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Single-Shell Tank Retrieval Sequence and Double-Shell Tank Space Evaluation

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Abstract:
This document describes the baseline single-shell tank (SST) waste retrieval sequence for the River Protection Project updated for Fiscal Year 2001. The SST retrieval sequence identifies the proposed retrieval order (sequence), the tank selection and prioritization rationale, and planned retrieval dates for Hanford SSTs. The double-shell tank (DST) space evaluation presents a projected range of tank needs that are used to generate recommendations regarding Site activities, waste management activities, facility requirements, and the need to build additional DSTs. This document presents the results of three distinct projection cases while satisfying the requirements of the *Hanford Facility Agreement and Consent Order* Milestones M-45-02, M-46-00, and M-46-01.

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Single-Shell Tank Retrieval Sequence and Double-Shell Tank Space Evaluation

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

CH2MHILL
Hanford Group, Inc.
Richland, Washington

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-99RL14047

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SINGLE-SHELL TANK RETRIEVAL SEQUENCE AND DOUBLE-SHELL TANK SPACE EVALUATION

RPP-8554 REV 0

September 2001

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EXECUTIVE SUMMARY

This report documents the single-shell tank (SST) waste retrieval sequence for the River Protection Project (RPP), updated for fiscal year (FY) 2001, and the basis for evaluating future double-shell tank (DST) space needs and waste transfers through FY 2028. The SST retrieval sequence identifies a risk-based priority order for retrieval and retrieval dates, projected by computer modeling, for SSTs at the Hanford Site. In addition, the tank selection criteria, rationale, reference retrieval methods, and risk reduction performance are discussed. The DST space evaluation presents a projected range of tank needs that are used to generate recommendations regarding Site activities, waste management activities, facility requirements, and the need to build additional DSTs. This document presents the results of three distinct projection cases while satisfying the requirements of the *Hanford Federal Facility Agreement and Consent Order* Milestones M-45-02 *Submit Annual Updates to SST Retrieval Sequence Document*, M-46-00 *Double-Shell Tank Space Evaluation*, and M-46-01 *Concurrence of Additional Tank Acquisition.*

Case 1 meets the Tri-Party Agreement milestone date for completion of SST retrieval (M-45-05; M-45-05-T05 through M-45-05-T09 are not constraining), completes waste treatment in 2028, and includes tank space options to save 3 million gallons of space by 2011. Case 2 includes risk based SST retrieval within existing DST capacity (completion in 2027), waste treatment completion in 2028, and includes tank space options to save 0.85 million gallons by 2011. Under Case 2, SST waste is retrieved as DSTs become available and is not constrained by funding for SST retrieval infrastructure. Both Case 1 and Case 2 use the risk-based SST sequence derived from the SST Retrieval Sequence evaluation. Case 3 includes a Tri-Party Agreement compliant SST waste retrieval schedule that retrieves tanks with the smaller remaining volumes first to meet Tri-Party Agreement milestones for number of tanks started each year while trying to stay within available DST space for a longer period of time. Case 3 includes tank space options to save 0.85 million gallons of space by 2011.

The results of Case 1 show that 24 additional DSTs (for a total of 52) are required to implement SST waste retrieval under the Case 1 assumptions and constraints. The first additional DSTs would be required for use in 2010. Case 2 operates within the capacity of the currently existing 28 DSTs. Under the assumptions and constraints of Case 3, current DST capacity is exceeded in 2012 and 67 additional DSTs are required to implement SST waste retrieval.

CONTENTS

1.0 INTRODUCTION 1-1

2.0 METHODOLOGY FOR EVALUATING DOUBLE-SHELL TANK SPACE REQUIREMENTS 2-1
- 2.1 PROCESS DESCRIPTION 2-1
- 2.2 MODELING ASSUMPTIONS 2-3
  - 2.2.1 Model Description 2-3
  - 2.2.2 Tank Spare-Space Allocations 2-3

3.0 SINGLE-SHELL TANK RETRIEVAL SEQUENCE 3-1
- 3.1 TANK SELECTION CRITERIA AND RATIONALE 3-1
  - 3.1.1 Technical Approach 3-1
  - 3.1.2 Risk Parameters 3-2
  - 3.1.3 Performance Criteria and Assumptions 3-3
  - 3.1.4 Tank Selection Basis 3-3
  - 3.1.5 Tank Selection Logic 3-4
  - 3.1.6 Logic to Select First Three Tanks 3-5
- 3.2 SINGLE-SHELL TANK WASTE RETRIEVAL AND TRANSFER SYSTEM 3-6
  - 3.2.1 Single-Shell Tank Farm Background 3-6
  - 3.2.2 Retrieval Technologies 3-9
  - 3.2.3 Infrastructure Requirements 3-11
  - 3.2.4 Tank Integrity 3-12
- 3.3 SINGLE-SHELL TANK RETRIEVAL SEQUENCE DESCRIPTION AND SCHEDULE 3-12
  - 3.3.1 Retrieval Sequence and Schedule 3-12
  - 3.3.2 Limitations On Single-Shell Tank Retrieval Sequence And Schedule 3-12
  - 3.3.3 Retrieval Waste Generation 3-13
  - 3.3.4 Double-Shell Tank Space Utilization 3-13

4.0 RISK REDUCTION RESULTS FROM SINGLE-SHELL TANK RETRIEVAL SEQUENCE 4-1

5.0 DOUBLE-SHELL TANK SPACE EVALUATION 5-1
- 5.1 DOUBLE-SHELL TANK SPACE EVALUATION ASSUMPTIONS AND CONSTRAINTS 5-1
  - 5.1.1 Projection Case 1 Assumptions 5-1
  - 5.1.2 Projection Case 2 Assumptions 5-2
  - 5.1.3 Projection Case 3 Assumptions 5-2
- 5.2 ACTUAL WASTE GENERATION COMPARED TO MANAGEMENT LIMITS 5-3
- 5.3 SPACE-SAVING ALTERNATIVES 5-8
- 5.4 DOUBLE-SHELL TANK SPACE USE PROJECTIONS 5-9

5.4.1 Projection Case 1 Results 5-11
5.4.2 Projection Case 2 Results 5-13
5.4.3 Projection Case 3 Results 5-18
5.4.4 Interpretation of Short-Range Projection Results 5-20
5.4.5 Evaporator Waste Volume Reduction and Liquid Effluent Retention Facility Condensate 5-29
5.5 PROJECTED TANK NEEDS 5-32
5.5.1 Case 1 Projected Tank Needs 5-32
5.5.2 Case 2 Projected Tank Needs 5-32
5.5.3 Case 3 Projected Tank Needs 5-32
5.5.4 Cost Estimates for Additional Double-Shell Tanks 5-33

6.0 CONCLUSIONS 6-1
6.1 SINGLE-SHELL TANK RETRIEVAL SEQUENCE 6-1
6.1.1 Single-Shell Tank Risk-Sequence Benefits 6-1
6.1.2 Single-Shell Tank Assumption-Based Benefits 6-1
6.2 DOUBLE-SHELL TANK SPACE EVALUATION 6-2

7.0 REFERENCES 7-1

APPENDICES

A. ASSUMPTIONS MATRIX FOR 2001 SINGLE-SHELL TANK RETRIEVAL SEQUENCE AND DOUBLE SHELL TANK SPACE EVAULATION A-1

B. HANFORD TANK WASTE OPERATION SIMULATOR MODELING ASSUMPTIONS B-1

C. SINGLE-SHELL TANK RISK CALCULATIONS AND RANKINGS C-1

D. ADDITIONAL MODELING ASSUMPTIONS FOR CASES 1, 2, AND 3 ..... D-1

E. GENERAL FACILITY DESCRIPTIONS E-1

F. WASTE TRANSFER REQUIREMENTS F-1

G. SINGLE-SHELL TANK RETRIEVAL SEQUENCE FOR CASE 1 ..... G-1

H. SINGLE-SHELL TANK RETRIEVAL SEQUENCE FOR CASE 3 ..... H-1

FIGURES

Figure 1-1. Tri-Party Agreement Milestones M-45-02, M-46-00, and M-46-01. 1-2

Figure 2-1. Methodology of Waste Volume Projection..... 2-2

Figure 3-1. Logic Used for Tank Selection. 3-5

Figure 3-2. Single-Shell Tank Waste Transfer Plan. 3-8

Figure 3-3. Single-Shell Tank Retrieval/Case 2 Sequence and Schedule. 3-18

Figure 3-4. Case 2 Individual Double-Shell Tank Volume Plots. 3-20

Figure 4-1. Case 1 and 2 Airborne Risk Reduction Versus Volume Retrieved. 4-3

Figure 4-2. Case 1 and 2 Groundwater Risk Reduction Versus Volume Retrieved. 4-3

Figure 4-3. Case 1 and 2 Chemical Risk Reduction Versus Volume Retrieved..... 4-4

Figure 4-4. Case 2 Airborne Risk Reduction Over Time. 4-4

Figure 4-5. Case 2 Groundwater Risk Reduction Over Time..... 4-5

Figure 4-6. Case 2 Chemical Risk Reduction Over Time. 4-5

Figure 4-7. Cumulative High-Level Waste and Low-Activity Waste Glass Fractions. 4-6

Figure 5-1. Monthly Facility Generations. 5-4

Figure 5-2. Comparison of Monthly Average Waste Generation to Target Rate. 5-5

Figure 5-3. Monthly contributions from Saltwell Liquid Pumping. 5-6

Figure 5-4. Contributions from Facility Terminal Cleanout..... 5-7

Figure 5-5. Double-Shell Tank Space Requirements for the Case 1 Projection..... 5-12

Figure 5-6. Double-Shell Tank Space Requirements for the Case 2 Projection..... 5-14

Figure 5-7. Aging Tank Requirements for Case 2. 5-16

Figure 5-8. Aging Waste Tank Use for Case 2. 5-17

Figure 5-9. Double-Shell Tank Space Requirements for the Case 3 Projection..... 5-19

Figure 5-10. Tank Levels During the Short-Range Projection. 5-21

Figure 5-11. Dilute Receiver Tanks and 242-A Evaporator Operations. 5-24

Figure 5-12. West Area Waste Generations and SY Tank Levels..... 5-25

Figure 5-13. AN Farm Tank Levels..... 5-26

Figure 5-14. AP Farm Tank Levels. 5-27

Figure 5-15. AW Farm Tank Levels..... 5-28

TABLES

Table 1-1. Single-Shell Tank Retrieval Technology Locations and Goals. 1-3

Table 3-1. Designated Receivers and Quadrants of Single-Shell Tank Farms..... 3-7

Table 3-2. Single-Shell Tank Retrieval/Case 2 Sequence Data. (3 sheets) 3-15

Table 4-1. Relative Risks for SSTs Selected for Near-Term Retrieval. 4-1

Table 5-1. Comparison of Average Monthly Waste Generation Rates. 5-3

Table 5-2. Eight Tank Space-Saving Options (Boyles et al. 2001)..... 5-8

Table 5-3. Summary of DST Space Use Projections..... 5-9

Table 5-4. Spreadsheet of Waste Additions and Reductions (Kgal) for Case 2..... 5-15

Table 5-5. Projected Tank Use on 09/2003. 5-22

Table 5-6. Evaporator Waste Volume Reduction and Liquid Effluent Retention Facility Additions for Case 2 and 3 Projections..... 5-29

Table 5-7. Evaporator Campaign Schedule for the Three Projections. 5-30

Table 5-8. Cross-Site Transfer Schedule for the Three Projections 5-31

Table 5-9. Number of New Double-Shell Tanks to be Constructed and Funding Required ($M) to Meet Space Needs for the Case 1 and Case 3 Projections..... 5-34

TERMS

BBI	best-basis inventory
CHG	CH2M HILL Hanford Group, Inc.
DST	double-shell tank
FEIS	final environmental impact statement (*Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement*, Volume 3, Appendix D, "Anticipated Risk")
FY	fiscal year
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
HLW	high-level waste
HTWOS	Hanford tank waste operation simulator
Kgal	kilogallon (1,000 gallons)
LAW	low-activity waste
Mgal	million gallons
MT	metric tonne
NCRW	neutralized cladding removal waste
RPP	River Protection Project
SST	single-shell tank
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TRU	transuranic
WL	watch list

1.0 INTRODUCTION

This report documents the single-shell tank (SST) waste retrieval sequence for the River Protection Project (RPP), updated for fiscal year (FY) 2001, and the basis for evaluating future double-shell tank (DST) space needs and waste transfers through FY 2028. The SST retrieval sequence identifies the proposed retrieval order (sequence) and retrieval dates, projected by computer modeling, for SSTs at the Hanford Site. In addition, the tank selection criteria, rationale, reference retrieval methods, and risk reduction performance are discussed. The DST space evaluation presents a projected range of tank needs that are used to generate recommendations regarding Site activities, waste management activities, facility requirements, and the need to build additional DSTs. This document presents the results of three distinct projection cases while satisfying the requirements of the *Hanford Federal Facility Agreement and Consent Order* (HFFACO, also referred to as the Tri-Party Agreement) (Ecology et al. 1996) and its Milestones M-45-02, M-46-00, and M-46-01 as defined in Figure 1-1. Operating assumptions for the three cases were based on the best information available in June 2001. No funding constraints were considered.

This report provides the information that was previously available in two annually-prepared reports: RPP-7087, *Single-Shell Tank Retrieval Sequence: Fiscal Year 2000 Update*, and HNF-SD-WM-ER-029, *Operational Waste Volume Projection*. During the River Protection Project mission, the SST waste retrieval will be the principle waste source for DSTs and the rate of SST retrieval is limited by DST space availability. Therefore, an integrated evaluation of SST retrieval and DST space utilization in a single document is an appropriate method for satisfying Tri-Party Agreement Milestones M-45-05, M-46-00, and M-46-01.

Three cases are considered to provide an evaluation of DST space requirements over a range of schedule and process scenarios. Operating assumptions for the three cases were established in June 2001. Need dates for new DST construction, tank retrievals, facility schedules, waste generation reductions, conflicts in meeting Tri-Party Agreement milestones (Ecology et al. 1996; WHC 1996a; WHC 1996b), and funding priorities are discussed in relation to tank space availability. Assumptions for all three cases are provided in Appendix A.

Case 1 meets the Tri-Party Agreement milestone date for completion of SST retrieval (M-45-05; M-45-05-T05 through M-45-05-T09 not constraining), completes waste treatment in 2028, and includes tank space options to save 3 million gallons of space by 2011.

Case 2 includes risk based SST retrieval within existing DST capacity (completion in 2027), waste treatment completion in 2028, and includes tank space options to save 0.85 million gallons by 2011. Under Case 2, SST waste is retrieved as DSTs become available and is not constrained by funding for SST retrieval infrastructure.

Both Case 1 and Case 2 use the risk-based SST sequence derived from the SST Retrieval Sequence evaluation. The SST retrieval risk-based sequence was designed using criteria prioritizing highest risk tanks first, with consideration for limitations of SST waste retrieval technology. The retrieval sequence considered both airborne and groundwater pathways in

evaluating risk rankings for each tank. The modeling also incorporated the near-term retrieval activities provided under Tri-Party Agreement Milestone M-45-00A. A detailed description of the scenario and defining assumptions can be found in Appendices A and B of this document and in HNF-SD-WM-SP-012 (2001), *Tank Farm Contractor Operation and Utilization Plan, Rev.3.* The near-term retrieval and demonstrations included in the sequence modeling are summarized in Table 1-1. The criteria and logic for this sequence are discussed in Section 3.0.

Case 3 includes a Tri-Party Agreement compliant SST waste retrieval schedule that retrieves tanks with the smaller remaining volumes first to meet Tri-Party Agreement milestones for number of tanks started each year while trying to stay within available DST space for a longer period of time; waste treatment completion in 2028; and includes tank space options to save 0.85 million gallons by 2011.

Figure 1-1. Tri-Party Agreement Milestones M-45-02, M-46-00, and M-46-01.

M-45-02	SUBMIT ANNUAL UPDATES TO SST RETRIEVAL SEQUENCE DOCUMENT. THIS PROVIDES FOR AN ANNUAL UPDATE OF A SST RETRIEVAL SEQUENCE DOCUMENT THAT WILL DEFINE THE TANK RETRIEVAL SEQUENCE, SELECTION CRITERIA AND RATIONALE, REFERENCE RETRIEVAL METHOD(S) FOR EACH TANK, AND THE ESTIMATED RETRIEVAL SCHEDULES. THE RETRIEVAL SEQUENCE DOCUMENT WILL DETAIL RETRIEVAL METHODOLOGIES TO BE EMPLOYED AND ESTIMATED WASTE VOLUMES TO BE GENERATED DURING RETRIEVAL (TO BE TRANSFERRED TO THE DSTs OR OTHER AVAILABLE SAFE STORAGE). THE REPORT WILL ALSO DETAIL TANK SELECTION RATIONALE BASED ON THE PRIMARY OBJECTIVE OF MAXIMIZING RISK REDUCTION THROUGH THE RETRIEVAL OF MOBILE, LONG-LIVED RADIONUCLIDES OR POTENTIAL AIRBORNE CONTAMINANTS AND PRINCIPLE NON RADIOLOGICAL HAZARDOUS CONSTITUENTS IN A MANNER WHICH IS SENSITIVE TO WASTE TREATMENT FACILITY REQUIREMENTS AND INFRASTRUCTURE CONSTRAINTS. THE SEQUENCING WILL ALSO TAKE IN CONSIDERATION DOUBLE-SHELL TANK (DST) SPACE AND DST WASTE COMPATIBILITY WHEN SELECTING THE SST RETRIEVAL SEQUENCE. THE ANNUAL UPDATES WILL BE SUBMITTED TO ECOLOGY FOR APPROVAL AS AGREEMENT PRIMARY DOCUMENTS.	9/30/2000 and annually thereafter.
M-46-00	DOUBLE-SHELL TANK SPACE EVALUATION. THIS NEW MILESTONE REPLACES EXISTING MILESTONE M-31-02. A TANK VOLUME PROJECTION REPORT SHALL BE SUBMITTED ON AN ANNUAL BASIS TO ECOLOGY AND EPA. THIS REPORT SHALL INCLUDE DISCUSSIONS COVERING ALL ASSUMPTIONS THAT FORM THE BASIS OF THE PROJECTION. THE REPORT SHALL INCLUDE OR SHALL BE ACCOMPANIED BY DOE'S PLANS FOR ACQUISITION OF ADDITIONAL TANKS BASED ON THE TANK VOLUME PROJECTION.	9/30/1999 and annually thereafter.
M-46-01	CONCURRENCE OF ADDITIONAL TANK ACQUISITION. THE THREE PARTIES SHALL MEET TO ESTABLISH NEW MILESTONES, IF REQUIRED, FOR ACQUISITION OF ADDITIONAL TANKS.	11/30/1999 and annually threreafter.

Table 1-1. Single-Shell Tank Retrieval Technology Locations and Goals.

Single-Shell Tank Retrieval Technology	Location of Technology Use	Goals
Saltcake dissolution	Tank 241-S-112	Meet the Tri-Party Agreement Milestone M-45-03C date of September 30, 2005, for complete demonstration. [Goals of this demonstration shall include the retrieval to safe storage of approximately 550 curies of mobile, long-lived radioisotopes and 99% of tank contents by volume (per DOE Best-Basis Inventory Data, 8/1/2000)].
Fluidic mixer	Tank 241-S-102	Meet the Tri-Party Agreement Milestone M-45-05A date of September 30, 2006, for complete retrieval. [Goals of this initial waste retrieval project shall include the retrieval to safe storage of approximately 490 curies of mobile, long-lived radioisotopes and 99% of tank contents by volume (per DOE Best-Basis Inventory Data, 8/1/2000)].
Confined sluicing/ robotic technology	Tank 241-C-104	Meet the Tri-Party Agreement Milestone M-45-03I date of September 30, 2006, for complete construction. [Goals, as specified under M-45-03F, include demonstration of retrieval to safe storage of approximately 89 kg of plutonium which represents approximately 17% of the total plutonium inventory within the SST system; and 99% of tank contents by volume (per DOE Best-Basis Inventory Data, 8/1/2000)].

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2.0 METHODOLOGY FOR EVALUATING DOUBLE-SHELL TANK SPACE REQUIREMENTS

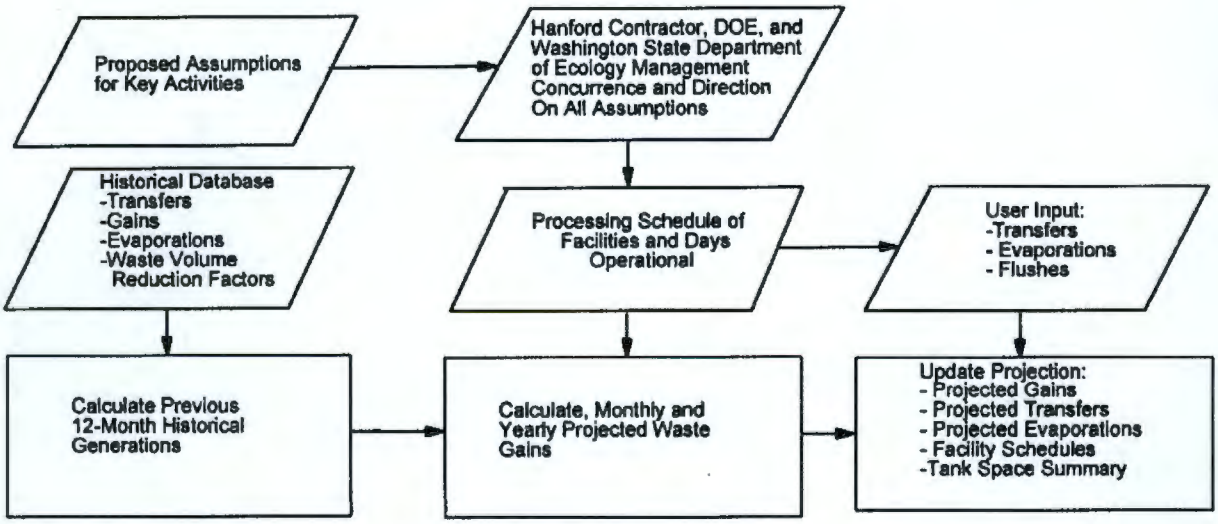
Completion of the RPP mission is dependent on the availability and efficient use of DST space. The DST space evaluation process provides the projected DST space use, based on specific assumptions for the generation of wastes, the composition of wastes, and the operation of tank farms and waste processing facilities. Three cases are considered to provide an evaluation of DST space requirements over a range of schedule and process scenarios. The assumptions for these three cases capture the engineering inputs or bases supplied by the facilities, based on their future operational plans (determined by budget, U.S. Department of Energy directive, Tri-Party Agreement milestones, etc.). The Hanford tank waste operation simulator (HTWOS) model is used to simulate the operation of the tank farm system within the constraints of the assumptions for the three cases.

The principal activities contributing waste volume to the DST system are interim stabilization and retrieval of wastes in SSTs. The projected waste volumes received from interim stabilization are reviewed annually and are incorporated into all DST space evaluation cases. A risk-based priority for the retrieval of waste from the SSTs has been adopted as a result of changes to the Tri-Party Agreement negotiated in August 2000. The process for developing the SST retrieval sequence with the resulting schedule and projected waste volumes are provided in Section 3.0. The risk-based SST retrieval sequence is incorporated into DST space evaluation Cases 1 and 2, while the historic SST retrieval strategy of low-volume tanks first is incorporated in Case 3.

2.1 PROCESS DESCRIPTION

The process of updating the DST space evaluation begins with the request for updated facility or project assumptions from each of the operating facilities and projects that will contribute waste to the DST inventory. The operating facilities and projects provide estimates of volume, composition, and radionuclide content data for each distinct waste stream to be sent to the DSTs. In addition to the projected facility waste generation rates, the processing schedules of each of the plants are factored into the projection. The process followed in preparing a waste volume projection is shown in Figure 2-1.

Figure 2-1. Methodology of Waste Volume Projection.



Once the facility and project assumptions are established, waste composition data are used to calculate the waste volume reduction factors and to determine waste segregation requirements (because of chemical, radionuclide, or heat content). The waste volume reduction factor (Cruzen 1988) is defined as the percent of water (by volume) that can be removed from a waste stream by evaporation for storage. From the facility assumptions, a matrix of basic assumptions for the three cases is established. These assumptions are presented in Appendix A. Because the projected waste transfers are crucial to DST operating plans, the U.S. Department of Energy has requested that the DST space evaluation document provide a list of all transfers for the next fiscal year (Kinzer 1998). Appendix F lists all the gains, losses, and transfers for projection Cases 1, 2, and 3 through May 31, 2002.

Once the projection cases have been established, the historical database of past waste gains, transfers, and evaporations is updated with data from the most recent twelve months of tank farm operations. In the first three years of the projection, monthly waste volumes are predicted. For the subsequent years of the projection, yearly waste volumes are predicted.

The processing sequence in the simulation is designed to model the actual activities in the tank farms. After a dilute receiver tank is filled with waste, the contents are transferred to an available holding tank, sampled (sampling and analysis require four months), and transferred to the 242-A Evaporator feed tank (Tank 241-AW-102) for evaporation. After dilute waste is concentrated in the 242-A Evaporator, it is sent to a slurry receiver tank (Tank 241-AW-106) as double-shell slurry feed and then transferred to another DST for storage. The concentrated waste will be eventually treated for disposal through the low-activity waste (LAW) processing and vitrification facilities.

The neutralized current acid waste and transuranic (TRU) solids will be processed at the Waste Treatment Plant, immobilizing the high-level waste (HLW) solids into a glass matrix for disposal. It is anticipated that the HLW pretreatment will generate a LAW supernate stream that

would be pretreated to remove radionuclides and later sent to LAW vitrification for immobilization and final disposal.

2.2 MODELING ASSUMPTIONS

2.2.1 Model Description

The HTWOS is a computerized dynamic simulation that models the operation of the tank farm systems in the 200 East and 200 West Areas. HTWOS simulates Initial Quantity feed retrieval and staging activities, Initial Quantity SST retrieval, and Balance-of-Mission SST retrieval activities, providing a common assumption basis for all activities as well as accounting for operational conflicts. Tank farm operational constraints as well as physical equipment capacities also are modeled.

HTWOS is a chemical/radionuclide, component-based model that maintains a mass balance of liquid and solid components in tanks as waste is moved through the system. The original inventory is derived from the best-basis inventory (BBI) maintained by CHG. The HTWOS models waste transfers, using partitioning factors to predict the composition of the waste as it is retrieved from the tanks and delivered to the waste treatment facility. It also applies glass-formulation rules to predict the amount and composition of glass product produced. The availability and capacities for various systems and processes can be set to determine a processing schedule for waste retrieval and treatment. A more detailed description of the HTWOS modeling assumptions and the BBI can be found in Appendix B.

2.2.2 Tank Spare-Space Allocations

DOE Order 435.1, *Radioactive Waste Management*, requires that emergency space be reserved to store waste in case a leak should occur in a DST. In compliance with DOE Order 435.1, emergency space of approximately 4,315 m^3 (1.14 Mgal), was reserved to store waste in case of a leak in a DST. However, in addition to the emergency space to respond to potential DST leaks, the Tank Farm Contractor was requested to provide the capability to receive up to one DST equivalent size tank of either LAW or HLW return from the Waste Treatment Plant on an emergency basis in Taylor (1999) (letter, "Contract No. DE-AC06-96RL13200—Planning Guidance Revision for Development of Contract Deliverables Required by Performance Agreement TWR1.3.5"). Accordingly, an additional 4,315 m^3 (1.14 Mgal) of space has been reserved to accommodate LAW or HLW return if required by a tank failure in the Waste Treatment Plant.

To meet the requirements for storing HLW returns, the space in Tank 241-AY-101 is designated as dedicated emergency space until the receipt of wastes from Tank 241-C-104 in FY 2008. In FY 2008, Tank 241-AZ-102 will be designated as the dedicated emergency tank through the end of the SST retrieval project and will provide approximately 3,800 m^3 (1.12 Mgal) of the required emergency space. The remaining emergency space allocation is distributed primarily within the waste receiver tanks (Tanks 241-AP-108, 241-AW-105, and 241-SY-102).

3.0 SINGLE-SHELL TANK RETRIEVAL SEQUENCE

3.1 TANK SELECTION CRITERIA AND RATIONALE

The Tri-Party Agreement Milestone M-45-02 requires that an SST retrieval strategy be based on maximizing risk reduction. The strategy is discussed in detail in HNF-2944, *Single-Shell Tank Retrieval Program Mission Analysis Report*, and HNF-5095, *Single-Shell Tank Program Plan*. In the September 2000 SST retrieval sequence update (RPP-7087, *Single-Shell Tank Retrieval Sequence: Fiscal Year 2000 Update*), 10 tank categories were established for prioritizing tanks based on risk, as measured by ^{99}Tc inventory, waste types, and tank integrity. For FY 2001, these categories have been replaced by a composite measure of tank risk for both airborne and groundwater contamination. In addition, infrastructure issues and waste treatment facility feed needs were factored into the retrieval prioritization process. The retrieval demonstrations were also a consideration in establishing the retrieval priorities. The risk-based sequence is incorporated in Cases 1 and 2 (Case 3 uses a retrieval sequence that prioritizes smallest volume retrievals first.)

3.1.1 Technical Approach

The risk-based scenario for the FY 2001 update was developed using an iterative process. To calculate risks, a set of factors was selected to approximate the human health and environmental impacts of exposure to certain chemicals and radionuclides. Two documents were determined to be applicable for this purpose. The first was EPA 520/1-88-020, Federal Guidance Report No. 11, *Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*. The second was DOE/EIS-0189, *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement*, Volume 3, Appendix D, "Anticipated Risk" (FEIS). Both documents provide factors for all the analytes required for calculating the airborne, groundwater, and chemical risks. Using the EPA 520/1-88-020 factors "as is" would imply that transport phenomena from the tanks to the exposed person were identical, whatever the radionuclides. The FEIS factors, however, incorporate pathways from the environment to the exposed person, offering an enhanced method of calculating relative risk (dose) to potential recipients. The variable mobilities and transport phenomena of radionuclide and chemical species from the tank to the environment also are considered: only the mobile, long-lived radionuclides and mobile chemicals with significant human health impact according to the FEIS are taken into account in this study. The approach and constituents of concern used in this study are similar to those used in other Hanford Site studies such as *Retrieval Performance Evaluation Methodology for the AX Tank Farm* (DOE/RL-98-72, 1999) and *Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site* (PNNL-11800, 1998).

Reduction in the long-term risk of unretrieved waste to the public and the environment was the major concern in formulating the retrieval strategy employed in developing the current retrieval sequence. There are two types of long-term risk concerns – (1) protection of the groundwater

and (2) protection from airborne contamination. Three risk parameters were chosen to develop the 2001 SST retrieval sequence. These parameters are groundwater, airborne, and chemical risk. Within the FEIS four scenarios are applicable for the calculation of both the groundwater and the chemical risks. These scenarios pertain to the different ways that a person might be exposed to hazardous tank waste. The scenarios are labeled Industrial, Native American, Recreational Shore Line User and Land User, and Residential Farmer. Each scenario has a different factor for each analyte, based on alternative pathways for human interaction.
A comparison of the tank rankings using each of the four scenarios showed that although there may be some minor shuffling of tanks, there was no significant difference in the sequence using any particular scenario when considering all factors in tank prioritization. The Industrial scenario was chosen because it was determined to be the most likely end-use scenario for 200 Area plateau facilities.

The airborne contamination risk factors, however, are only given in one scenario – that of an intruder dose, which assumes that a person drills into the top of a tank and the contamination becomes airborne. Two subsets of this scenario, the driller and post-driller subsets, are available for calculation. The post-driller subset was used because of the number of people involved and the time span concerned.

The risk factors used to calculate the airborne, groundwater, and chemical risks are found in Tables D.2.1.21, D.2.1.23, and D.7.3.1 of the FEIS. These factors, along with sample calculations, also are listed in Appendix C of this document.

3.1.2 Risk Parameters

The contaminants of concern from a groundwater protection standpoint are long-lived, mobile radionuclides and mobile, noncarcinogenic chemicals. According to results documented in the FEIS, these contaminants are ^{14}C, ^{79}Se, ^{99}Tc, ^{129}I, and ^{238}U for mobile radionuclides with very long half-lives; and nitrate, nitrite, and chromium for mobile, noncarcinogenic chemicals. These radionuclides and chemicals are found primarily in the saltcake tanks. The waste in the saltcake tanks looks and acts very much like coarse table salt exposed to moisture (i.e., the waste dissolves easily in liquids and moves with the water). A simplifying assumption is made that 100% of the chemicals and radionuclides listed above are mobile. In the future, when more information is available, this assumption will be modified.

The contaminants of concern from an airborne contamination standpoint are the long-lived, alpha–emitting radioactive elements, primarily plutonium. These materials are found predominantly in the sludge tanks. Sludge, which contains most of the metals, looks like fine mud and dries very hard. Sludge tends to be insoluble in most liquids.

The information in the October 1, 2000, best-basis inventory (BBI) (the primary source for inventory data) and supplemental information from HNF-EP-0182-148, *Waste Tank Summary Report for Month Ending July 31, 2000* (see Appendix B for more information on the BBI), was modified to reflect a post-saltwell-pumping liquid inventory to account for a decrease in tank risk after the removal of saltwell liquor. Modifying the data in this way reflects the as-retrieved inventory situation. Using the modified inventory, airborne, groundwater, and chemical risk values were calculated for each tank. Two separate lists ordering the tanks by decreasing

airborne and groundwater risk value became the basis for sequencing the SST waste retrievals for FY 2008 and beyond, using the HTWOS model. Appendix B details the use of and background information on the HTWOS model.

3.1.2.1 Groundwater Risk

The analytes used to calculate the groundwater risk comprise mobile, long-lived radionuclides, specifically ^{14}C, ^{79}Se, ^{99}Tc, ^{129}I, and ^{238}U. Groundwater risk factors come from the Industrial scenario in the FEIS. The groundwater risk from a particular radionuclide is calculated as the product of the analyte activity and its associated risk factor. The overall tank risk is the sum of the individual radionuclide risks.

3.1.2.2 Airborne Risk

Airborne risk is calculated similarly to the groundwater risk, i.e. the product of the analyte activity and its associated risk factor. These risk factors come from the intruder dose post-driller scenario in the FEIS. The analytes used to calculate the airborne risk comprise uranium and transuranic and other isotopes, specifically americium, curium, niobium, neptunium, plutonium, tin, thorium, and ^{238}U.

3.1.2.3 Chemical Risk

The analytes used to determine the chemical risk are NO_2^-, NO_3^-, and CrO_4^-. The risk for each analyte is calculated by multiplying its weight inventory by a specific risk factor. The overall risk for a tank is calculated by summing the risks for each analyte. The risk factors come from the Industrial scenario in the FEIS. The results are displayed for informational purposes and are not used for prioritizing tank retrievals.

3.1.3 Performance Criteria and Assumptions

The FY 2001 SST retrieval sequence improves on risk reduction performance over previous sequence submittals. The performance improvement is derived from the expansion of risk consideration to include all principal contaminants of concern for groundwater, rather than simply ^{99}Tc, and consideration of airborne risk when sequencing the tanks. Reduction of risk from chemical contamination also was evaluated for informational purposes. Two assumptions were made in developing the sequence. The first assumption was that the processing of all SST and DST waste must be complete by 2028. The second assumption was that retrieval of inventory from tanks that are considered or assumed to have leaked begins in FY 2018. This second assumption has been implemented to allow for maturation of leak detection systems as well as the maturation and demonstration of proposed novel retrieval technologies.

3.1.4 Tank Selection Basis

To have a basis for selecting tanks, certain parameters are set as constraints or initial condition assumptions. First, five near-term retrieval and technology demonstration tanks (241-S-112, S-102, S-105, S-106, C-104) were prioritized to be encountered first in the sequence. The tanks that are subject to specific Tri-Party Agreement milestones (S-112, S-102, and C-104) were date

constrained. Tank C-107 was date constrained due to the current design and construction schedule.

Twenty-one tanks are nearly empty; specific issues prevent prediction of a reasonable retrieval rate or require other special considerations. They are placed at the end of the sequence to maintain accurate accounting of work scope and waste inventory. These tanks may be individually accelerated at such time as technology and programmatic considerations warrant. The 21 specific tanks are listed in the HTWOS Software Change Summary Form in Appendix A.

The remaining 121 SSTs were ordered in two lists, ranking each tank with respect to airborne and groundwater risks by decreasing risk order. The logic employed to determine the final SST retrieval sequence is explained in Section 3.1.5. In this sequence, only 148 tanks are considered for future retrieval. No new retrieval attempt is assumed for Tank 241-C-106. It was retrieved by "past-practice sluicing" in FY 1999.

3.1.5 Tank Selection Logic

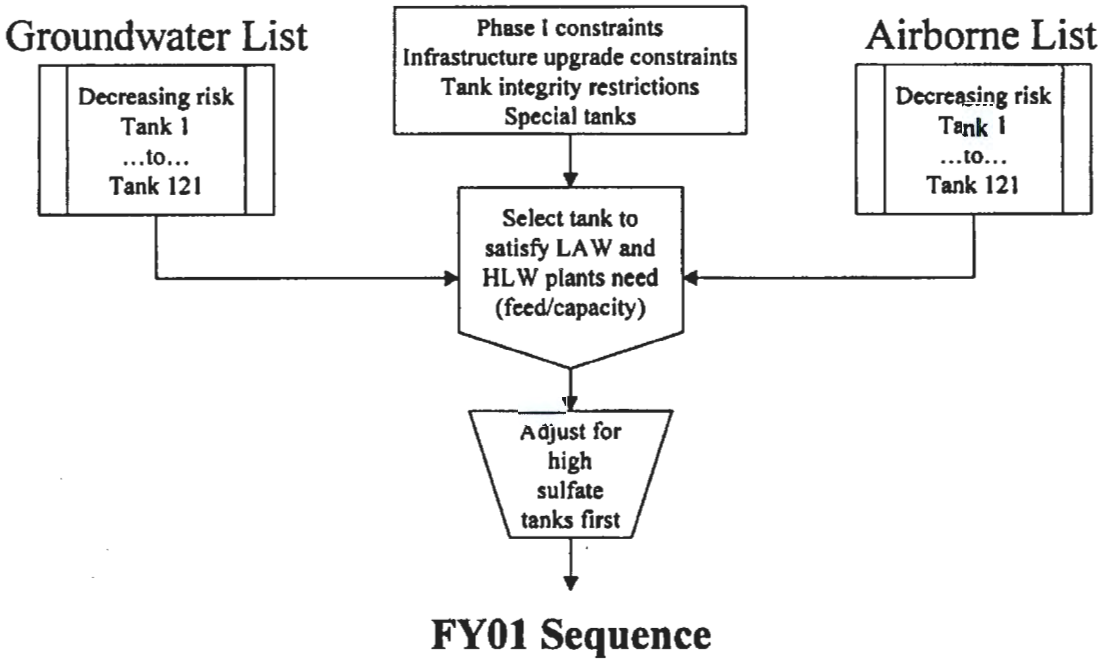
The logic used to sequence tanks using the airborne and groundwater risk ranking lists are provided below. Figure 3-1 illustrates the tank selection logic.

1. Use two lists, ranking tanks by decreasing airborne and groundwater risk.
2. Consider infrastructure upgrades and transfer system construction requirements in the retrieval sequence development.
3. Tanks considered or assumed to have leaked will not be retrieved before FY 2018.
4. Certain high-sulfate tank retrievals (241-BY-101, BY-102, BY-109, TX-112, and TX-113) will not begin before FY 2018, to improve airborne and groundwater risk reduction versus Waste Treatment Plant processing time.
5. Waste may be retrieved simultaneously from up to seven tanks (Specific to Case 2. Cases 1 and 3 retrieve simultaneously from up to 16 tanks).
6. Waste from multiple SSTs will be mixed in the staging tanks to increase incidental blending.

After the first six steps are complete, two tanks will be available for retrieval – one on the airborne risk list and the other on the groundwater risk list. To choose between the two lists, one additional criterion is used. This selection criterion incorporates a balance between sludge retrieval and saltcake tanks. The HTWOS model preferentially chooses the tank that will bring the ratio of $\frac{\text{cumulative projected LAW glass fraction}}{\text{cumulative projected HLW glass fraction}}$ closest to 1.0. Maintaining this ratio near 1.0 helps to keep both the LAW and HLW vitrification facilities fed until the end of the mission. Preferential retrieval of one waste type over another (all saltcake or all sludge) can

result in temporary shutdown of either the LAW or HLW Waste Treatment Plant, resulting in processing delays and decreased risk reduction.

Figure 3-1. Logic Used for Tank Selection.



3.1.6 Logic to Select First Three Tanks

Based on the tank selection criteria from FY 1999 and FY 2000 (risk ranking by total curies), the first three tanks of the retrieval sequence were chosen. These near-term retrievals and technology demonstrations were not selected based on the FY 2001 risk rankings.

Tanks 241-S-112 and 241-S-102 were ranked No. 8 and No. 9 on the FY 2000 priority-ranking list (based on total curies, highest-to-lowest-value ranking). The highest-ranking tank was Tank 241-U-107. However, the U Farm has the worst infrastructure of the SST farms and will require significant upgrades and new construction. There are no suitable pipelines nearby to transport the wastes; transporting the wastes to the DST receiver tanks requires construction of intermediate waste receiver facilities. Electricity and other utilities currently are not available at the U Farm, and other upgrades are needed as well. These upgrades add substantially to the cost of a retrieval project in the U Farm. Therefore, Tank 241-U-107 was eliminated from consideration for near-term retrievals or technology demonstrations. These issues with the U Farm also eliminated Tank 241-U-108, ranked No. 7 on the FY 2000 priority-ranking list.

Tanks 241-SX-105, 241-SX-103, and 241-SX-102 were ranked No. 3, 4, and 5, respectively, on the FY 2000 priority-ranking list. These tanks were eliminated from consideration for near-term retrievals or technology demonstrations because they are located in the SX Farm, which has had the most historical suspected leaks and spills and has the worst soil contamination of the farms.

It would be very difficult to test and prove the initial leak-detection systems in this farm. Also, because of the large number of SX tanks that are assumed to have leaked, all tanks in the SX Farm are more suspect than tanks in other farms. Tank 241-TX-113, ranked No. 6 in the FY 2000 priority-ranking list, is listed as an assumed leaker and has infrastructure upgrade and construction issues similar to those of the tanks in U Farm.

Eliminating these tanks from consideration for near-term retrievals or technology demonstrations left Tank 241-A-101 (ranked No. 2 in the FY 2000 priority-ranking), Tank 241-S-112 (No. 8), and Tank 241-S-102 (No. 9). Tank 241-A-101 is quite full, and the waste has a high aluminum content and chemical mix. This waste forms a gel-like material that has been known to plug lines, requiring significantly more dilution in the pipelines. The material in Tank 241-A-101 is not purely saltcake or sludge, making it less desirable for demonstrations. Given the volume of waste generation from the retrieval of Tank 241-A-101 and the amount of DST space available, use of Tank 241-A-101 would limit the SST Retrieval Project to only one retrieval technology demonstration.

Tanks 241-S-112 and 241-S-102, when added together, have more contaminants of concern than Tank 241-A-101, representing a higher combined risk reduction and broader opportunity for technology assessments and demonstration deployments. Tank 241-S-112 contains mostly saltcake (with only 2.5 to 5.0 cm [1-2 in.] of sludge in the very bottom). Both Tanks 241-S-102 and 241-S-112 contain appropriate early feed for the LAW vitrification plant as well as being excellent demonstrations tanks. The S Farm is close to the main DST receiver tanks in the 200 West Area, allowing temporary overground lines to be used, and has other necessary infrastructure in place. Tank 241-S-112 has been selected for the first "limits of technology" demonstration under Milestone M-45-00B, employing a saltcake dissolution retrieval technology. Tank 241-S-102 has been selected as the baseline-planning tank for initial SST waste retrieval under Milestone M-45-05A.

The criteria for the second "limits of technology" demonstration tank were that it contain mostly sludge and that it be located in the 200 East Area. Options quickly narrowed to Tank 241-C-104. Tank 241-C-104 has more plutonium than any other tank (SST or DST), with a total of 89 kg of plutonium or 16% of the plutonium found in all the SSTs. The waste in Tank 241-C-104 also contains appropriate feed for the HLW Waste Treatment Plant and currently is planned for Initial Quantity feed delivery. Infrastructure had been installed to support retrieval of Tank 241-C-106, which is close to Tank 241-C-104; much of that infrastructure also can be used for retrieval of Tank 241-C-104. Tank 241-C-104 has been selected for the second "limits of technology" demonstration under Milestone M-45-00B, employing a confined sluicing, robotic retrieval technology.

3.2 SINGLE-SHELL TANK WASTE RETRIEVAL AND TRANSFER SYSTEM

3.2.1 Single-Shell Tank Farm Background

The SST farms consist of 149 tanks grouped in 12 tank farms. Six of the SST farms are located in the 200 East Area, while the remaining six are located in the 200 West Area. To retrieve

waste from the SSTs, a waste transport system and receiver must be available within the pumping constraints of the SST transfer system. Some of the SST farms are in proximity to DST farms, and waste from the SSTs can be retrieved into available DSTs. For retrieving waste from the remote SST farms, the current plan requires the construction of interim receiver facilities, referred to as waste receiver facilities, to stage the waste for transport to the DST system. The current waste receiver strategy is summarized in Table 3-1. The SST waste transfer plan is depicted graphically in Figure 3-2.

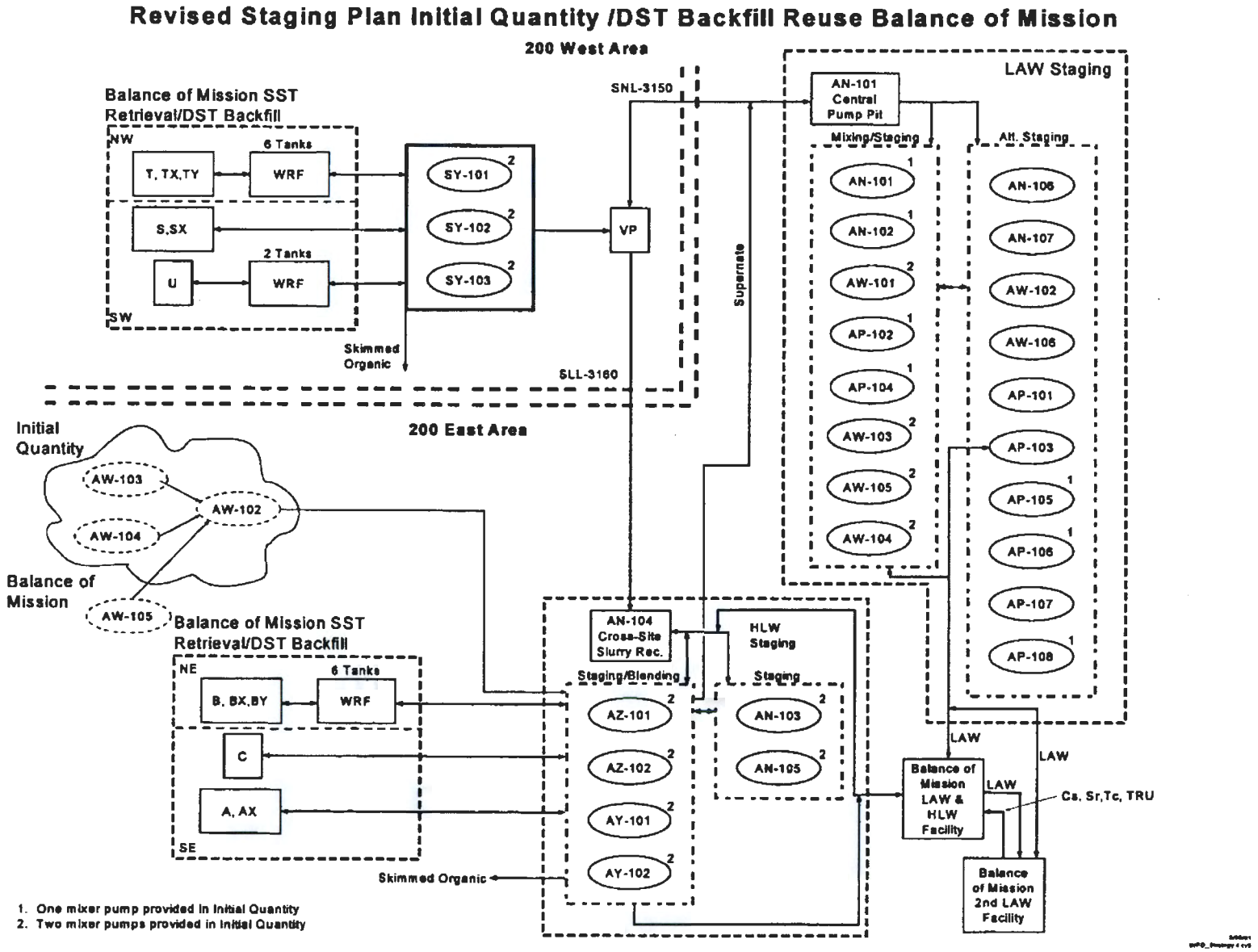
Table 3-1. Designated Receivers and Quadrants of Single-Shell Tank Farms.

Quadrant	Designated Receiver	Single-Shell Tank Farms
NW	NW WRF (six 570-m^3 [150,000-gal] tanks)	T, TX, TY
NE	NE WRF (six 570-m^3 [150,000-gal] tanks)	B, BX, BY
SW	SY Tank Farm (modeled as 241-SY-101)*	SX
	SW WRF (two 570-m^3 [150,000-gal] tanks)	U
	SY Tank Farm (modeled as 241-SY-103)*	S
SE	Tank 241-AY-102, Tank 241-AY-101	A, AX, C

NE = Northeast.
NW = Northwest.
SE = Southeast.
SW = Southwest.
WRF = waste receiver facility.

* NOTE: The S Tank Farm designated DST receiver tank is Tank 241-SY-102. Tank 241-SY-103 cannot receive waste today. Success of the sequence modeling for S Farm retrievals and transfer is dependent on removal of Tank 241-SY-103 from the Watch List and construction of the required piping systems. Tank 241-SY-101, previously on the Watch List, has been removed (Huntoon, C. L., letter to H. Boston, "Approval to Close the Flammable Gas Safety Issue for Tank 241-SY-101 and Remove the Tank from the Watch List").

Figure 3-2. Single-Shell Tank Waste Transfer Plan.



3.2.2 Retrieval Technologies

The SST Retrieval Program, and its predecessor organizations, have reviewed and evaluated numerous technologies for potential application to retrieval of SSTs (RPP-6947, *Hanford Tank Initiative/Acquire Commercial Technology for Retrieval Report and Database*). Of the many systems and potential configuration options evaluated, the only system with recent experience in retrieval of SSTs is the traditional approach, "past-practice sluicing." This system was applied in the retrieval of Tank 241-C-106 in FY 1999.

To evaluate the potential for cost and/or performance improvements, the program has elected to test and deploy several alternative technologies in "near-term" retrieval applications committed to in Milestone M-45-00A of the Tri-Party Agreement. Below is a brief description of the past-practice sluicing system and the alternative technology systems that are planned for deployment in the first three SSTs planned as retrieval or technology demonstration projects under the Milestone M-45-00A negotiated agreement.

3.2.2.1 Past-Practice Sluicing

Past-practice sluicing is the introduction of a liquid at high pressures and volumes, typically recycled supernatant, into the waste matrix to break apart and suspend the solids materials into the sluicing fluid for subsequent transport out of the tank. The sluicing liquid is introduced through a nozzle or nozzles inserted through risers on the perimeter of the tank. The slurry is retrieved from the tank by a pump that is lowered through an available riser into the slurry pool formed by the sluicing action on the top of the solids. The pump is lowered incrementally to the bottom of the tank as the sluicing action dislodges and suspends the solids. This system proved effective in the retrieval of Tank 241-C-106, retrieving an estimated 97% of the solids in the tank (RPP-6696, *Data to Support C-106 Waste Retrieval Determination*).

3.2.2.2 Saltcake Dissolution

Saltcake dissolution is the addition of a solvent (primarily water) to a salt waste (primarily sodium salts) to dissolve the solids; subsequently liquid is removed from the tank. Several configuration variations and operations approaches available under this technique are being evaluated for deployment at the Hanford Site. Controlled addition of the solvent and coordinated removal of the liquid is planned to minimize the volume of liquid present in the tank and to reduce the potential for leakage. This has been referred to as the low-volume density gradient (LVDG) method. This method will be demonstrated in Tank 241-S-112 (HNF-2944). An early "proof-of-concept" test of the LVDG method will be conducted during FY 2001 in Tank 241-U-107 in conjunction with planned saltwell pumping efforts under the Interim Stabilization Program. A Topographical Mapping System will also be demonstrated in Tank 241-U-107 to evaluate the effectiveness of the saltcake dissolution process. Efforts are also underway through the DOE Office of Science and Technology (EM-50) to conduct bench-scale testing of saltcake dissolution processes in support of tank waste retrieval operations.

3.2.2.3 Fluidic Mixing

Fluidic mixing, also known as pulse jet mixing, typically involves the use of large-diameter pulse tubes vertically mounted in the tank and immersed in the tank fluid. A vacuum is applied to the pulse tube, using a jet pump with air as the motive fluid. Sludge and liquid fill the pulse tube, and when the tube is full, the jet is turned off and the tube is vented or charged. The fluid in the tube falls back into the tank and imparts the mixing action or is directed to a receiving tank for transfer and processing. The system operates with no moving parts in contact with the wastes and very low maintenance. The system was successfully deployed at Oak Ridge and is being demonstrated at Los Alamos National Laboratory. This method currently is planned for use in Tank 241-S-102 (HNF-2944). The fluidic mixing system discussed above is an AEA Technology system. Field-scale testing of the AEAT power fluidics system will be conducted during FY 2001 at AEAT's home office in Charlotte, North Carolina. A parallel technology demonstration effort is underway to demonstrate the Russian Pulsating Mixing and Pumping System. The Russian system is similar to the AEAT system and is planned for demonstration in Russia at end of FY 2001 or early FY 2002.

3.2.2.4 Confined-Sluicing Robotic Crawler

Sludge waste mobilization and retrieval is accomplished by introduction of a small (sometimes collapsible or foldout) vehicle into the tank environment. In a confined-sluicing approach, sluicing nozzles are mounted on the vehicle and direct a low volume of high-pressure sluicing fluid onto the waste in the immediate proximity of the vehicle. The vehicle also contains a slurry pump, which draws the resulting waste slurry out of the tank at a rate determined to minimize free-liquid accumulation. This approach reduces the amount of freestanding liquids in the tank and thereby reduces the potential for leaks during retrieval. In the most common applications, the vehicle also serves as a platform to mount other tools that can be used to dislodge compacted wastes or wastes adhering to sidewalls or appendages. For the SST application, the sluicing fluid primarily will be recycled supernatant. This method currently is planned for use in Tank 241-C-104 (HNF-2944). The crawler-based, robotic, confined-sluicing system is being procured through Los Alamos Technical Associates (LATA) with the resumption of an industry contract initiated under the former Hanford Tank Initiative (HTI) project. CHG is designing a separate crawler-based, robotic system in parallel with procurement of the LATA system. As a result of lessons learned at Oak Ridge National Laboratory during the retrieval of the Gunite Tanks, an articulated mast will be deployed in conjunction with the crawler-based, robotic confined sluicing system to enhance system effectiveness and flexibility. The "articulated mast" is mentioned below in Section 3.2.2.5.

3.2.2.5 Manipulator or Arm

Wastes can be retrieved from the SSTs, or retrieval operations can be supported, using a mechanical arm typically folded in several sections. This device may be used to deliver various tools to specified locations within the interior of the tank. The arm is fixed at one end, often from or above the tank risers and, as with the crawler, various tools often are mounted at the opposite end of the arm. One proposed application is to mount a sluicing nozzle at the working end of the arm and use this device in conjunction with a crawler that serves as a pump to retrieve and transfer the waste slurry out of the tank (HNF-2944).

3.2.2.6 Leak Detection, Mitigation, and Monitoring

Tank leak detection technology development and demonstration is underway at the 105-A Mock Tank Site in 200 East Area. A total of six leak detection technologies are being demonstrated for their capabilities with respect to early leak detection, locating leaks, and quantifying the volume of leaks. The six technologies include Partitioning Interwell Tracer Tests (PITT), Electrical Resistivity Tomography (ERT), High Resolution Resistivity (HRR), Cross Borehole Electromagnetic Induction (CEMI), Cross Borehole Seismic (XBS), and Cross Borehole Radar (XBR). The new technologies promise to be more sensitive to potential leaks during retrieval operations by virtue of the fact that they are "volume integrating" rather than point source measurement techniques. In-tank leak detection technology demonstrations are planned for FY 2002 and will include spectral gamma ray and pressure transducer techniques for determining interstitial liquid volumes. A leak mitigation technology demonstration is underway at the bench-scale to conduct "proof-of-concept" tests on Apatite Reactive Zone technology for sequestering technetium and uranium.

3.2.3 Infrastructure Requirements

The following types of infrastructure hardware are required to functionally support pumping of solutions/slurries from SSTs:

- Tank-related retrieval systems
  - In-tank hardware and support systems
  - Monitoring and control systems for leak detection, mitigation, and retrieval control
  - Jumper/pit upgrades, confinement systems, maintenance features
  - In-farm piping to waste receiver DSTs (including waste receiver facilities)
- Waste receiver facilities
  - Facility features including instrumentation, control systems, ventilation, and personnel features
- New transfer lines (temporary aboveground lines or newly installed lines)
  - Connections from SST farms to DSTs or waste receiver facilities
  - Connections from waste receiver facilities to DST receivers.

3.2.4 Tank Integrity

Issues regarding tank integrity, such as reliability of liners, thermal cycling, and interim stabilization, are being investigated. Sixty-seven of the SST's are known or suspected to have leaked. All of the SST's have exceeded their original design lives and continue to degrade. Tank integrity is being addressed through routine measurements of liquid levels, tank dome surveys, and in-tank video inspections. Efforts are underway through the Interim Stabilization Program to remove all of the pumpable liquids from the SSTs to minimize the potential for leakage losses to the vadose zone. Interim Stabilization Program saltwell pumping activities are planned for completion by the end of FY 2004 under the terms and conditions of the Tri-Party Agreement Consent Decree. Efforts are also underway through the DOE Office of Science and Technology (EM-50) Tanks Focus Area to develop and demonstrate acoustic and electrical methods for evaluating DST corrosion and integrity with possible applications to SST inspections. As more information is obtained or developed to address these issues, they will be considered in sequencing the SSTs for retrieval. These items are noted and listed in this document for future consideration and analysis.

3.3 SINGLE-SHELL TANK RETRIEVAL SEQUENCE DESCRIPTION AND SCHEDULE

3.3.1 Retrieval Sequence and Schedule

An HTWOS model run was made to integrate the U.S. Department of Energy's Initial Quantity guidance with the risk-based SST retrieval strategy, to develop the current retrieval sequence. The first six tank retrievals support Milestone M-45-00A in the Tri-Party Agreement. The SST waste will be retrieved and transferred into DSTs as space becomes available, with the exception of Tank C-107, which was date constrained. At the beginning of the Balance-of-Mission, the design capacity of the existing HLW and LAW glass plants are assumed to increase, and additional higher capacity LAW and HLW glass plants will be added. On March 1, 2018, it is assumed that the two LAW glass plants will have a design capacity of 60 MT/day each (120 MT/day total, 85% TOE), and the two HLW glass plants will have a design capacity of 6.0 MT/day each (12 MT/day total, 85% TOE).

Under these constraints, SST waste retrieval will be completed in FY 2027. Processing of both LAW and HLW will be completed in 2028. The projected retrieval sequence and timing for this scenario are presented in Figure 3-3. The SST waste retrieval data associated with Figure 3-3, including the timing, duration, and quantity of waste retrieved, are presented in Table 3-2.

3.3.2 Limitations On Single-Shell Tank Retrieval Sequence And Schedule

Some practical limitations within the Hanford Site tank waste system will drive the SST retrieval sequence and schedule. These limitations are discussed below.

- Limited physical space is available in the tank farms for simultaneously performing construction and retrieval operations.

- Inadequate piping available between tanks within a farm and between tank farms restricts the number of simultaneous waste transfers that can be made. The presence of contaminated soil constraints greatly increases the cost of adding more transfer lines to overcome this limitation.

- The layout of the farms on the Hanford Site restricts the number of simultaneous transfers that can be made because of the logistics requirements for operating within a tank farm to effectively monitor and control waste transfers.

- The ability to transfer waste across the Site is constrained by the availability of the SY Farm tanks, the availability of Tank 241-AN-104 to receive slurry transfers, and the lack of space in the 200 West Area in which to separate liquids from insoluble solids to enable transfer of supernatants to Tank 241-AN-101.

- SST waste can be transferred to DSTs only with the proper equipment. The use of DSTs to store retrieved SST waste may be constrained by the equipment installed in the DST. Not all DSTs are being equipped with the two mixer pumps needed to mobilize insoluble solids that may be present in some SST waste.

3.3.3 Retrieval Waste Generation

Currently, it is assumed that enough water will be added to the SST waste to result in a sodium concentration ≤5 *M* and an insoluble solids loading ≤10 wt% (HNF-SD-WM-SP-012). Solutions or slurries that meet these two criteria can be transferred reliably within the existing waste transfer system, with limited or no crystallization and/or solids settling. Additional liquid will be added outside the tank to dilute solutions and slurries so the waste can be transferred from the SSTs to the DSTs and, ultimately, to the Waste Treatment Plant. The amount of water that needs to be added to retrieve and transport waste from a specific SST to a waste receiver facility tank or DST depends on the composition of waste in that SST.

Retrieval of the approximately 128,000 m^3 (33,600,000 gal) of SST waste will produce an estimated 359,000 m^3 (94,800,000 gal) of retrieved waste because of the addition of retrieval and transport liquids. This is nearly a three-fold volume increase. The amount of water needed to retrieve and transport the waste from a specific SST can be adjusted in the future when better information is available about the waste, the specific transfer routes, and transport phenomena.

3.3.4 Double-Shell Tank Space Utilization

Available DST space was filled with retrieved SST waste to the maximum extent possible without violating spare space and near-term feed delivery requirements and within known limitations of the DSTs and associated piping systems. Figure 3-4 shows the liquid volume in each of the 28 DSTs for the duration of the mission. The projected DST space needs for this scenario are evaluated in Case 2 of the DST Space Evaluation (Section 5.4.2) and depicted in

Figure 5-6. The available DST space is not fully utilized during the mission because of bottlenecks created by cross-site slurry-transfer tank allocations.

Actions for optimizing tank use are being reviewed under Milestone M-45-12A of the Tri-Party Agreement. These actions could free up additional tank space by reducing the number of feed staging tanks and operational tanks. Other options planned to be evaluated under Milestone M-45-12A include identifying options for additional Tri-Party Agreement-compliant storage for SST retrievals. A study of potential space-saving measures has been performed (Boyles 2001). A brief discussion of these options is given in Section 5.3 of this document.

Table 3-2. Single-Shell Tank Retrieval/Case 2 Sequence Data. (3 sheets)

241-S-112	10/1/2004	198	4/17/2005	1,347,300	4,837	1,352,137	10	55
241-S-102	1/3/2006	111	4/24/2006	836,100	8,401	844,501	21	50
241-S-105	1/1/2007	291	10/19/2007	1,326,005	2,549	1,328,554	22	77
241-S-106	10/20/2007	395	11/18/2008	1,140,419	4,929	1,145,348	33	97
241-C-104	1/16/2008	185	7/19/2008	717,700	49,536	767,236	7	1
241-S-107	11/19/2008	1942	3/15/2014	927,934	35,456	963,390	37	11
241-S-101	1/1/2014	390	1/26/2015	1,539,169	49,389	1,588,558	20	22
241-C-102	3/15/2014	1537	5/30/2018	1,383,321	51,539	1,434,860	132	2
241-C-107	5/15/2014	158	10/20/2014	557,247	31,108	588,356	64	8
241-C-112	10/20/2014	1451	10/10/2018	509,741	19,964	529,704	11	57
241-U-108	10/21/2014	1452	10/12/2018	1,097,780	28,123	1,125,903	5	72
241-BY-111	1/22/2015	1313	8/27/2018	1,430,043	45,215	1,475,258	6	59
241-U-107	1/23/2015	1347	10/1/2018	730,479	3,813	734,291	8	53
241-S-110	1/24/2015	1582	5/25/2019	1,093,815	19,664	1,113,479	19	25
241-S-108	1/25/2015	1464	1/28/2019	1,257,000	2,483	1,259,482	29	26
241-C-103	5/29/2018	179	11/24/2018	564,078	21,087	585,165	55	4
241-A-106	10/11/2018	216	5/15/2019	438,513	13,567	452,080	68	6
241-C-105	11/25/2018	179	5/23/2019	682,792	25,316	708,108	63	13
241-AX-103	5/16/2019	146	10/9/2019	276,065	3,073	279,138	66	19
241-A-102	5/24/2019	115	9/16/2019	91,981	2,536	94,516	78	24
241-BX-104	5/24/2019	116	9/17/2019	684,931	26,008	710,938	30	31
241-SX-105	5/30/2019	426	7/29/2020	1,249,121	11,733	1,260,854	1	12
241-SX-103	5/31/2019	411	7/15/2020	1,352,019	8,275	1,360,294	2	27
241-TX-118	6/1/2019	231	1/18/2020	823,912	8,487	832,399	56	3
241-B-101	6/2/2019	100	9/10/2019	358,035	3,323	361,358	71	9
241-AX-102	9/17/2019	117	1/12/2020	64,625	1,131	65,756	101	7
241-U-106	10/6/2019	155	3/9/2020	480,476	2,776	483,252	23	13
241-C-101	10/7/2019	95	1/10/2020	324,837	11,519	336,356	77	15
241-U-105	10/8/2019	238	6/2/2020	908,877	11,167	920,044	9	16
241-T-101	1/9/2020	95	4/13/2020	779,023	30,343	809,367	50	23
241-S-104	1/11/2020	213	8/11/2020	1,661,838	55,609	1,717,447	57	30
241-TX-113	1/17/2020	355	1/6/2021	2,460,712	18,676	2,479,388	4	83
241-BY-105	3/8/2020	306	1/8/2021	1,348,385	37,255	1,385,640	45	33
241-A-101	4/12/2020	549	10/13/2021	817,208	2,593	819,801	95	34
241-BY-109	6/1/2020	267	2/23/2021	764,956	16,591	781,547	12	98
241-A-103	7/14/2020	266	4/6/2021	913,484	8,360	921,843	40	37
241-U-102	7/28/2020	216	3/1/2021	672,677	11,774	684,451	47	38
241-SX-104	8/11/2020	384	8/30/2021	1,103,527	10,906	1,114,433	35	18
241-SX-101	1/5/2021	312	11/13/2021	1,094,032	12,624	1,106,656	58	20
241-BX-103	1/7/2021	77	3/25/2021	307,266	11,962	319,228	102	42
241-T-111	2/22/2021	259	11/8/2021	710,982	27,061	738,043	76	45
241-TX-101	2/28/2021	108	6/16/2021	523,656	18,006	541,661	100	45
241-S-103	3/24/2021	177	9/17/2021	608,960	3,304	612,264	42	47
241-AX-101	4/5/2021	446	6/25/2022	745,545	8,489	754,034	108	40
241-BX-105	6/15/2021	72	8/26/2021	242,660	8,965	251,625	109	48
241-U-110	8/25/2021	155	1/27/2022	1,545,445	55,884	1,601,329	69	49
241-TX-112	8/29/2021	375	9/8/2022	1,854,437	18,720	1,873,157	13	64
241-U-103	9/16/2021	270	6/13/2022	938,573	5,795	944,368	51	51
241-BY-103	10/12/2021	257	6/26/2022	1,124,083	20,801	1,144,884	24	52
241-SX-111	11/8/2021	156	4/13/2022	797,640	28,048	825,688	86	28
241-SX-109	11/12/2021	217	6/17/2022	1,163,411	36,273	1,199,684	74	29
241-BY-104	1/26/2022	259	10/12/2022	1,087,451	11,798	1,099,249	32	54

Table 3-2. Single-Shell Tank Retrieval/Case 2 Sequence Data. (3 sheets)

Tank								
241-SX-106	4/12/2022	323	3/1/2023	982,912	16,796	999,707	16	32
241-BX-101	6/12/2022	72	8/23/2022	285,088	10,859	295,947	70	56
241-B-111	6/16/2022	158	11/21/2022	301,004	11,567	312,571	75	58
241-SX-102	6/25/2022	356	6/16/2023	1,175,353	8,113	1,183,466	3	35
241-TX-109	6/29/2022	251	3/7/2023	426,023	9,742	435,765	65	60
241-C-111	8/22/2022	75	11/5/2022	393,399	14,186	407,585	93	61
241-TY-103	9/7/2022	176	3/2/2023	471,132	18,946	490,078	46	63
241-BX-102	10/11/2022	118	2/6/2023	473,620	17,814	491,434	117	65
241-TX-105	11/4/2022	355	10/25/2023	1,743,346	18,117	1,761,463	15	66
241-T-104	11/21/2022	246	7/25/2023	520,587	18,241	538,829	115	67
241-SX-107	3/2/2023	144	7/24/2023	653,964	22,515	676,480	97	36
241-TX-115	3/4/2023	371	3/9/2024	1,624,529	16,820	1,641,350	17	68
241-T-105	3/5/2023	94	6/7/2023	281,172	10,045	291,217	60	69
241-B-110	3/6/2023	163	8/16/2023	356,524	14,859	371,383	106	70
241-BY-101	6/6/2023	250	2/11/2024	959,318	23,845	983,163	18	70
241-SX-110	6/15/2023	137	10/30/2023	404,152	14,231	418,383	98	39
241-SX-112	7/25/2023	140	12/12/2023	702,157	24,695	726,852	91	41
241-TX-104	8/7/2023	101	11/16/2023	119,139	4,020	123,159	103	73
241-TX-114	8/16/2023	321	7/2/2024	1,517,257	15,213	1,532,470	26	74
241-BY-106	10/24/2023	371	10/29/2024	1,701,925	26,681	1,728,606	14	76
241-BY-112	10/29/2023	205	5/21/2024	1,116,222	21,620	1,137,842	25	101
241-SX-114	11/15/2023	183	5/16/2024	783,591	24,581	808,172	83	43
241-SX-108	12/11/2023	142	5/1/2024	322,122	10,695	332,817	81	44
241-TX-116	2/10/2024	368	2/12/2025	1,789,412	49,094	1,838,506	39	78
241-T-107	3/8/2024	129	7/15/2024	460,268	15,439	475,707	31	79
241-T-110	4/30/2024	226	12/12/2024	297,230	11,912	309,142	116	79
241-BY-102	5/15/2024	199	11/30/2024	896,073	20,901	916,974	36	81
241-C-109	5/20/2024	77	8/5/2024	320,329	12,219	332,548	88	83
241-TX-110	7/1/2024	286	4/13/2025	1,257,099	14,130	1,271,229	34	85
241-BY-110	7/14/2024	256	3/27/2025	1,233,060	17,121	1,250,181	27	94
241-TX-117	8/4/2024	363	8/2/2025	1,689,860	20,362	1,710,222	43	86
241-BX-112	10/29/2024	125	3/3/2025	353,363	13,280	366,643	121	87
241-TY-101	11/29/2024	122	3/31/2025	969,542	35,632	1,005,174	105	88
241-BX-106	12/11/2024	69	2/18/2025	183,107	6,995	190,101	112	89
241-BX-107	2/11/2025	210	9/9/2025	899,501	35,587	935,088	61	91
241-TX-106	2/18/2025	282	11/27/2025	1,017,017	4,589	1,021,605	38	92
241-S-109	3/2/2025	296	12/23/2025	1,480,789	5,558	1,486,347	28	93
241-BX-110	3/26/2025	144	8/17/2025	573,042	17,072	590,114	67	95
241-TX-111	3/31/2025	241	11/27/2025	983,646	11,808	995,455	41	117
241-U-111	4/12/2025	206	11/4/2025	718,920	9,806	728,726	44	96
241-U-109	8/2/2025	259	4/18/2026	787,885	11,608	799,493	48	100
241-B-104	8/17/2025	222	3/27/2026	477,157	12,403	489,561	94	102
241-BY-108	9/9/2025	175	3/3/2026	468,162	13,118	481,280	54	103
241-BY-107	11/3/2025	194	5/16/2026	968,156	18,663	986,819	49	109
241-BX-109	11/26/2025	139	4/14/2026	244,820	10,835	255,655	52	130
241-B-109	12/22/2025	107	4/8/2026	522,489	18,629	541,119	53	113
241-S-111	12/22/2025	350	12/7/2026	956,102	42,223	998,325	59	110
241-TX-102	3/2/2026	170	8/19/2026	619,588	6,591	626,179	62	104
241-TY-105	3/27/2026	176	9/19/2026	468,438	19,768	488,206	72	123
241-C-110	4/8/2026	131	8/17/2026	351,641	13,233	364,873	90	105
241-B-103	4/14/2026	75	6/28/2026	153,503	3,946	157,450	113	106
241-T-112	4/17/2026	76	7/2/2026	115,438	4,415	119,853	119	108
241-TY-104	5/15/2026	94	8/17/2026	146,104	5,551	151,655	85	111
241-BX-111	6/28/2026	123	10/29/2026	443,579	6,998	450,576	73	112
241-B-106	7/1/2026	101	10/10/2026	138,190	5,308	143,498	79	132

Table 3-2. Single-Shell Tank Retrieval/Case 2 Sequence Data. (3 sheets)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
241-B-204	8/16/2026	30	9/15/2026	74,542	2,765	77,307	141	114
241-B-203	8/17/2026	29	9/15/2026	88,799	3,236	92,035	134	116
241-B-107	8/18/2026	125	12/21/2026	485,352	19,617	504,969	99	118
241-T-102	9/14/2026	60	11/13/2026	297,724	11,147	308,871	87	119
241-B-105	9/15/2026	191	3/25/2027	381,550	4,426	385,976	110	121
241-TX-108	9/19/2026	131	1/28/2027	374,179	4,073	378,252	84	122
241-U-112	10/10/2026	71	12/20/2026	287,550	10,115	297,665	107	124
241-T-203	10/29/2026	23	11/21/2026	60,491	2,327	62,817	143	125
241-TX-103	11/12/2026	143	4/4/2027	448,466	4,496	452,962	89	127
241-U-104	11/20/2026	108	3/8/2027	479,526	15,689	495,214	92	128
241-B-108	12/6/2026	91	3/7/2027	257,823	9,426	267,249	96	139
241-B-102	12/19/2026	65	2/22/2027	108,592	2,770	111,363	118	142
241-T-204	12/21/2026	25	1/15/2027	59,096	2,281	61,377	142	129
241-T-108	1/14/2027	72	3/27/2027	139,919	4,967	144,886	128	133
241-B-112	1/27/2027	66	4/3/2027	45,787	1,841	47,628	122	144
241-TX-107	2/22/2027	91	5/24/2027	92,220	1,914	94,133	125	143
241-T-109	3/7/2027	76	5/22/2027	159,158	1,643	160,801	129	134
241-TY-102	3/25/2027	100	7/3/2027	208,120	561	208,681	130	137
241-C-108	3/26/2027	79	6/13/2027	236,345	7,996	244,340	131	141
241-SX-113	4/2/2027	100	7/11/2027	176,245	6,497	182,742	133	138
241-A-105	4/3/2027	86	6/28/2027	220,618	7,917	228,535	82	5
241-SX-115	5/20/2027	64	7/23/2027	42,838	1,385	44,223	124	10
241-U-101	5/21/2027	62	7/22/2027	143,065	5,014	148,079	126	90
241-T-103	5/23/2027	65	7/27/2027	131,222	5,009	136,232	123	62
241-A-104	6/12/2027	102	9/22/2027	237,183	8,713	245,896	120	21
241-BX-108	6/27/2027	64	8/30/2027	49,742	2,020	51,762	111	136
241-AX-104	7/3/2027	38	8/10/2027	89,758	3,359	93,116	80	17
241-TY-106	7/10/2027	71	9/19/2027	129,253	4,918	134,171	114	140
241-T-106	7/22/2027	59	9/19/2027	122,992	4,611	127,603	127	135
241-B-201	7/25/2027	19	8/13/2027	116,485	4,384	120,869	135	82
241-B-202	7/26/2027	19	8/14/2027	30,105	1,185	31,290	136	126
241-C-202	8/9/2027	8	8/17/2027	8,004	299	8,303	149	115
241-T-201	8/13/2027	19	9/1/2027	111,767	4,186	115,953	145	99
241-T-202	8/15/2027	16	8/31/2027	34,599	1,340	35,939	144	131
241-U-201	8/16/2027	9	8/25/2027	21,120	777	21,897	138	147
241-U-202	8/24/2027	10	9/3/2027	21,121	777	21,898	139	149
241-U-203	8/30/2027	21	9/20/2027	10,600	384	10,984	137	148
241-U-204	9/1/2027	7	9/8/2027	15,600	577	16,177	140	145
241-C-201	9/2/2027	8	9/10/2027	16,296	662	16,958	148	75
241-C-203	9/11/2027	8	9/19/2027	29,941	1,169	31,109	146	120
241-C-204	9/20/2027	8	9/28/2027	13,272	513	13,785	147	146

1: The SST (Case 2) retrieval sequence attempts to maximize risk reduction for both groundwater and airborne contamination with consideration to waste treatment plant processing needs. Therefore, the groundwater and airborne risk rankings are not ordered sequentially in the retrieval sequence. A detailed discussion of the sequence development is provided in Section 3.1, Tank Selection Criteria and Rationale, and Appendix C of this document. Under Case 2, SST waste is retrieved as DSTs become available and is not constrained by funding for SST retrieval infrastructure.

Figure 3-3. Single-Shell Tank Retrieval/Case 2 Sequence and Schedule.

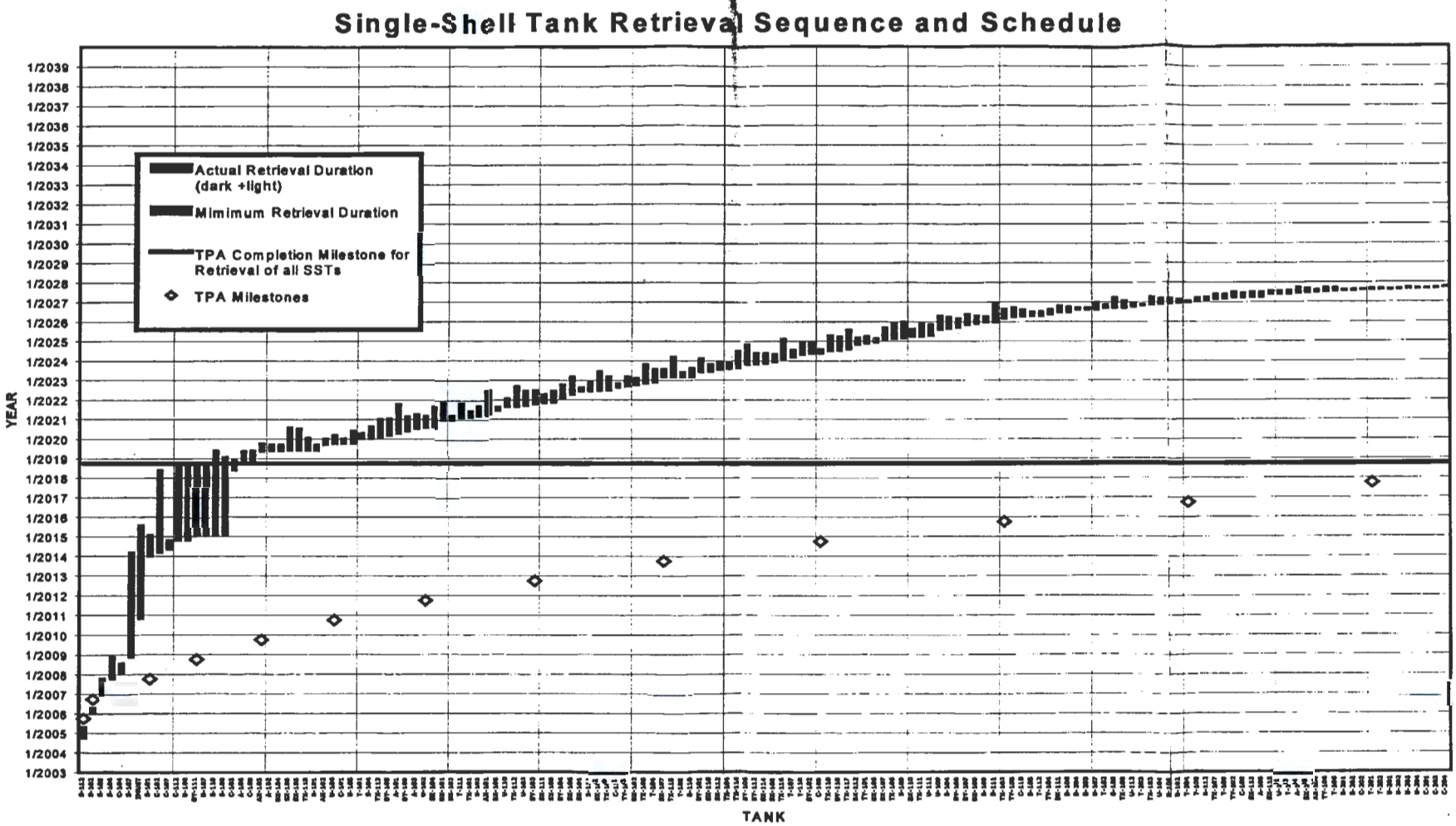
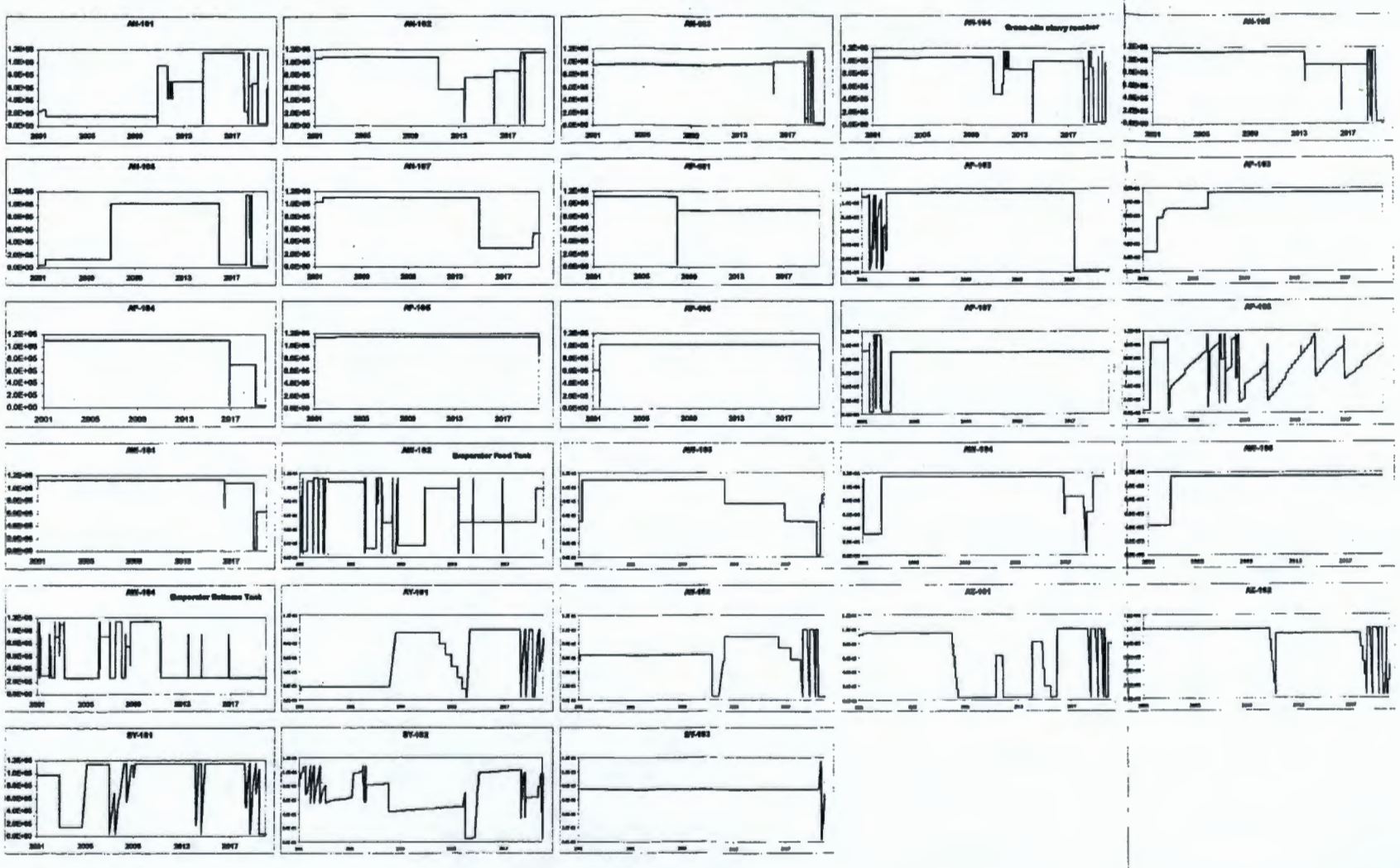


Figure 3-4. Case 2 Individual Double-Shell Tank Volume Plots.



4.0 RISK REDUCTION RESULTS FROM SINGLE-SHELL TANK RETRIEVAL SEQUENCE

The tank retrieval sequence for Cases 1 and 2 has been prioritized to meet the objective of maximizing risk reduction through retrieval of the mobile, long-lived radionuclides and the long-lived alpha-emitting radioactive elements of concern. Consideration in the sequence also was given to the Waste Treatment Plant requirements, infrastructure constraints, tank leak integrity, and suitability for technology demonstration deployments provided for in Milestone M-45-00A. While not used as a tank selection criterion, the results also were compared to risk reduction of the mobile, noncarcinogenic chemicals.

The relative risks of the identified contaminants for each of the SSTs selected for near-term retrieval are depicted in Table 4-1.

Table 4-1. Relative Risks for SSTs Selected for Near-Term Retrieval.

Tank	Groundwater Risk	Airborne Risk	Chemical Risk	Volume (kgal)
241-C-104	2.48 %	13.15 %	0.27 %	263
241-S-112	2.12 %	0.30 %	2.79 %	523
241-S-102	1.51 %	0.34 %	1.16 %	492
TOTAL:	**6.11 %**	**13.79 %**	**4.22 %**	**1,278**

To assess performance of this retrieval order, several key parameters were selected as success measures. Plots of the risk parameters are shown in the figures listed below:

- Airborne risk reduction versus volume retrieved (Mgal) (Figure 4-1)
- Groundwater risk reduction versus volume retrieved (Mgal) (Figure 4-2)
- Chemical risk reduction versus volume retrieved (Mgal) (Figure 4-3)
- Airborne risk reduction over time (Figure 4-4)
- Groundwater risk reduction over time (Figure 4-5)
- Chemical risk reduction over time (Figure 4-6).

The risk reductions versus volume retrieved pertain to both Projection Cases 1 and 2. The risk reduction versus time is relevant only for Case 2. Information for Case 1 risk reduction versus time is shown in Appendix G. Information for Case 3 risk reduction versus both volume retrieved and time is shown in Appendix H. Based on the above selection rationale and the risk-reduction performance depicted in Figures 4-1 through 4-6, the SST retrieval order is considered to meet the objectives in Milestone M-45-00A for long-term risk reduction.

When the current sequence is compared to the SST retrieval sequence from FY 2000, the overall reduction in airborne risk is accelerated in the early retrievals, better approximating the ideal

risk-reduction curve. The ideal risk reduction curve for each parameter (airborne, groundwater, and chemical risk) was developed by sequencing tanks in the order that gave the maximum risk reduction for the waste volume retrieved. The groundwater risk reduction curve for FY 2001 shows that increased risk reduction occurs in the earlier retrievals compared to those for FY 2000. The chemical risk reduction for FY 2000 was better than that for FY 2001. The improved airborne risk reduction and similar groundwater risk reduction result from two factors: the accelerated retrieval of known and assumed-to-have-leaked tanks and an improved risk measurement and sequence rationale. Because tank selection was based on radionuclides that control airborne and groundwater risk, tanks with higher chemical inventories, but low radionuclide inventories, were not necessarily retrieved earlier than those with lower chemical inventories. These figures do not contain risk data for the 21 SSTs placed at the end of the sequence (those that are nearly empty or that have specific retrieval issues).

Figure 4-1. Case 1 and 2 Airborne Risk Reduction Versus Volume Retrieved.

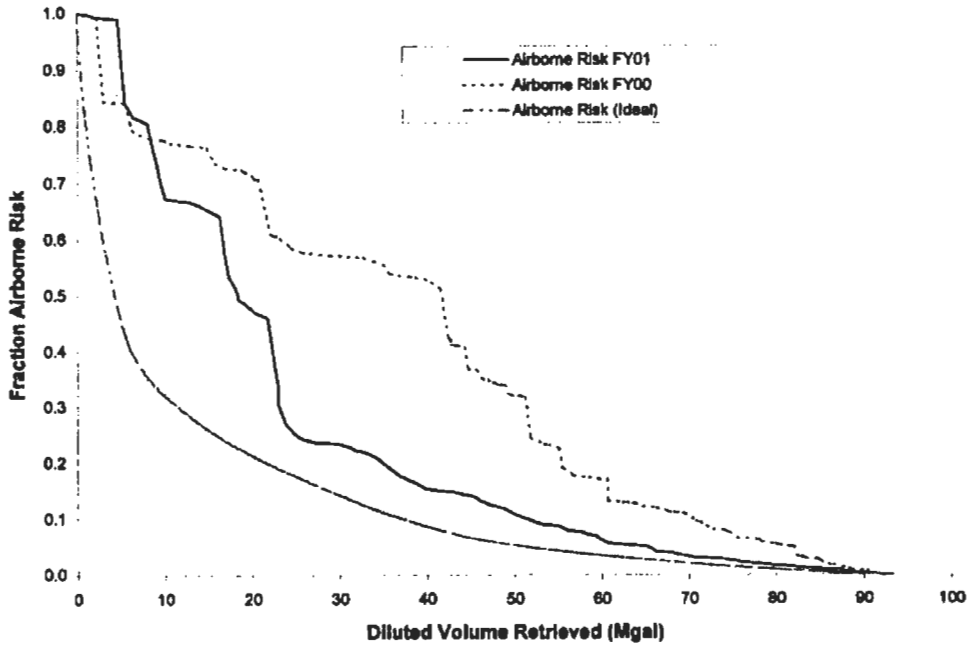


Figure 4-2. Case 1 and 2 Groundwater Risk Reduction Versus Volume Retrieved.

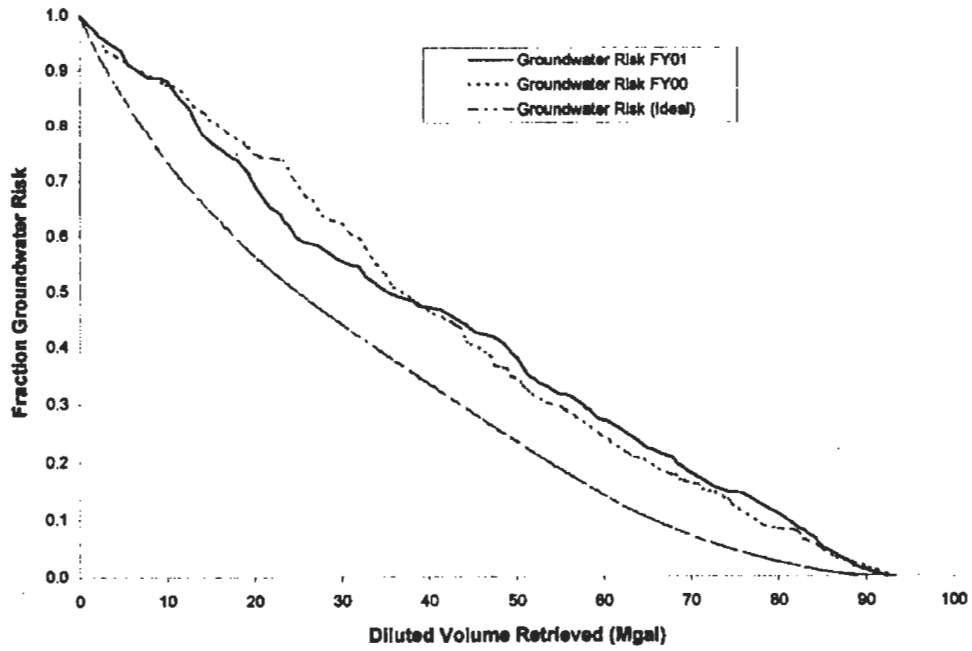


Figure 4-3. Case 1 and 2 Chemical Risk Reduction Versus Volume Retrieved.

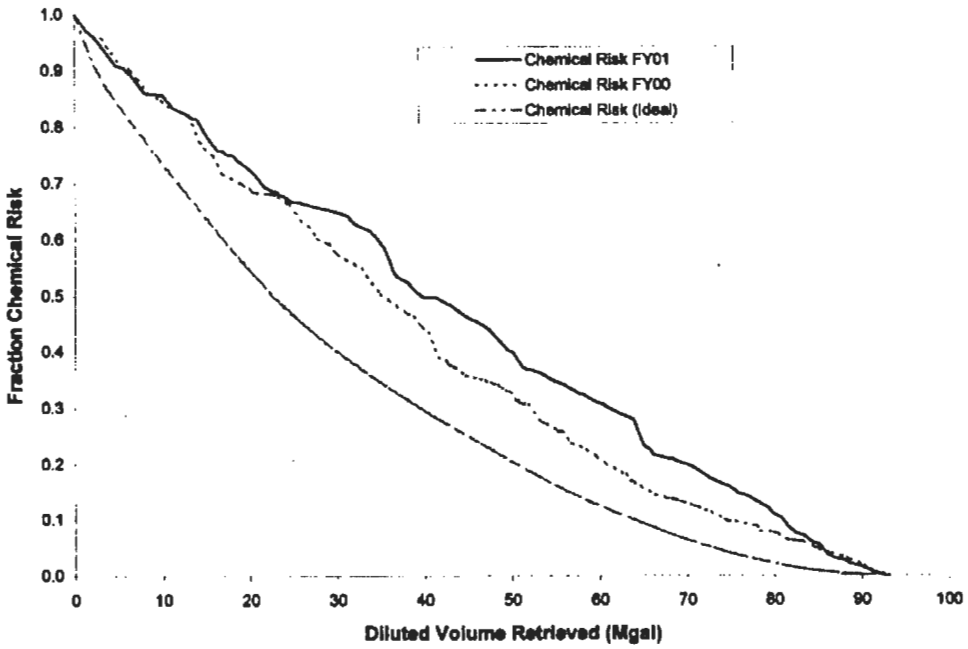


Figure 4-4. Case 2 Airborne Risk Reduction Over Time.

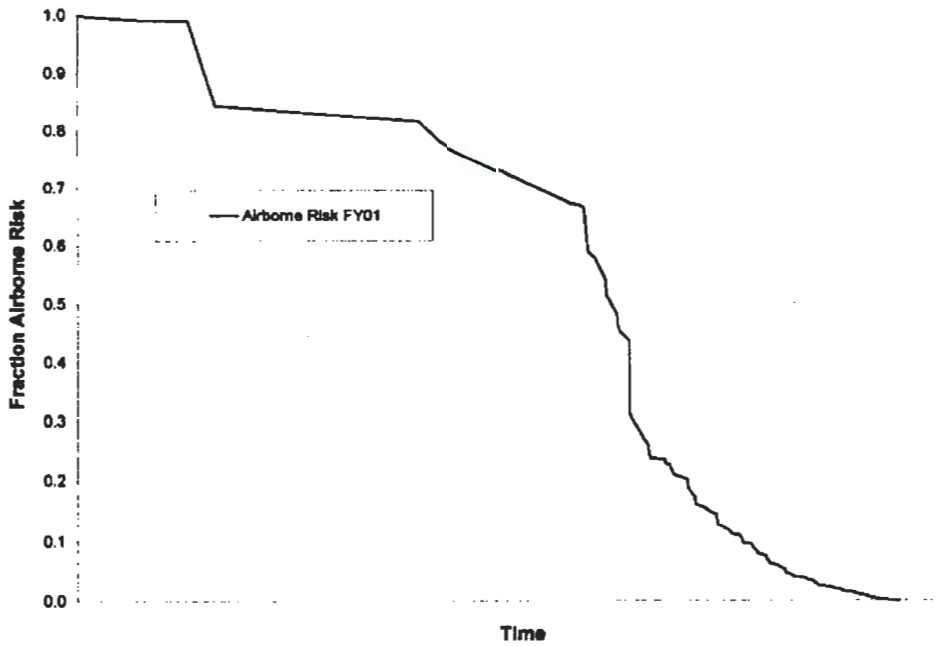


Figure 4-5. Case 2 Groundwater Risk Reduction Over Time.

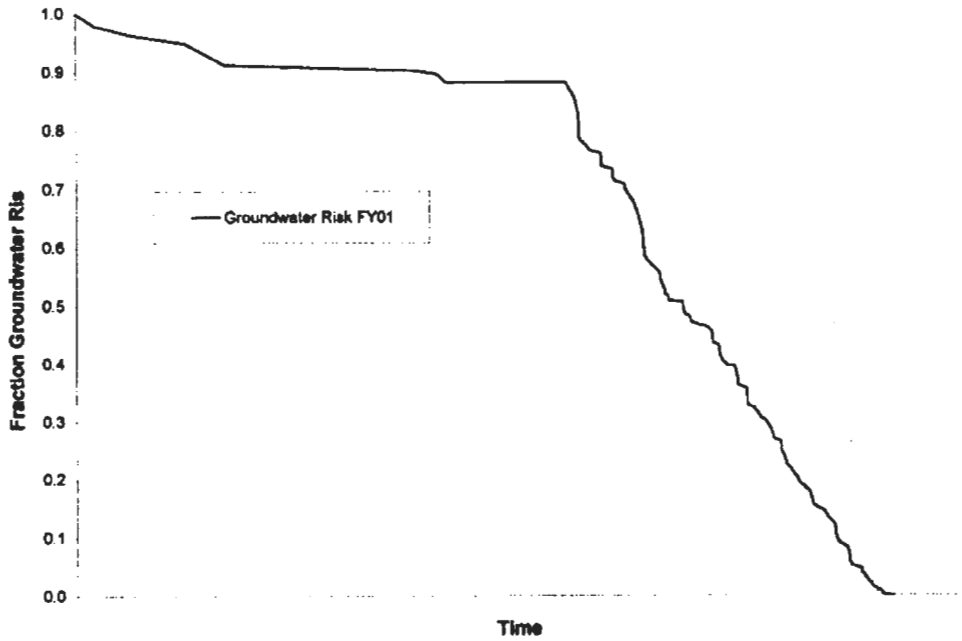


Figure 4-6. Case 2 Chemical Risk Reduction Over Time.

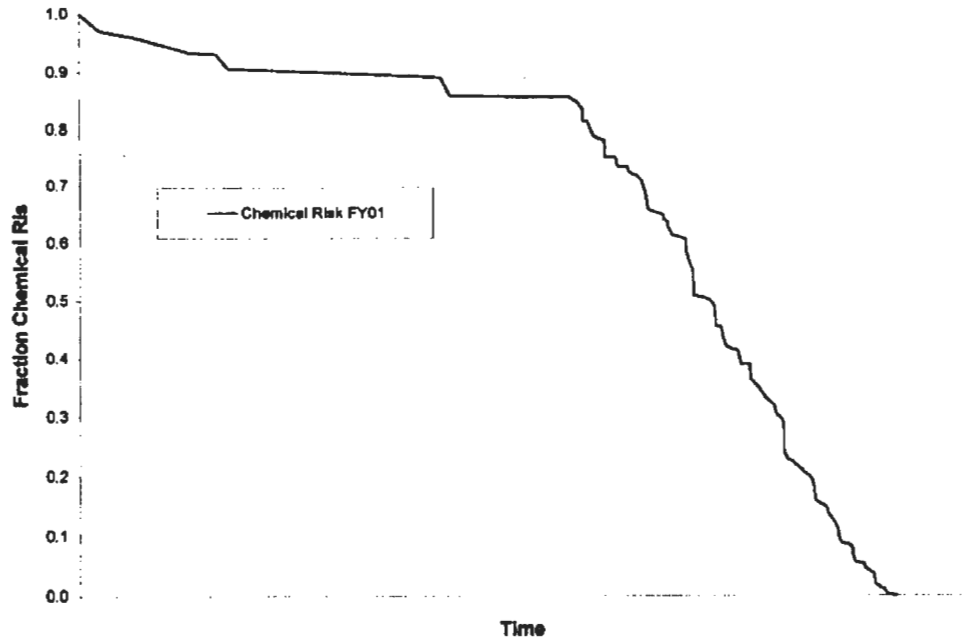
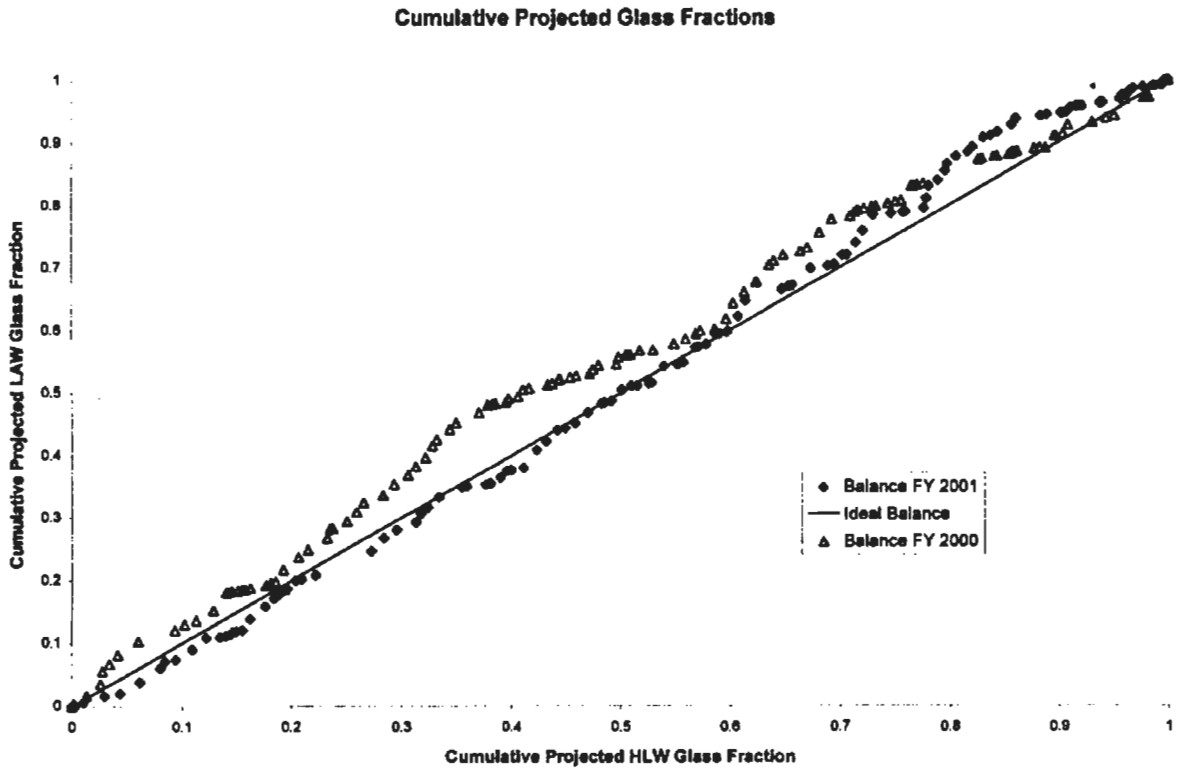


Figure 4-7 illustrates the effect of retrieval balancing. This figure is only representative of the 121 tanks for which HTWOS prioritizes a sequence. Replotting of the data to include all 148 tanks, however, shows no significant difference. Figure 4-7 also illustrates the improvement on the projected balance of the two glass fractions over the FY 2000 sequence.

Figure 4-7. Cumulative High-Level Waste and Low-Activity Waste Glass Fractions.



5.0 DOUBLE-SHELL TANK SPACE EVALUATION

5.1 DOUBLE-SHELL TANK SPACE EVALUATION ASSUMPTIONS AND CONSTRAINTS

Three projection cases were evaluated to consider a range of operational assumptions that determine the impact of changes in the SST retrieval and waste treatment schedule on DST needs. A complete listing of assumptions for the three projections is presented in Appendix A. The SST retrieval sequence for FY 2001 is based on the Case 2 projection that incorporates a risk-based SST retrieval sequence that completes waste vitrification in 2028 and maintains waste volumes within existing DST capacity. Case 1 and Case 3 incorporate SST waste retrieval scenarios that require new DST capacity. The assumptions and results are summarized in Table 5-3, with a more comprehensive listing provided in Appendix A.

5.1.1 Projection Case 1 Assumptions

Assumptions for Case 1 were developed after discussions with the Washington State Department of Ecology. Assumptions for the Case 1 projection are the same as those used for the Case 2 projection except for the following:

1. The Case 1 projection incorporates the same risk-based SST retrieval sequence as Case 2 but completes retrieval by 9/30/2018 (Tri-Party Agreement Milestone M-45-05; M-45-05-T05 through M-45-05-T09 not constraining). Since the purpose of this projection is to determine the space needed for fixed operational assumptions, the model used for the Case 1 projection has retrieved the SST wastes using near minimum retrieval durations rather than extending retrieval durations to avoid overfilling available DST capacity. This SST retrieval schedule would begin retrieving additional solids (solids beyond those needed as HLW feed in Initial Quantity timeframe) in FY 2005. Volumes used for this sequence were calculated based on tank inventory and composition information available in July 2000. The schedule and volume information for Case 1 SST waste retrieval is provided in Appendix G.

2. Tank space options were incorporated to save 3.0 million gallons of space by 2011. The options used and the space savings are listed below (Boyles, 2001):

- Increasing the fill limit for existing DSTs. This option fills 23 DSTs to 1.2 million gallons (436 inches) and fills the evaporator feed tank (AW-102) to 1.17 million gallons. Raising the fill limit for 24 DSTs creates an additional 1.4 million gallons of storage space.

- Decreasing dedicated operational space. It was assumed that the Inactive Miscellaneous Underground Storage Tank wastes could be retrieved to tank AP-108. This allowed tank AW-105 to be used to store concentrated wastes and created an additional 0.85 million gallons of storage space.

- Some of the existing concentrated wastes stored in DSTs could be concentrated to a higher specific gravity. In Projection Case 1, concentrating some of these wastes to a specific gravity of 1.4 was used to save an additional 0.75 million gallons.

5.1.2 Projection Case 2 Assumptions

The Projection Case 2 incorporates a risk-based retrieval sequence that completes waste vitrification in 2028 and maintains waste volumes within existing DST capacity. Under this scenario, SST waste retrieval is completed in 2027. A detailed description of the development of the SST retrieval sequence is provided in Section 3.0. The SST retrieval sequence for Case 2 is provided in Section 4.0

In all projection cases, Interim Stabilization is complete in 2004 to meet the Consent Decree milestone and non-tank farm facility waste generations are based on values provided from facility management.

The WTP Initial Quantity processing assumptions are based on Bechtel National, Incorporated contract information. The Balance-of-Mission processing schedule and Waste Treatment Plant processing rates are calculated to complete waste vitrification by 2028. A more comprehensive listing of the assumptions is provided in Appendix A. A detailed description of the waste generators and tank farm facilities is provided in Appendix E.

5.1.3 Projection Case 3 Assumptions

Assumptions for the Case 3 projection are the same as those used for the Case 2 projection except for the SST retrieval sequence.

The retrieval sequence used for the Case 3 projection retrieves the tanks with the smaller remaining volumes first to meet Tri-Party Agreement milestones for number of tanks started each year (M-45-05-T05 through M-45-05-T09) while trying to stay within existing DST space for a longer period of time. The Case 3 projection is Tri-Party Agreement compliant except it does not include the Case 2 risk-based sequence for the retrieval of SST wastes.

This sequence is not started until after tanks S-112 and S-102 have been retrieved. The full-scale saltcake waste retrieval technology demonstration of tank S-112 is completed by 9/30/2005 to satisfy Tri-Party Agreement milestone M-45-03C. Wastes from tank S-102 are retrieved by 9/30/2006 to satisfy Tri-Party Agreement milestone M-45-05A. The retrieval of wastes from tank C-104 starts on 1/16/2008 for all three projection cases. Because the purpose of this document is to determine the space needed for fixed operational assumptions, the minimum retrieval duration was used for retrieving waste from each tank rather than extending the retrieval duration to avoid overfilling the available tank space. Projection Case 3 incorporates 0.85 million gallons of tank space options by 2011 (decreased dedicated operational space) and completes vitrification in 2028. The retrieval sequence for Case 3 also completes SST retrieval by 9/30/2018 to satisfy Tri-Party Agreement milestone M-45-05. The retrieval sequence for Case 3 is provided in Appendix H.

5.2 ACTUAL WASTE GENERATION COMPARED TO MANAGEMENT LIMITS

New average monthly waste generation targets have been established for this projection with waste generations being reduced by the facilities (references and discussion in Appendix E). Table 5-1 presents a comparison of the previous limits established for each facility, the newly established target rates for this projection, and the actual average monthly waste generation rate for the period July 2000 through October 31, 2000. Terminal cleanout was completed at B Plant in 1998, and no additional waste will be received from this facility. Terminal cleanout at the Plutonium Uranium extraction Plant facility was completed, but the facility could be sending ~5 Kgal/year of collected condensate to the tank farms.

Table 5-1. Comparison of Average Monthly Waste Generation Rates.

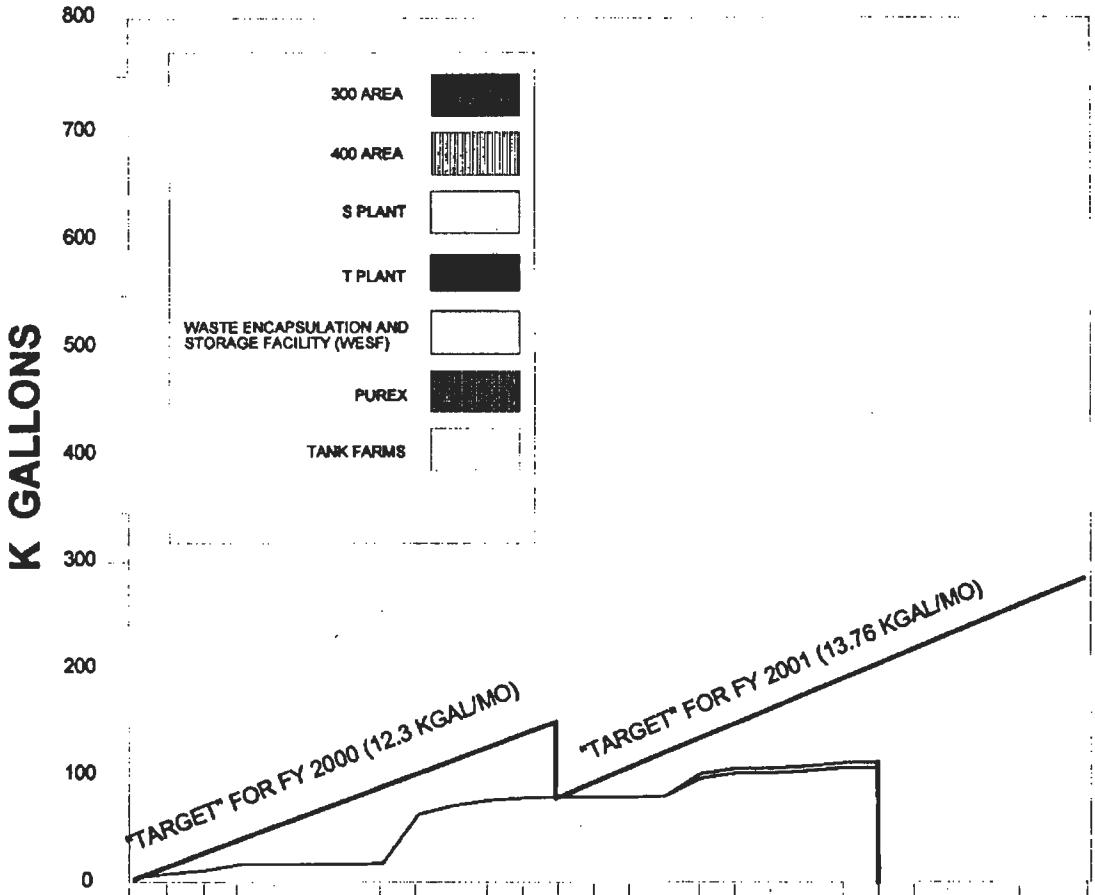
Facility	Management Limit From HNF-SD-WM-ER-029, Rev. 20 (64 Kgal/mo)	Facility Target For FY 2001	Average Monthly Facility Generations (10/1999 - 09/2000)
Tank farms	10.0	10.0	6.3
WESF/B Plant	23.0	0.42	0.0
PUREX	15.0	0.42	0.0
T Plant	6.0	1.67	0.0
222-S Laboratory	5.0	0.83	0.0
300 Area	5.0	0.42	0.0
400 Area	0.0	0.0	0.0
TOTAL	64.0	13.76	6.3

Notes:

Monthly total does not include terminal cleanout volumes or saltwell liquid pumping.
WESF = Waste Encapsulation and Storage Facility.

Waste generation estimates for the completion of SST interim stabilization are based on the estimated remaining liquid, the saltwell pumping schedule, and the flushing and dilution requirements. A comparison of actual volumes to projected volumes is shown in Figure 5-3, with a more comprehensive discussion provided in Appendix E. All waste generators are at or below their new waste generation target for the period October 1999 through September 30, 2000. A comparison of the volumes of waste entering the DST tank space for that time period is compared graphically to the various targets or projected generations in Figures 5-1, 5-2, 5-3, and 5-4.

Figure 5-1. Monthly Facility Generations.



TARGET		10/99	11/99	12/99	1/00	2/00	3/00	4/00	5/00	6/00	7/00	8/00	9/00	10/00	11/00	12/00	1/01	2/01	3/01	4/01	5/01	6/01	7/01	8/01	9/01	10/01	11/01	12/01
300 AREA	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
400 AREA	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
S PLANT	0.83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
T PLANT	1.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
WESF	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0						
PUREX	0.42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
TANK FARMS	10.0	4	3	6	0	0	0	1	46	8	5	2	1	0	0	1	16	5	0	2	3	0						
TOTAL	13.74	4	3	6	0	0	0	1	46	8	5	2	1	0	0	1	21	5	0	2	3	0						

NOTE: THIS GRAPHIC DEPICTS CONTRIBUTIONS FROM FACILITY GENERATIONS; TERMINAL CLEAN-OUT AND SWL PUMPING IS NOT SHOWN

FIG5-13

Figure 5-2. Comparison of Monthly Average Waste Generation to Target Rate.

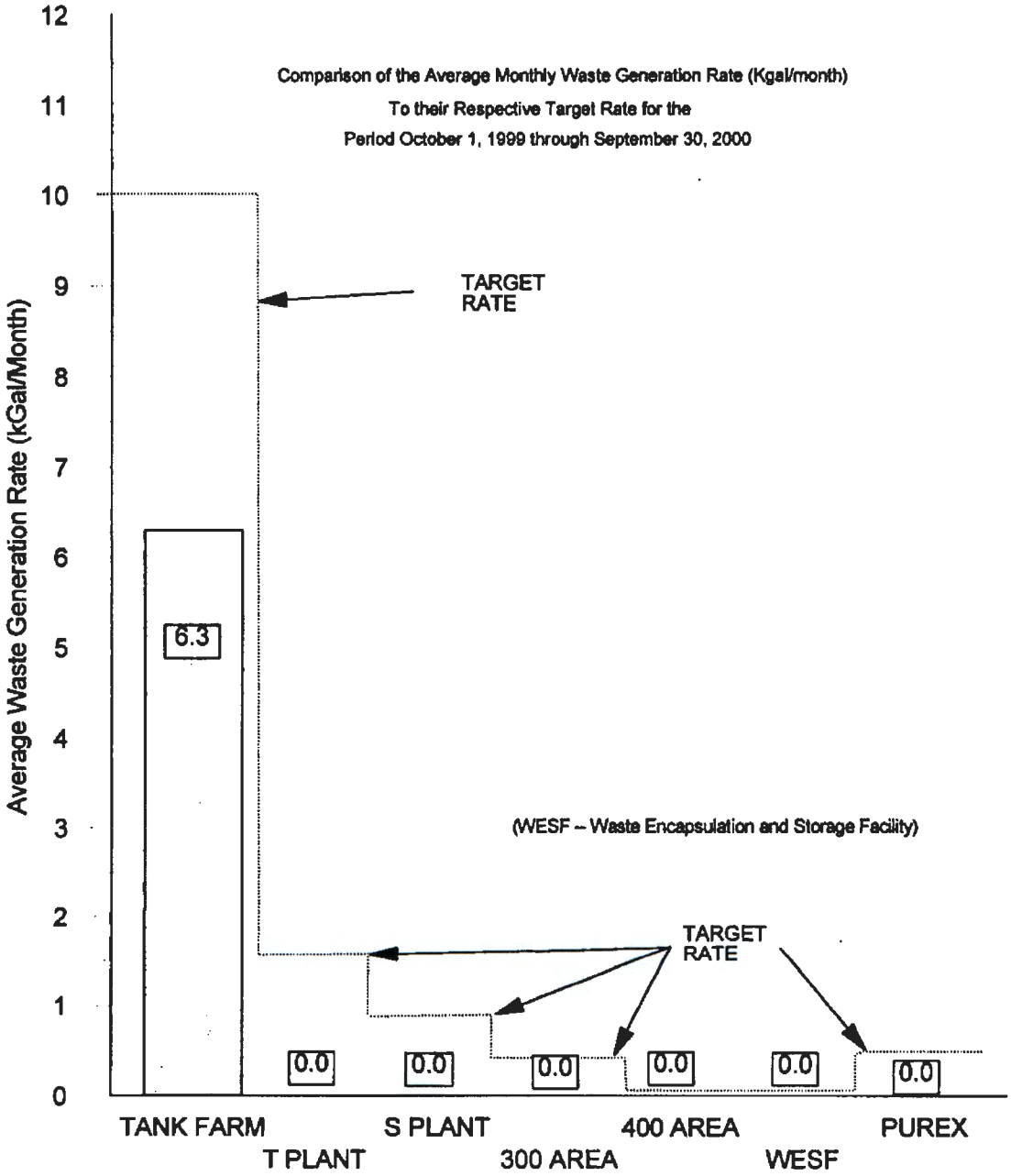


Figure 5-3. Monthly contributions from Saltwell Liquid Pumping.

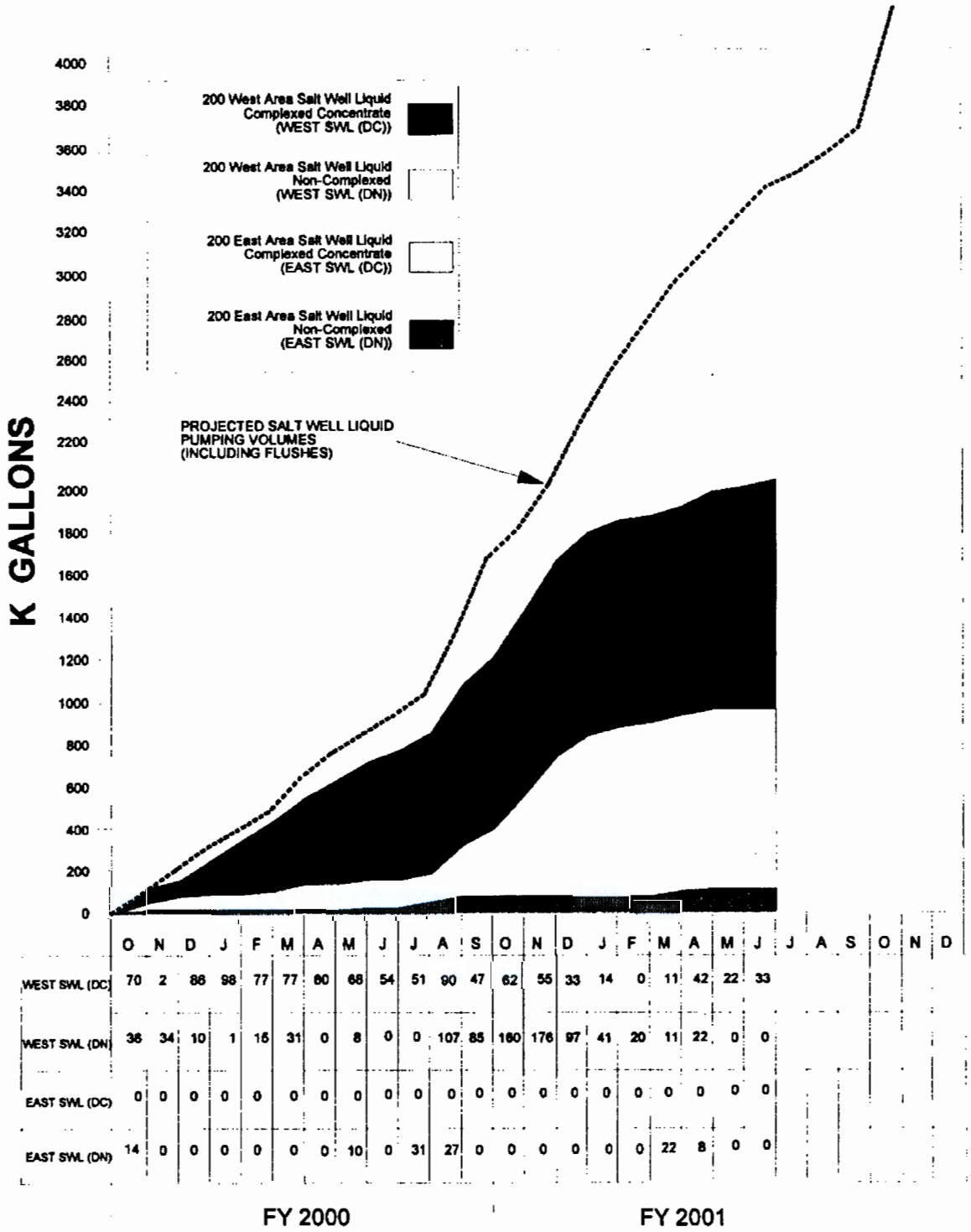
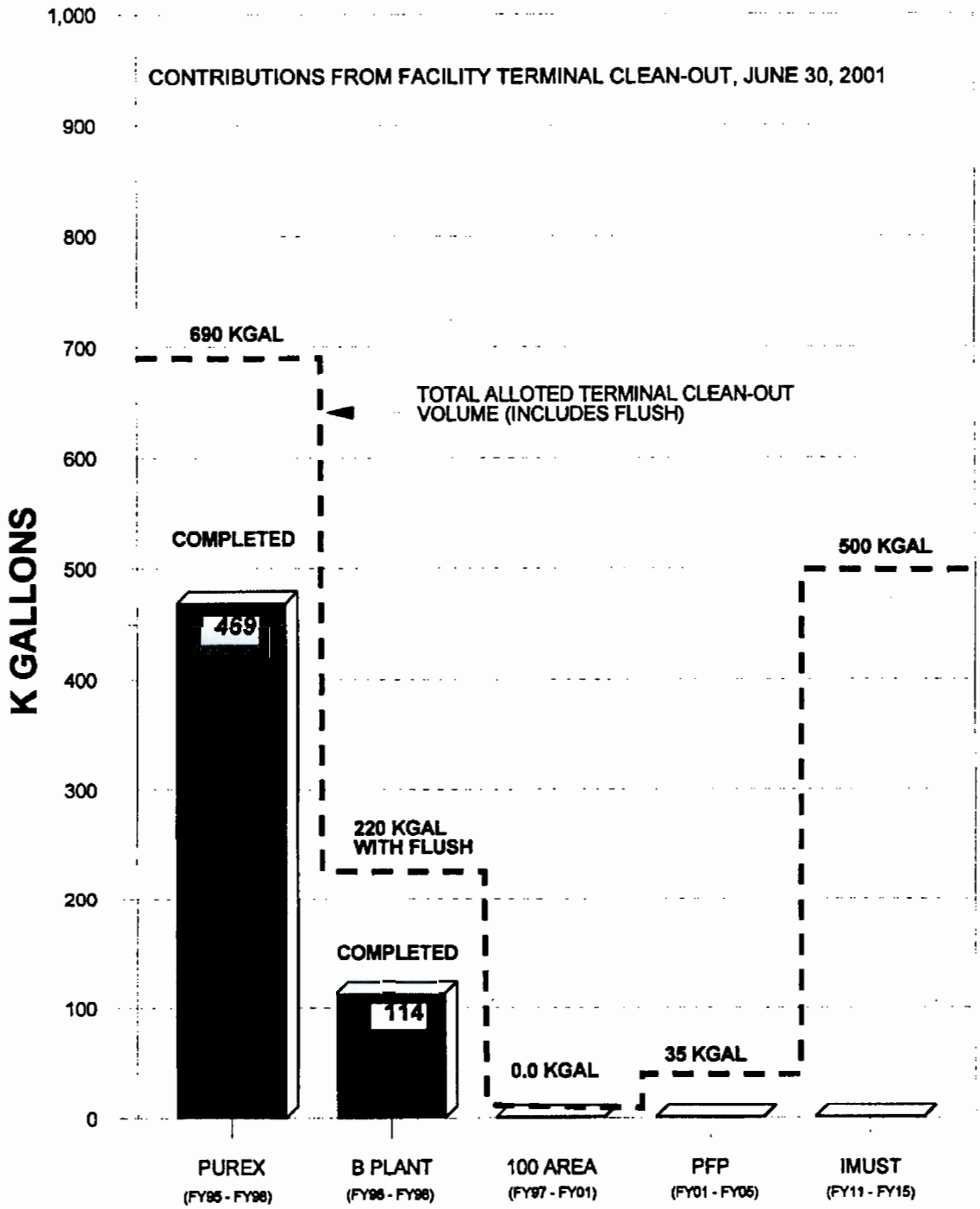


Figure 5-4. Contributions from Facility Terminal Cleanout.



5.3 SPACE-SAVING ALTERNATIVES

In previous waste volume projections, space-saving alternatives were proposed to alleviate potential DST space shortfalls. The proposed alternatives include waste minimization, continued availability of the 242-A Evaporator, Liquid Effluent Retention Facility availability, and the operation of the Effluent Treatment Facility.

In addition to minimizing waste generations, other actions could be pursued. A study has been completed to assess the space savings, costs, and risks associated with various space saving alternatives (Boyles et al. 2001). Eight options that encompass the construction of new capacity, modification of current storage practices, and waste treatment alternatives are identified and described in the report. The options were selecte3d for evaluation because they exhibited the potential to provide additional storage space for retrieval of high-risk SST waste during the years 2007-2011. The eight most promising options from the study are provided in Table 5-2.

Table 5-2. Eight Tank Space-Saving Options (Boyles et al. 2001).

Option	Additional Capacity (kgal)	Time to Implement (years)	Cost per Gallon	Total Cost ($K)	Used in Case:
Raise Allowable Waste Levels	1,400	1	$0.57	$800	1
Decrease Dedicated Operational Space	850	0.3	$0.22	$190	1, 2, 3
Use Restricted Tank Capacity	1,300	2	$7.23	$9,900	
Combine Aging Waste	980	8	$3.12	$3,060	
Utilize Alternative Storage for Emergency Reserves	2,280	4	$2.19-$4.65	$5,000-$10,600	
Concentrate Waste to a Higher Specific Gravity	2,200	6	$3.98	$8,750	1
Use Double-Contained Surface Storage	1,000	7	$5.75-$8.80	$5,750-$8,800	
Construct new DSTs (per tank)	1,200	7	$62.50	$75,000	

5.4 DOUBLE-SHELL TANK SPACE USE PROJECTIONS

A summary of the major assumptions, results, and the number of additional DSTs required beyond the existing 28 tanks is presented in Table 5-3. None of the space-saving options is currently funded, and funding from DOE would have to be raised before any could be implemented.

Table 5-3. Summary of DST Space Use Projections.

	Case1	Case 2	Case 3
Brief Description	Risk-based SST Retrieval Completion by 2018 (Ecology Case)	Risk-based SST Retrieval within Existing DST Capacity	SST Retrieval Completion by 2018 with Low-Volume Retrieval First
DST Space Saving Options Incorporated	Saves 3 Mgal by 2011. Increase tank fill limit. Decrease operational space. Additional concentration of DST wastes.	Save 0.85 Mgal by 2011. Decrease operational space.	Save 0.85 Mgal by 2011. Decrease operational space.
LAW treatment rate	From - To / Units LAW 12/31/07-12/31/09 / 300 total 12/31/09-2/28/18 / 1,100/year 3/1/18-12/31/28 / 5,500/year	From - To / Units LAW 12/31/07-1/31/11 / 300 total 2/1/11-2/28/18 / 1,100/year 3/1/18-12/31/28 / 5,500/year	From - To / Units LAW 12/31/07-1/31/11 / 300 total 2/1/11-2/28/18 / 1,100/year 3/1/18-12/31/28 / 5,500/year
HLW treatment rate	From - To / Cans HLW 12/31/07-12/31/09 / 60 cans total 12/31/09-2/28/18 / 120 cans/yr 3/1/18-12/31/28 / 1220 cans/yr	From - To / Cans HLW 12/31/07-1/31/11 / 60 cans total 2/1/11-2/28/18 / 120 cans/yr 3/1/18-12/31/28 / 1220 cans/yr	From - To / Cans HLW 12/31/07-1/31/11 / 60 cans total 2/1/11-2/28/18 / 120 cans/yr 3/1/18-12/31/28 / 1220 cans/yr
Initiate HLW Vitrification (full capacity)	12/31/2009	2/1/2011	2/1/2011
SST Retrieval Complete retrieval Wastes evaporated	9/30/2018 All retrieved SST wastes	9/30/2027 Through S-106 only	9/30/2018 Through S-106 only
Maximum number of simultaneous retrievals	16	7	16
ILAW Facility Available	1/31/2007	12/31/2007	12/31/2007
IHLW Facility Available	2/01/2007	9/30/2008	9/30/2008
Number of Additional DSTs required beyond the existing 28 tanks.	24 additional DSTs	None	67 additional DSTs

The results of a waste volume projection can be used to forecast tank space needs versus time; forecast the evaporator operation; forecast the needed LAW processing and disposal rates and HLW processing and storage; analyze tank space issues for aging and non-aging waste tanks; predict tank use; or determine the need and schedule for retrievals or cross-site transfers. To predict tank space needs, a graphic is produced showing tank count versus time, compared to the available space. Generations and evaporations for the near term (through 2002) are modeled on a monthly basis, whereas the remainder of the projection is typically modeled on an annual basis.

All projection cases assume that dilute waste will be evaporated to double-shell slurry feed in the year that it is produced, provided an evaporator is operational. In later parts of the projections when tank space becomes tight because of processing needs and/or the amount of SST wastes being retrieved, the evaporator is assumed to operate yearly even if volumes are small, to minimize waste storage needs. Long-range projection graphics for the three projection cases are presented in Sections 5.4.1, 5.4.2, and 5.4.3. A tank space requirement graphic has been included for all three projections. Short range graphics, tank use graphics, and evaporator waste volume reduction data have been included for the three projection cases.

Other assumptions in the projections that impact tank space are listed below.

- It was assumed that the Tank Farm Contractor will need to use Tanks 241-AN-101, AN-106, AN-104, and AN-105 for waste management during the same time frame that Project W-211 is preparing them for use as intermediate feed staging tanks. If the tanks had to be emptied before the Project W-211 activities began, the impact would be over 3 Mgal.

- Some double-shell tanks are nearing the end of their design life. In these projection cases, it was assumed that no tanks fail. Emergency space would be used if a failure/loss of a DST should occur. Such a failure reduces the space available for the return of waste streams to the tank farms and also could impact waste feed delivery and processing. Technology development and demonstration activities are underway to interrogate DST integrity and seal any leaks that might occur. The DST integrity work is being conducted at Hanford. The DST leak sealing work is being conducted by Savannah River.

- All three projections assumed that evaporator capacity would be available on an annual basis from FY 2001-2018. A reduction in evaporation capacity during years when space is tight or when waste receipts are high could result in a tank space shortage.

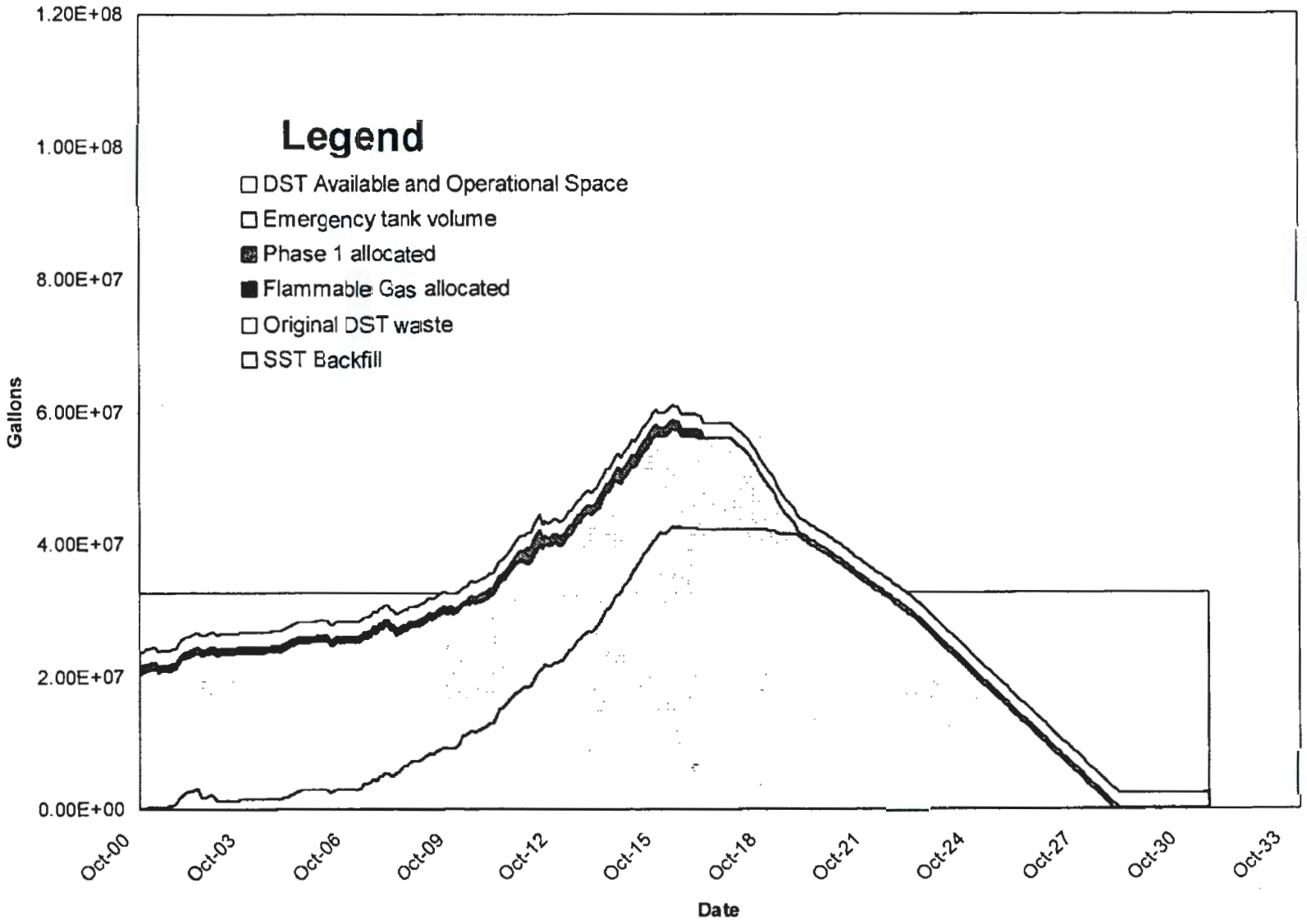
The space-saving actions listed above reduce the need for construction of new DST space as was recommended based on a previous projection, but these actions introduce additional uncertainties and risks into the overall RPP. If many of these items are not possible, or if waste generations exceed those used in this projection, it may be necessary to delay Site cleanup activities, delay Tri-Party Agreement milestones (e.g., saltwell liquid pumping and/or SST retrieval), increase the waste treatment rate, or build additional tank space to avoid exceeding the available DST space. A special trade study was completed in FY 2001 to assess the space savings, costs, and risks associated with many of the space saving alternatives mentioned above (Boyles et al. 2001).

The U.S. Department of Energy Office of River Protection has requested that this document provide a list of all transfers for the next fiscal year (Kinzer 1998). Appendix F in this document lists all the gains, losses, and transfers for the three projections through FY 2002.

5.4.1 Projection Case 1 Results

The projected tank space needs for the Case 1 projection are shown in Figure 5-5. The projected tank space needs for the Case 1 projection exceed existing DST capacity by 2 tanks in FY 2010, by up to 7 tanks in FY 2011, and by up to a maximum of 24 additional tanks by FY 2016. The tank space shortage during the period FY 2010-2018 is the result of the delay in the start of waste treatment and the reduced waste treatment rates compared to the waste treatment assumptions that were used when the Tri-Party Agreement milestones were initially negotiated. The waste treatment schedule used in Case 1 will not free up DST space fast enough to support a fully Tri-Party Agreement-compliant SST retrieval schedule without exceeding existing DST capacity. Options to reduce the tank space shortage include adjusting the SST retrieval schedule to match available space, increasing the waste treatment rates, and/or building additional DST space. Costs and schedule estimates to build the additional tanks have been included in Section 5.5. The retrieval sequence and risk-reduction curves for Case 1 are shown in Appendix G. The schedule shown in Appendix G will not meet Tri-Party Agreement milestones M-45-05-T05 through M-45-05-T09 for the number of retrievals to start each year.

Figure 5-5. Double-Shell Tank Space Requirements for the Case 1 Projection.



5.4.2 Projection Case 2 Results

The SST retrieval sequence for FY 2001 and the body of this report are based on the Case 2 projection that incorporates a risk-based SST retrieval sequence to fit existing DST capacity. The Case 2 projection has extended retrieval durations or delayed the start of additional SST retrieval starts to prevent overfilling available space. The Case 2 projection incorporates 0.85 million gallons of tank space options by 2011 (decreased dedicated operational space). Tank space needs for the Case 2 projection are shown in Figure 5-6. The retrieval sequence and risk reduction curves for Case 2 are shown in Section 4.0.

A spreadsheet summarizing the waste generations, evaporator waste volume reduction, and processing requirements for the Case 2 projection is included in Table 5-6. The near term tank use, evaporator, and cross-site transfer information for Case 2 are identical to those presented for Case 3 and are shown in Tables 5-6 through 5-8.

Figure 5-6. Double-Shell Tank Space Requirements for the Case 2 Projection.

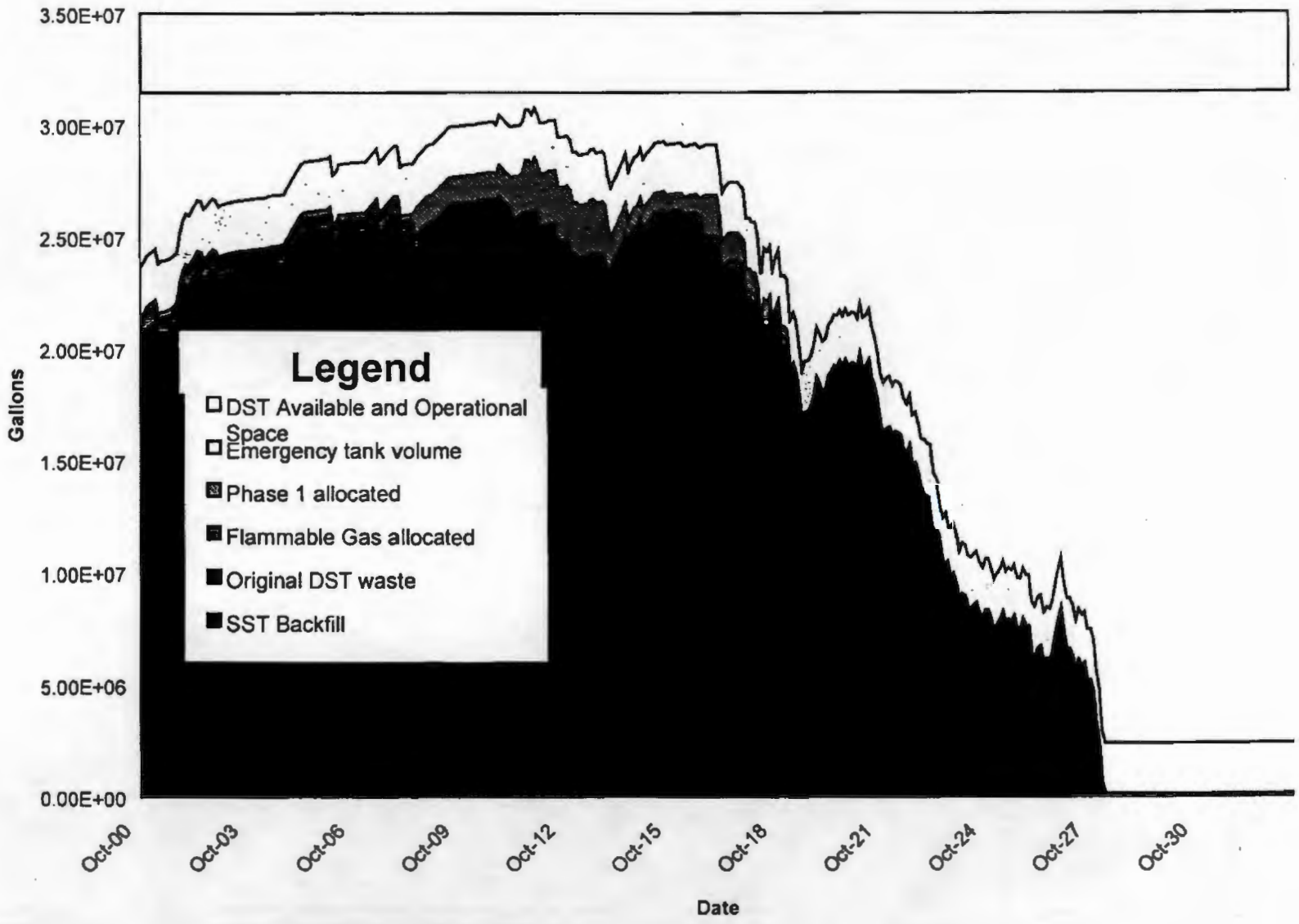


Table 5-4. Spreadsheet of Waste Additions and Reductions (Kgal) for Case 2.

FISCAL YEAR	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
STARTING INVENTORY	18990	20415	21147	23497	23438	23652	25178	25062	25546	24749	25783	25980	25412	24908	24051	24428	25519	23592	22443
SPACE UTILIZATION																			
Spare Space	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140
Watchlist Space	862	692	692	1688	1688	696	696	1341	1377	689	689	655	884	1097	1159	466	284	61	0
Contingency Space	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Restricted Space	749	779	779	606	634	636	636	1434	1556	1556	1556	2100	1677	1680	438	766	194	1502	1391
Priority/Operational Space	4126	2541	3202	2520	2038	1502	2153	226	865	519	322	380	878	1719	2522	1796	3391	3194	3781
Solids Return Tank	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140
NEW WASTE ADDITIONS																			
B Plant/WESF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S Plant/WSCF	0	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
T Plant	0	7	19	18	15	12	8	5	3	3	3	3	3	3	3	3	3	3	3
300/400 Areas	0	0	2	2	19	18	29	8	3	3	4	3	4	4	4	4	4	4	4
TCO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flushes	10	15	0	30	13	6	19	8	5	5	5	5	5	5	5	5	5	5	5
SWL Pumping	1209	1326	3397	288	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tank Farms	0	60	159	120	150	120	160	117	170	120	170	120	170	120	170	120	170	120	170
SST Retrieval	0	0	0	0	1	1354	853	1240	1042	886	1	0	0	0	2370	2779	0	747	3360
PFP	3	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Inventory	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Retrieval Water	885	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Everything Else	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pretreatment Dilution	0	0	0	0	0	0	0	0	638	206	203	1349	3222	1928	613	849	1512	858	6682
In-Tank Washing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PUREX	0	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
IMUST	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	0	0	0
NEW WASTE ADDITIONS TOTAL	2107	1420	3593	474	214	1526	1085	1393	1876	1238	401	1595	3519	2175	3280	3875	1709	1752	10239
TOTAL WASTE BEFORE EVAP	21097	21835	24740	23971	23652	25178	26263	26455	27422	25987	26184	27575	28931	27083	27331	28303	27228	25344	32682
EVAPORATOR WVR	-682	-688	-1243	-533	0	0	-1201	-909	-818	0	0	-9	-630	-771	0	0	-877	0	0
CUM EVAPORATOR WVR	-682	-1370	-2613	-3146	-3146	-3146	-4347	-5256	-6074	-6074	-6074	-6083	-6713	-7484	-7484	-7484	-8361	-8361	-8361
Outflow to SST Wash Facility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-201
Low Activity Waste Outflow	0	0	0	0	0	0	0	0	-136	-204	-204	-542	0	-1188	-1781	-1438	-1751	-2206	-3136
High Level Waste Outflow	0	0	0	0	0	0	0	0	-1719	0	0	-1612	-3393	-1073	-1122	-1346	-1008	-695	-5724
Phase 2 Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2653
EVAP AND OUTFLOWS TOTAL:	-682	-688	-1243	-533	0	0	-1201	-909	-2673	-204	-204	-2163	-4023	-3032	-2903	-2784	-3636	-2901	-11714
NET INVENTORY CHANGE	1425	732	2350	-59	214	1526	-116	484	-797	1034	197	-568	-504	-857	377	1091	-1927	-1149	-1475
END OF YEAR INVENTORY	20415	21147	23497	23438	23652	25178	25062	25546	24749	25783	25980	25412	24908	24051	24428	25519	23592	22443	20968
TOTAL CAPACITY	28432	27439	30450	30532	30292	30292	30827	30827	30827	30827	30827	30827	30827	30827	30827	30827	29741	29480	28420
% of DST CAPACITY IN USE	90%	87%	97%	97%	96%	96%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	95%	94%	90%

5.4.2.1 Aging Waste Tank Space for Case 2

Because the Plutonium Uranium Extraction Plant has been decommissioned, only two aging waste tanks (Tanks 241-AZ-101 and AZ-102) are required to store existing aging waste.

Waste from Tank 241-C-106 was retrieved to Tank 241-AY-102 in FY 1999. Tank 241-AY-101 will be used to retrieve the SST wastes from Tank 241-C-104 starting in FY 2008.

Space is kept available in one aging waste tank for receiving the contents of a DST in the event of a tank leak (DOE Order 435.1). This tank also could be used to store a HLW (or LAW) return from the Waste Treatment Plant. In FY 2001, Tank 241-AY-101 is the designated emergency tank space. Tank 241-AY-101 currently is undergoing a tank integrity evaluation that could impact its capacity. In FY 2008, Tank 241-AY-101 is used to receive Tank 241-C-104 wastes, and Tank 241-AZ-101 will be designated as the dedicated emergency tank through the end of the projection. See Appendix E for a detailed description of this space.

A graph of aging waste tank space requirements as a function of time is presented in Figure 5-7. The uses of each individual aging waste tank for the Case 2 projection are shown in Figure 5-8.

Figure 5-7. Aging Tank Requirements for Case 2.

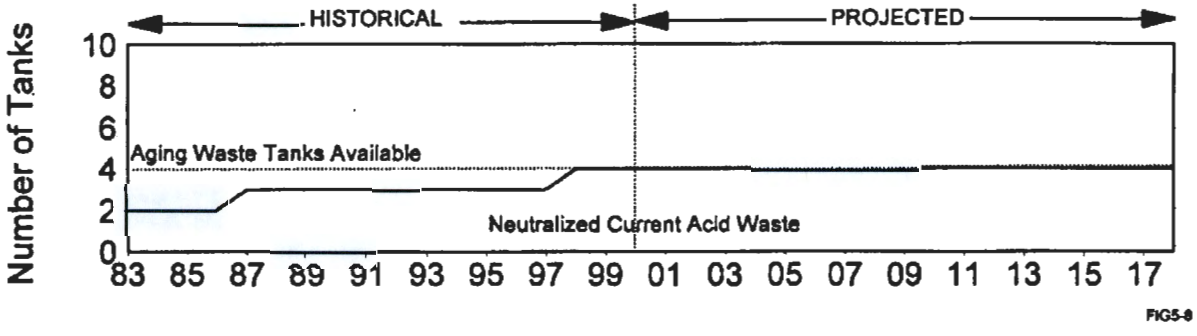
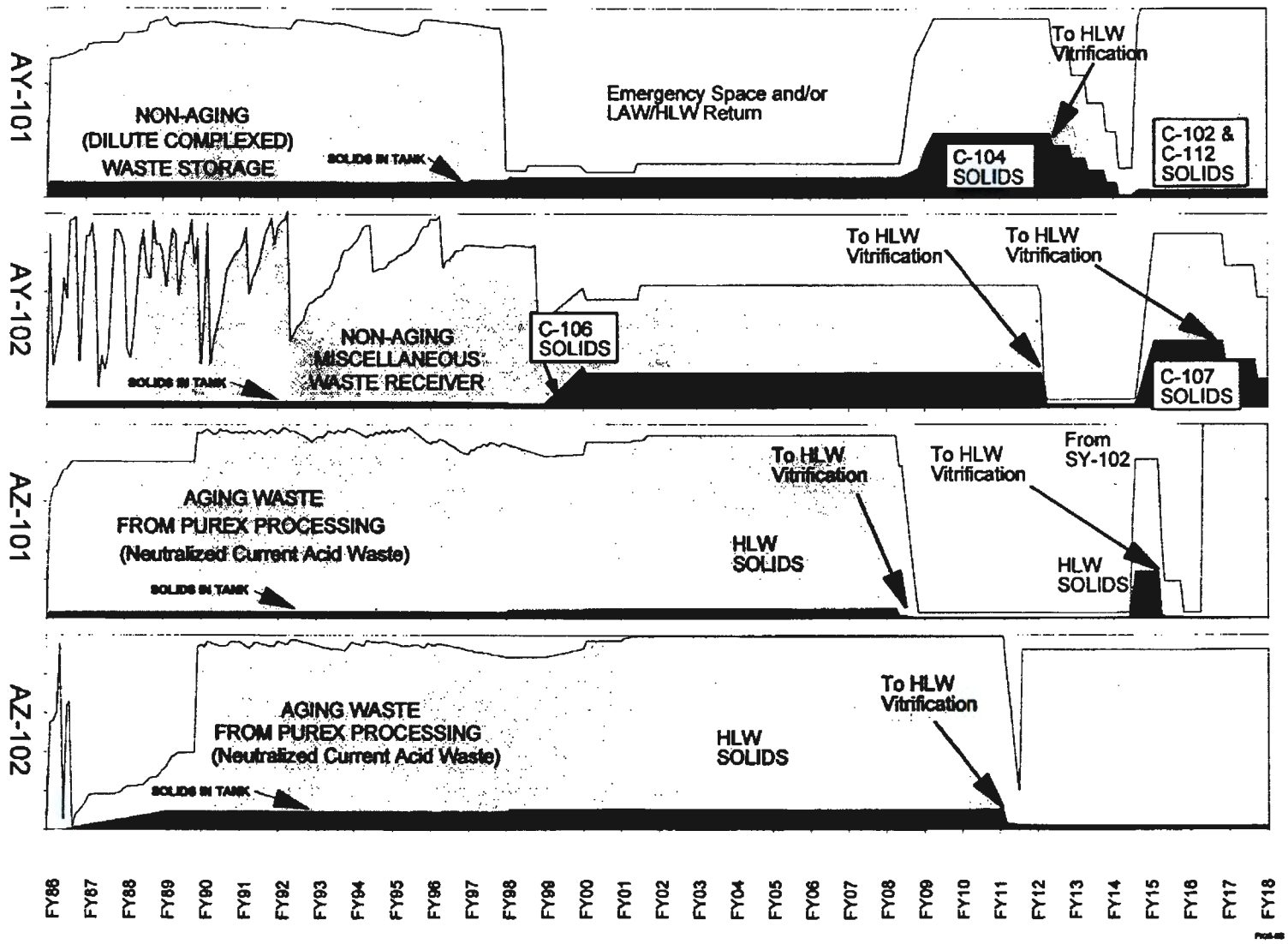


Figure 5-8. Aging Waste Tank Use for Case 2.



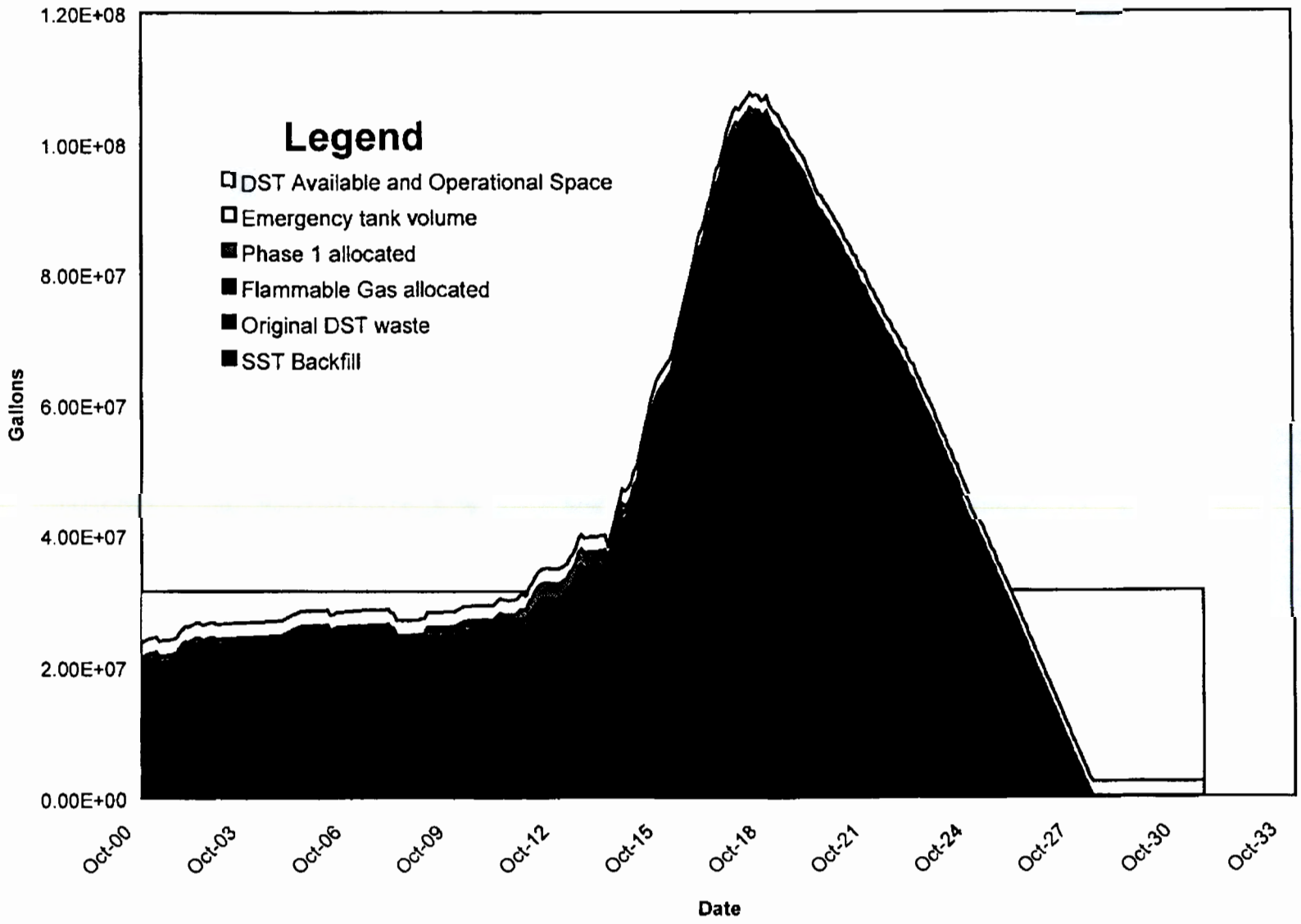
5.4.3 Projection Case 3 Results

The Case 3 projection incorporates an SST retrieval sequence that retrieves the tanks with the smaller remaining volumes first to meet Tri-Party Agreement milestones for number of tanks started each year while trying to stay within existing DST space for a longer period of time. Since the purpose of this projection is to determine the space needed for fixed operational assumptions, the model used for the Case 3 projection has retrieved the SST wastes using near minimum retrieval durations rather than extending retrieval durations to avoid overfilling available DST capacity. The Case 3 projection incorporates 0.85 million gallons of tank space options by 2011 (decreased dedicated operational space). The retrieval sequence and risk reduction curves for Case 3 are shown in Appendix H.

Projected tank space needs for the Case 3 projection are shown in Figure 5-9. The projected tank space needs for the Case 3 projection exceed existing DST capacity by 4 tanks in FY 2012, by up to 8 tanks in FY 2013, and by up to a maximum of 67 additional tanks in FY 2018. Since the Case 3 projection does not evaporate retrieved SST waste after the retrieval of S-106, more space is required compared to the Case 1 projection.

Options to reduce the tank space shortage are listed in Section 5.3 and include adjusting the SST retrieval schedule to match available space, increasing the waste treatment rates, and/or building additional DST space.

Figure 5-9. Double-Shell Tank Space Requirements for the Case 3 Projection.



5.4.4 Interpretation of Short-Range Projection Results

This section provides an interpretation of detailed short-range projection results, applicable to all three projection cases. These figures are intended to be used for near-term planning. This section presents certain information in the form of graphics. A number of these graphics show 12 months of historical operations and 24 months of projected operations. Most of the vertical axes represent thousands of gallons of waste generated.

In the computer simulation, facility waste streams are routed to a receiver tank. A tank fill graphic shows the filling of the receiver tank and is on the same page as the facility waste generation graph of the waste stream it receives. The tank fill graphic shows the rate at which a specific tank is filled with waste. Usually when a receiver tank is full, waste is transferred to a holding tank. This waste is either evaporated or stored for future disposal. For every transfer out of a tank, there is a corresponding receipt of the same volume into another tank or facility. For every evaporation out of a tank there is a corresponding receipt of the more concentrated waste in the receiving tank and an increase in the condensate from the 242-A Evaporator being sent to the Liquid Effluent Retention Facility.

The accuracy of this projection is directly related to the facility-supplied assumptions. Some of the major assumptions are listed below.

- Process operating schedules define the planned dates of plant operations or deactivation activities. These assumptions are consistent with the RPP program planning. Volumes and schedules for the various Hanford facilities for the three projection cases are presented in Appendix E.

- Plant waste generation assumptions define the volume and type of waste that will be generated by the plants. These assumptions result from an analysis of recent waste generation history and future plans specified by the plants. Most waste stream volumes are projected based on historical data and/or facility-supplied operating schedules. Section 5.2 includes a comparison of actual waste receipts to the facility waste generation targets for October 1999 to June 30, 2001.

Tank roles and waste routings define the use of tanks in the system. For example, a tank will be designated to act as the receiver of the Plutonium-Uranium Extraction Plant facility miscellaneous waste (Tank 241-AW-105), while other tanks will store concentrated waste.

Figure 5-10 shows the role of each tank for a period of four years. Note that if there are several transfers in or out of a tank in one month, no fluctuation in the tank level may appear. This is because the graphic program plots tank levels as of the last day of the month, and changes occurring during the month are not shown. The projected tank inventories and tank space usage for all three projections as of September 2003 are included in Table 5-5.

Figure 5-10. Tank Levels During the Short-Range Projection.

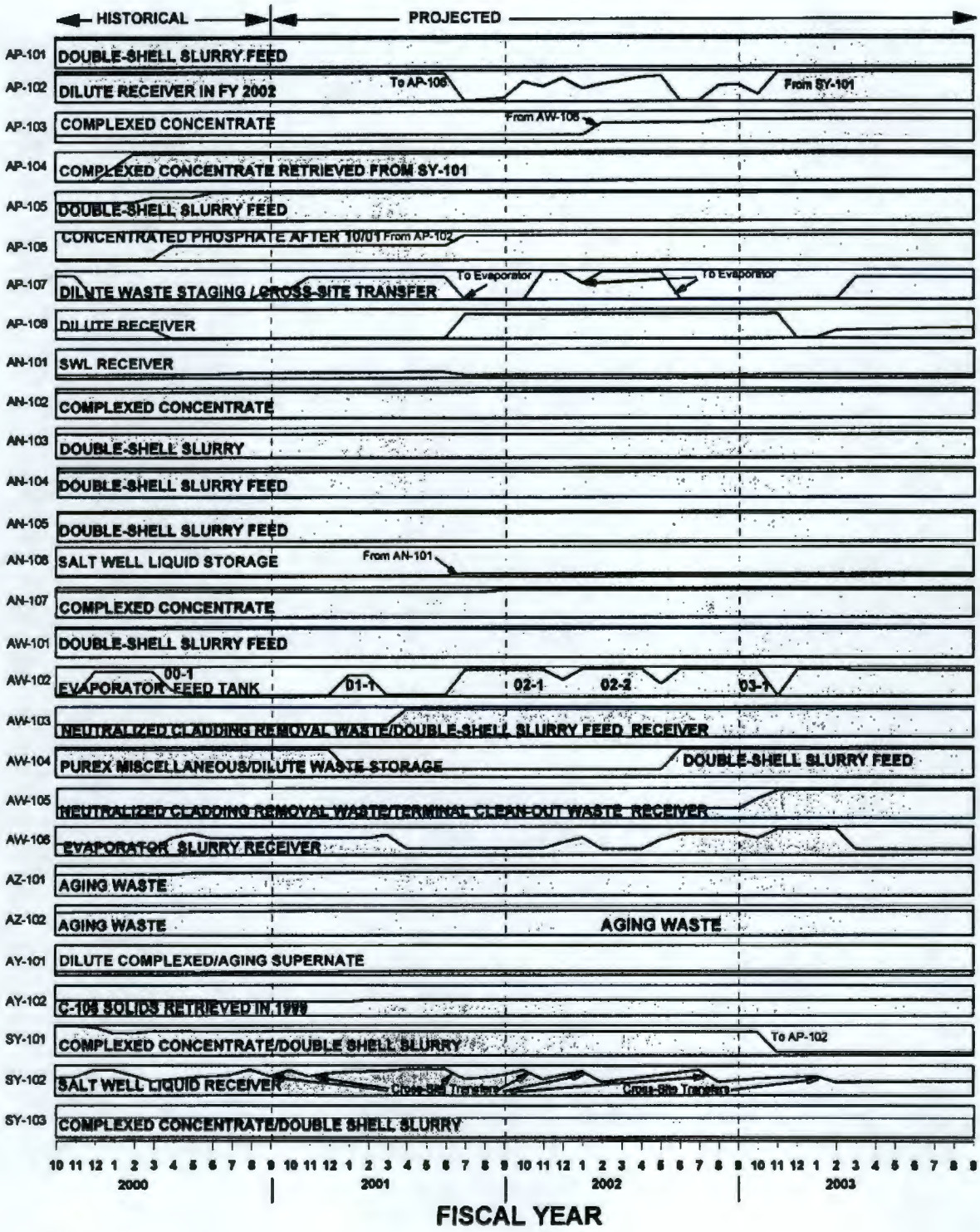


Table 5-5. Projected Tank Use on 09/2003.

Tank	Liquid (Kgal)	Solids (Kgal)	Total (Kgal)	Comment/Projected Use for Tank as of 09/2003
AY-101	75	108	183	Emergency space; used to retrieve SST waste from FY 2008 on
AY-102	452	184	636	Received Tank 241-C-106 solids in FY 1999-2000; third HLW feed tank in all projection cases
AZ-101	892	52	944	NCAW/SL; first HLW feed tank in all projection cases
AZ-102	891	105	996	NCAW/SL; second HLW feed tank in all projection cases
SY-101	62	82	144	CC/SL inventory; retrieval/dilution completed in FY 2000; transferred to AP-102 in FY 2002; to be used for SST retrieval
SY-102	519	72	591	DN/PT inventory; 200 West Area saltwell liquid and dilute receiver
SY-103	357	387	744	CC/SL inventory; WL tank
AW-101	752	375	1127	DSSF/SL inventory; WL tank
AW-102	1036	30	1066	Evaporator feed tank
AW-103	739	363	1102	DN/PD solids; DSSF added to tank in FY 2001 and beyond
AW-104	973	171	1144	DN/SL; DN evaporated in 09/2001; projected refill w/ DSSF started in FY 2002
AW-105	889	255	1144	DN heel/PD solids; projected refill w/ DSSF
AW-106	28	234	262	Evaporator slurry receiver tank; tank level will vary as concentrated waste is added and removed
AN-101	153	0	153	Cleaned out for use as an intermediate staging tank in FY 2005
AN-102	1039	36	1075	CC (TRU) inventory; fourth source tank of LAW waste processed (NCAW supernate are second and third sources)
AN-103	498	459	957	DSS inventory; WL tank
AN-104	603	449	1052	DSSF inventory; WL tank; second LAW tank to be processed
AN-105	636	492	1128	DSSF inventory; WL tank
AN-106	121	17	138	DN/SL; projected refill w/ DSSF
AN-107	830	275	1105	CC (TRU)/SL inventory
AP-101	1113	0	1113	DSSF; first LAW waste to be processed
AP-102	1143	1	1144	CP inventory; transferred to AP-106 tank in FY 2001 to allow AP-102 to be used as a dilute receiver because project W-314 work on the AW-A and AW-B valve pits would not allow transfers to AP-108
AP-103	904	0	904	CC/SL; received concentrated waste 02/1999 on
AP-104	1108	0	1108	CC; received cross-site waste from Tanks 241-SY-101 and SY-102 in FY 2000
AP-105	1117	27	1144	Filled with DSSF in June 2000
AP-106	1027	0	1027	Received CP from AP-102 in FY 2001
AP-107	901	0	901	DN/DC; used to receive cross-site waste from Tank 241-SY-102 and to stage dilute for evaporation; received DSSF in FY 2003
AP-108	470	1	471	Dilute receiver in 200 East Area

Table 5-5. Projected Tank Use on 09/2003.

Tank	Liquid (Kgal)	Solids (Kgal)	Total (Kgal)	Comment/Projected Use for Tank as of 09/2003

Notes:

- CC = complexant concentrate waste.
- CC/SL = complexant concentrate/ solids.
- CC(TRU) = complexant concentrate transuranic waste.
- CP = concentrated phosphate waste.
- DN = dilute noncomplexed waste.
- DN/DC = dilute noncomplexed waste/dilute complexed waste.
- DN/PD = dilute non-complexed waste/ PUREX decladding sludge.
- DN/PT = dilute non-complexed waste/ PFP TRU solids.
- DN/SL = dilute non-complexed waste/ solids.
- DSS = double-shell slurry.
- DSSF = double-shell slurry feed.
- NCAW/SL = neutralized current acid waste/ solids.
- PD = PUREX decladding sludge.
- PUREX = Plutonium Uranium Extraction Plant.
- WL = watch list.

5.4.4.1 Non-Aging Tank Space

In later parts of the projections when tank space becomes tight because of processing needs and/or the amount of SST wastes being retrieved, the evaporator is assumed to operate yearly to minimize waste storage needs and to decrease the volume of retrieved SST waste. Tank space pinches occurring between FY 2001 and FY 2018 (Figure 5-11) are caused by a combination of factors, including the following:

- Saltwell liquid pumping (SST interim stabilization) volumes are pumped by the end of FY 2003 and two tanks in the 200 East Area are available to receive saltwell liquid
- The number of intermediate staging tanks used to stage wastes for Initial Quantity processing (Tanks 241- AN-101, AN-102, AN-105, AP-104, and AP-101)
- The large volume of SST waste retrieved beginning in FY 2005
- The decision not to operate the Grout Facility, which has eliminated an early means of freeing up DST space
- The decision not to consolidate neutralized current acid waste solids, which have increased the DST space needs from 2001 on.

Figures 5-12, 5-13, 5-14, and 5-15 show the detailed operation of all the DST waste tanks for the three projections during the near term.

Figure 5-11. Dilute Receiver Tanks and 242-A Evaporator Operations.

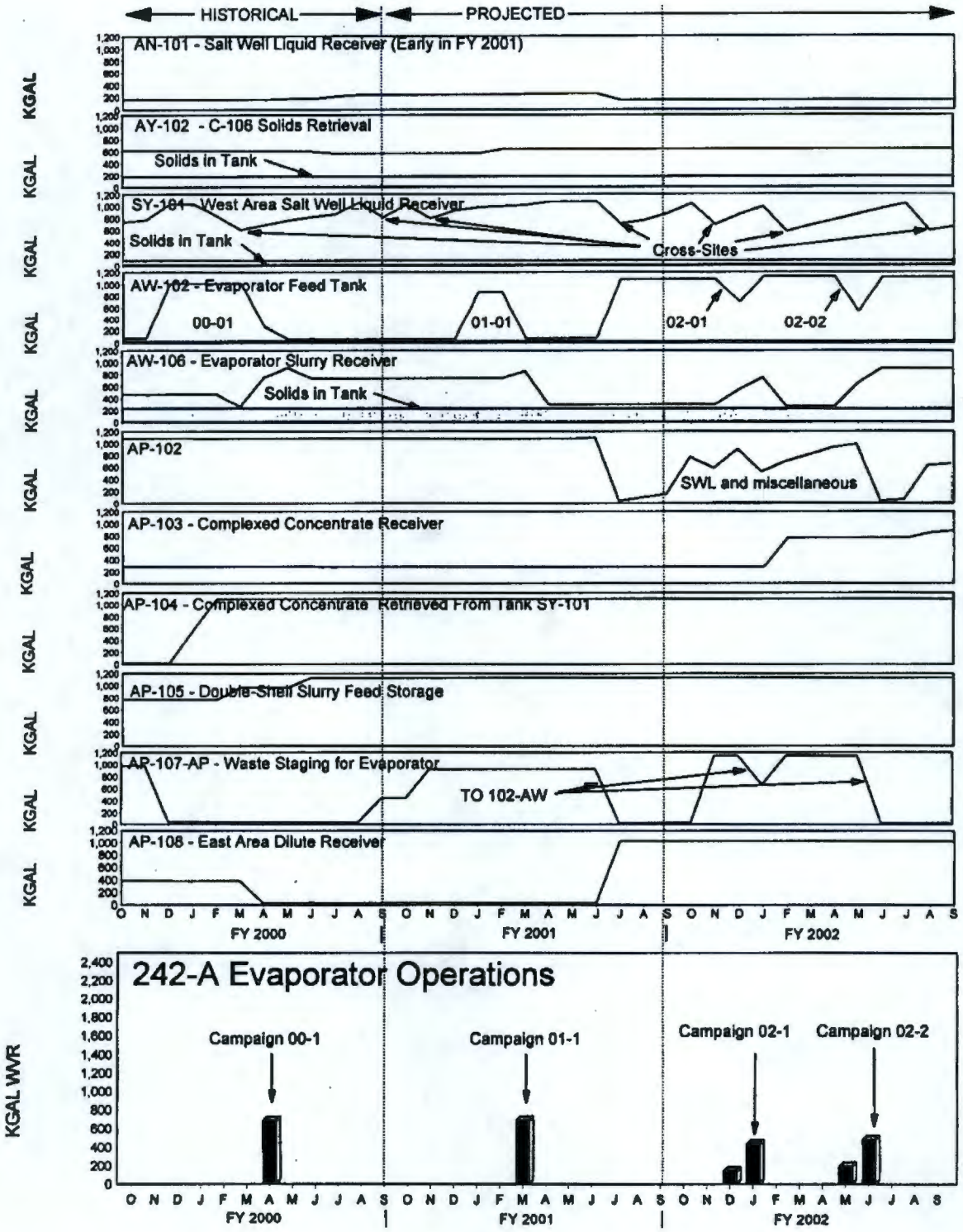


FIG5-3

Figure 5-12. West Area Waste Generations and SY Tank Levels.

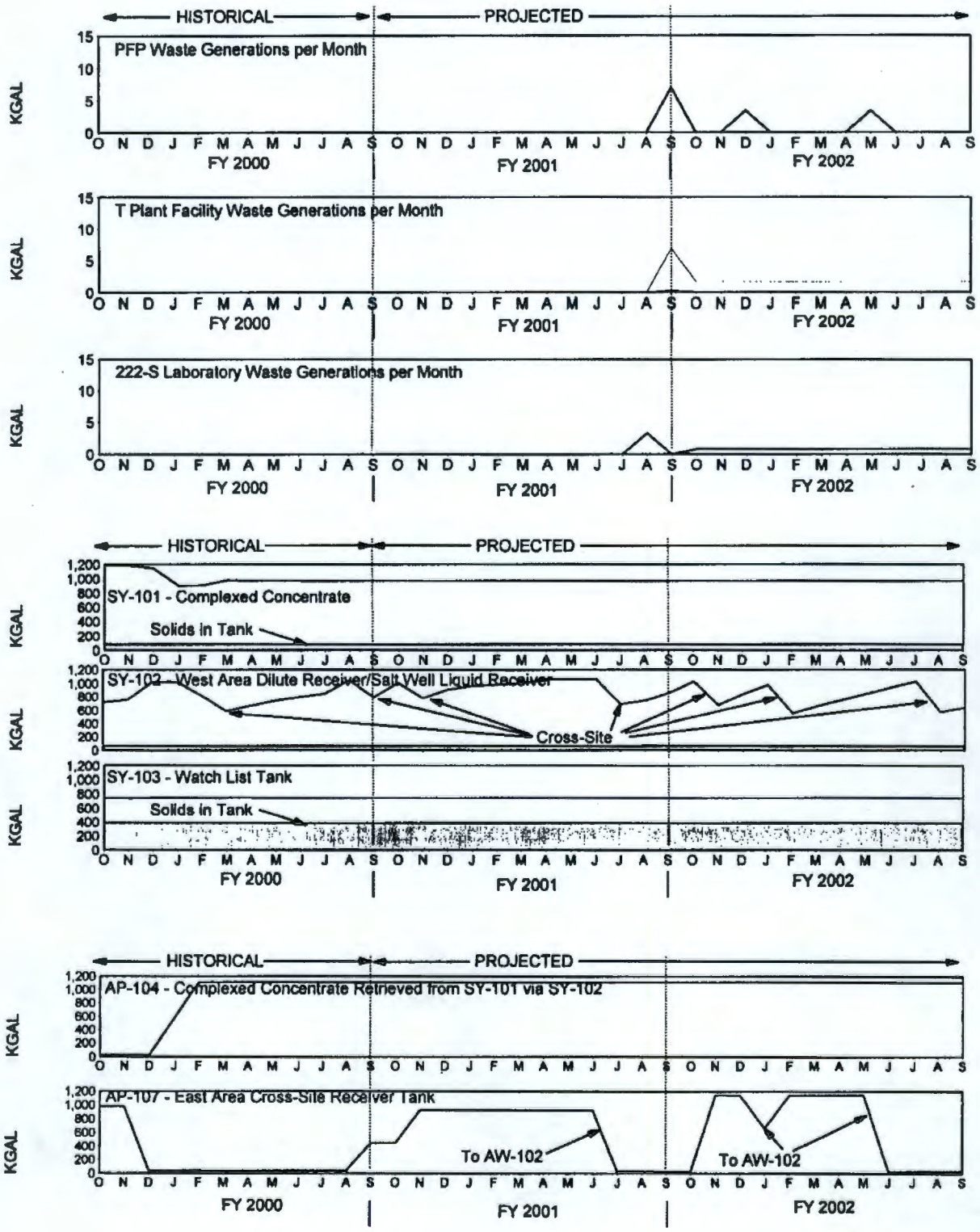


Figure 5-13. AN Farm Tank Levels.

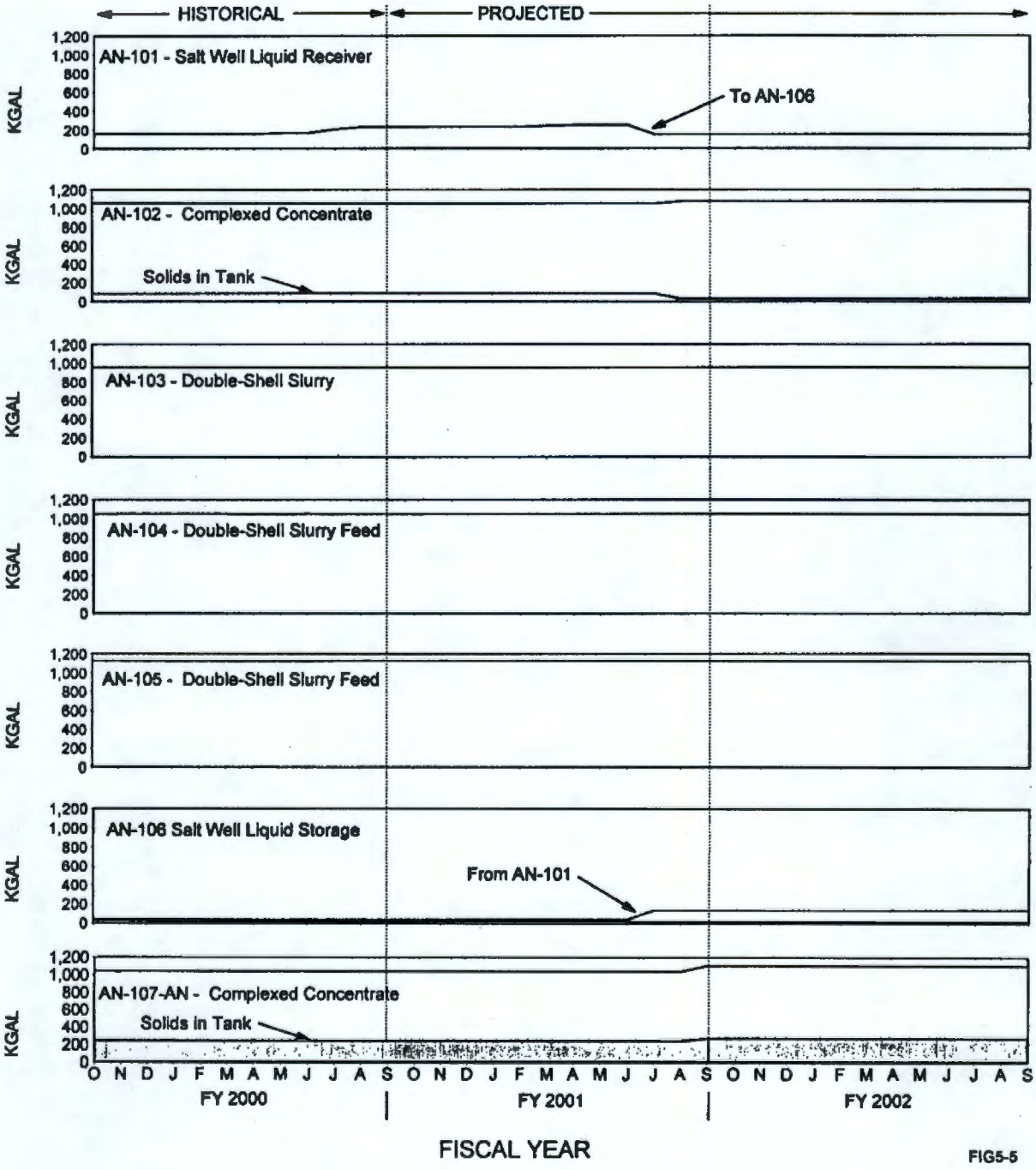


Figure 5-14. AP Farm Tank Levels.

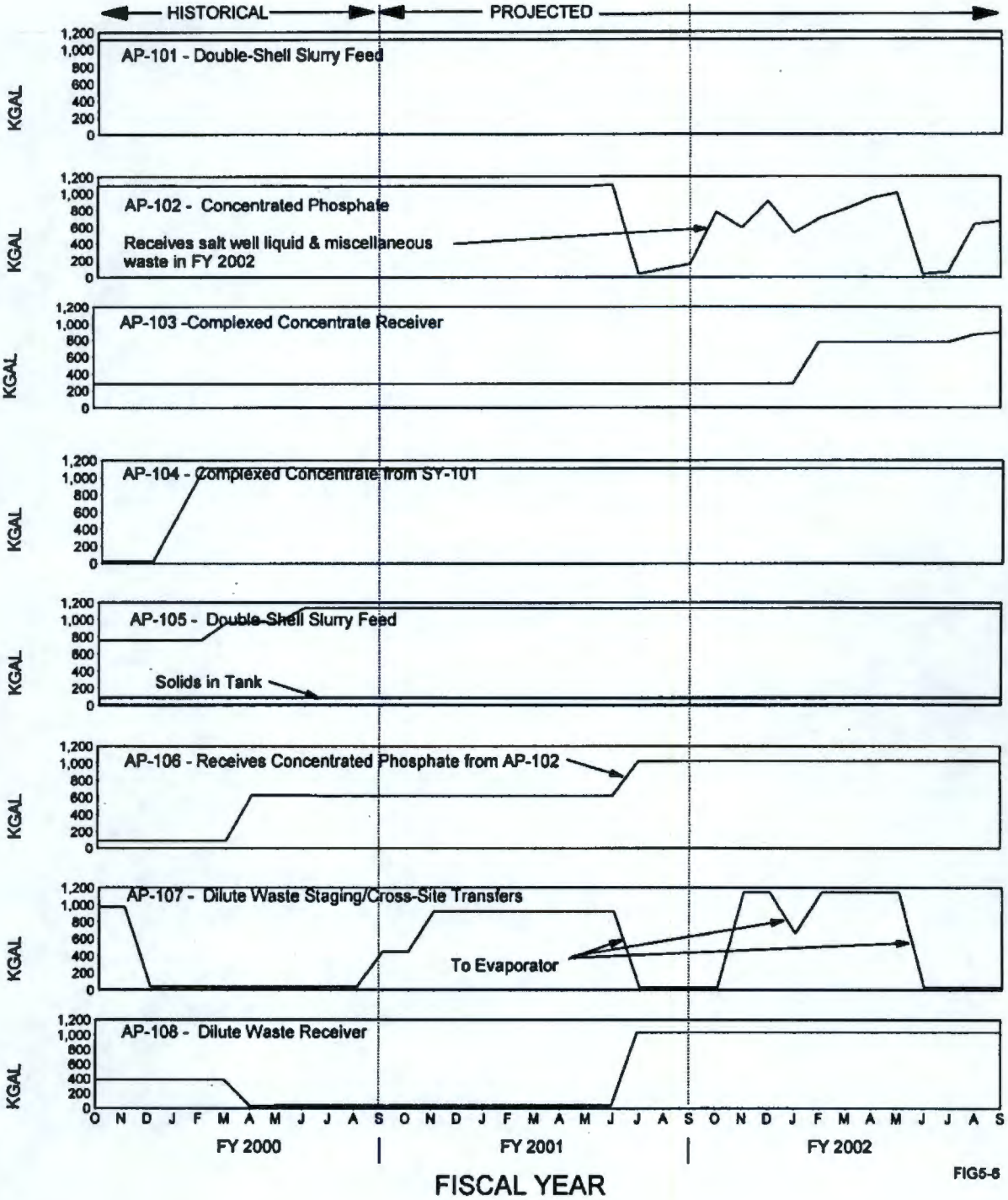
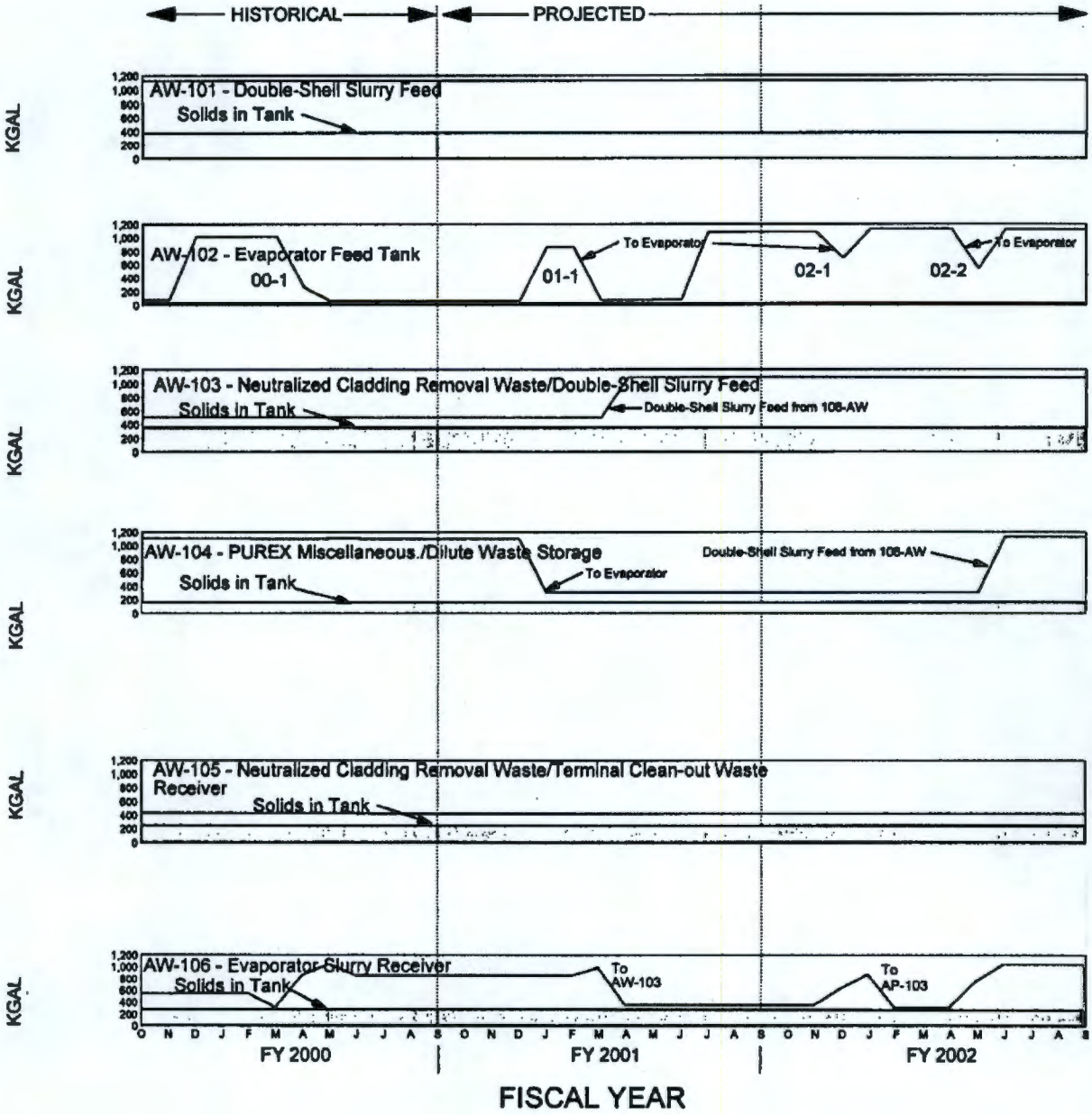


Figure 5-15. AW Farm Tank Levels.



5.4.5 Evaporator Waste Volume Reduction and Liquid Effluent Retention Facility Condensate

Schedule and operational considerations presented in Appendix E result in the following evaporator waste volume reduction and Liquid Effluent Retention Facility condensate production volumes for the Case 2 and 3 projections. The ratio of process condensate sent to the Liquid Effluent Retention Facility for every gallon of waste volume reduction for Evaporator Campaigns 94-1, 94-2, and 95-1 was 1.29, 1.24, and 1.26, respectively (Guthrie 1996). The evaporator seal water and demister spray upgrade could reduce future process condensate production to 1.15 gal of condensate/gallon of waste volume reduction, which would lower the value used for future projections. All three projections used a value of 1.15 gal of condensate/gallon of waste volume reduction (Bowman 2000 and Smith 2001) to project future condensate production recorded in Table 5-6. The waste sources, campaign schedule, and concentrated waste receiver tanks used in the Case 2 and 3 projections are summarized in Table 5-7. Table 5-7 shows evaporator campaigns through the FY 2003. Cross-site transfers through FY 2003 are shown in Table 5-8.

Table 5-6. Evaporator Waste Volume Reduction and Liquid Effluent Retention Facility Additions for Case 2 and 3 Projections.

Fiscal Year	Evaporator Waste Volume Reduction (Kgal)	Condensate to Liquid Effluent Retention Facility (Kgal)
2001	690	790
2002	1240	1430
2003	530	610
2004	0	0
2005	0	0
2006	1200	1380
2007	910	1050
2008	820	940
2009	0	0
2010	0	0
2011	10	10
2012	630	720
2013	770	890
2014	0	0
2015	0	0
2016	880	1010
2017	0	0
2018	0	0

Table 5-7. Evaporator Campaign Schedule for the Three Projections.

Campaign	Start Date	Staging Tank (Staging Date to AW-102)	Source	Waste Feed Type	Feed Volume (Kgal)	Receiver Tank
01-1	3/2001	Direct to AW-102 (1/2001)	AW-104 to AW-102—1/2001	DN	~800	AW-103
02-1	12/2001	AP-107 (7/2001)	SY-102 to AP-107--- 9/2000 SY-102 to AP-107---11/2000	DN/DC DN/DC	~950	AP-103
02-2	5/2002	AP-107 (1/15/2002)	AP-102 to AP-107--- 11/19/2001	DN/DC DN/DC	~950	AW-103, AW-104
	6/2002	AP-107 (6/3/2002)	AP-102 to AP-107--- 1/29/2002	DN/DC	~950	AW-104
03-1	10/2002	AP-107 (6/24/2002)	AP-102 to AP-107--- 6/19/2002	DN/DC	~950	AW-105
	11/2002	Direct to AW-102 (10/27/2002)	AP-102 to AW-102--- 10/27/2002	DN/DC	~380	AW-105
03-2	3/2003	AP-108 (12/2002)	SY-102 to AP-108--- 7/2001 AP-106 to AP-108--- 7/2001	DN/DC DN/DC	~950	AP-107

Notes:

DC = dilute complexed waste.

DN = dilute noncomplexed waste.

DN/DC = dilute noncomplexed/dilute complexed waste.

Table 5-8. Cross-Site Transfer Schedule for the Three Projections

Date for Cross-site	Receiver Tank	Volume (Kgal)	Comments
11/2000	AP-107	~500	DN/DC-salt well liquid and DN
7/2001	AP-108	~500	DN/DC-salt well liquid and DN
11/2001	AP-102	~500	DN/DC-salt well liquid and DN
2/2002	AP-102	~500	DN/DC-salt well liquid and DN
8/2002	AP-102	~500	DN/DC-salt well liquid and DN.
2/2003	AP-108	~250	DN/DC-salt well liquid and DN

Notes:

DN = dilute noncomplexed waste.
DN/DC = dilute noncomplexed/dilute complexed waste.

Additional Notes for Tables 5-7 and 5-8:

1. Double-shell slurry feed waste is stored on top of the solids in Tanks AW-103 and AW-104 to free up other tank space that is needed later in the projection for intermediate feed staging tanks.
2. Some evaporator campaigns could be accelerated.
3. The evaporator campaign and cross-site schedules are the same for projection Cases 1 and 2. Tank AP-107 is used to stage dilute waste for evaporation.

See Figure 5-11 for dilute receiver tanks, evaporator waste volume reduction, and the 242-A Evaporator operating schedules for the Case 2 and 3 projections.

Based on the 5 Mgal/year treatment capacity for the Effluent Treatment Facility, the Effluent Treatment Facility should have no problem processing the projected evaporator condensates through 2018. There should be sufficient Liquid Effluent Retention Facility and DST space for storage of Hanford facilities-generated waste and condensates between FY 2001 and the end of 2018, provided the following:

- The 242-A Evaporator schedule is achieved
- The amount of condensate sent to the Liquid Effluent Retention Facility does not grossly exceed the 1.15 gal condensate/gallon waste volume reduction factor
- Facilities stay within their respective generation limits
- No unexpected waste receipts are received in the DSTs.
- Tank farm outages due to construction projects do not prohibit timely evaporator support.

5.5 PROJECTED TANK NEEDS

5.5.1 Case 1 Projected Tank Needs

The Case 1 projection will retrieve SST wastes through FY 2009 without exceeding available space. By FY 2010 it will be necessary to begin retrieving SST tanks faster to meet the retrieval of all SST wastes by 2018. This causes the projected DST space need to exceed available space:

- By two tanks by the end of FY 2010
- By up to seven tanks total by the end of FY 2011
- By up to ten tanks total by the end of FY 2012
- By up to twenty-four tanks total by the end of FY 2016.

The Initial Quantity extended order waste treatment will be processing DST waste until approximately 2020, and very little SST retrieval waste could be processed, which accounts for the large number of additional tanks that would be required. If the Tri-Party Agreement-compliant SST retrieval schedule is to be met, and the waste treatment throughput and startup cannot be increased, additional DSTs will have to be built. Table 5-9 shows the schedule, number of DSTs to be started, and funding requirements. For Case 1, two tanks are needed by the start of FY 2010.

5.5.2 Case 2 Projected Tank Needs

Case 2 was built on the assumption that no new tanks would be built, and all retrieval activities would occur within the existing DST capacity. For Case 2, no new tanks are needed.

5.5.3 Case 3 Projected Tank Needs

The Case 3 projection will retrieve SST wastes through FY 2011 without exceeding available space. By FY 2012 it will be necessary to begin retrieving SST tanks faster to meet the retrieval of all SST wastes by 2018. This causes the projected DST space need to exceed available space:

- By four tanks by the end of FY 2012
- By up to eight tanks total by the end of FY 2013
- By up to fourteen tanks total by the end of FY 2014
- By up to sixty-seven tanks total by the end of FY 2018.

The Initial Quantity extended order waste treatment will be processing DST waste until approximately 2020, and very little SST retrieval waste could be processed, which accounts for the large number of additional tanks that would be required. If the Tri-Party Agreement-compliant SST retrieval schedule is to be met, and the waste treatment throughput and startup cannot be increased, additional DSTs will have to be built. Table 5-9 shows the schedule, number of DSTs to be started, and funding requirements. For Case 3, four tanks are needed by the start of FY 2012.

5.5.4 Cost Estimates for Additional Double-Shell Tanks

Cost estimates for building new DST's were completed during 1993-1994 to support new tank construction (project W-236A). Discussions about current estimates with some of the W-236A staff members resulted in a rough estimate of around $75 million in today's dollars to build a simplified version of the tank designed seven years ago for project W-236A. Project W-236A estimated six years from design to construction complete. The time to complete construction could be accelerated to five years if a lower confidence schedule were adopted. (e.g., reduced 50% confidence the project would be completed within the designated cost and schedule vs. the typical 80% confidence). However, a 50% confidence schedule may not be accepted performance of sufficient work to assure with reasonable certainty that the Office of River Protection will accomplish series M-45 major and interim milestone requirements.

For Case 1, the total cost using year 2001 dollars would be on the order of $1.8 billion to build the 24 tanks needed by 2016. To calculate total cost for the job on a yearly cost basis, the Project W-236A construction and cost schedule was used to calculate year 1 (8%), year 2 (25%), year 3 (35%), year 4 (31%), and year 5 (1%).

For Case 3, the total cost using year 2001 dollars would be on the order of $5.0 billion to build the 67 tanks needed by 2018. To calculate total cost for the job on a yearly cost basis, the Project W-236A construction and cost schedule was used to calculate year 1 (8%), year 2 (25%), year 3 (35%), year 4 (31%), and year 5 (1%).

The cost and schedule presented represent only the costs to design and procure new tanks (capital line item). The schedule represents the standard times for performing conceptual designs, title II design, and construction based on Project W-236A. It assumes that funding for this will be obtained when requested. In recent experience, it may take several years to obtain the authorization and funding necessary for a line item of this magnitude. The costs do not reflect the life-cycle costs of the additional tanks. Specifically, additional costs would be incurred for the following items:

- Readiness review/acceptance of the new tanks
- Operations of the new tank farms (it is assumed that the tanks would be grouped in farms, rather than built on an 'as needed' basis as presented, to minimize operational expenses). These expenses include added surveillances and maintenance of the new tank farm facilities
- Cleanout of the new tank systems at the end of their use
- Closure of the new tank systems, assuming clean closure cannot be achieved
- Postclosure monitoring of the new tank systems.

These additional costs likely will exceed the initial cost of construction of the new tanks. The intent in this section is to present a general feel for the number of new tanks and relative construction costs associated with them. Should the decision be made to build new tanks, a

complete life-cycle cost estimate will be performed to assess the optimum number and grouping (e.g., number of new farms) that may be needed before proceeding with design.

For the Case 1 projection, the first two new tanks are required to be available for use by the start of FY 2010. That means that funding would be needed to start this project by the start of FY 2004. It is expected that the funding request would start in FY 2003 so that design can be started by 2005 to meet the construction complete schedule of 2009. Project staff needs to start planning for this new work in two fiscal years.

For the Case 3 projection, the first four new tanks are required to be available for use by the start of FY 2012. That means that funding would be needed to start this project by the start of FY 2006. It is expected that the funding request would start in FY 2005 so that design can be started by 2007 to meet the construction complete schedule of 2011. Project staff needs to start planning for this new work in four fiscal years.

Table 5-9. Number of New Double-Shell Tanks to be Constructed and Funding Required ($M) to Meet Space Needs for the Case 1 and Case 3 Projections.

	Number of Tanks and Cost for Case 1		**Number of Tanks and Cost for Case 3**	
Fiscal Year	**New Double-Shell Tanks**	**Funding Required ($M)**	**New Double-Shell Tanks**	**Funding Required ($M)**
2001		0		0
2002		0		0
2003		0		0
2004		0		0
2005		12		0
2006		68		0
2007		164		24
2008		252		99
2009	2	283		216
2010	5	276		401
2011	3	303	4	631
2012	3	269	4	944
2013	5	146	6	1135
2014	5	26	15	931
2015	1	1	16	535
2016			18	106
2017			4	3
TOTALS	24	$1,800	67	$5,025

6.0 CONCLUSIONS

6.1 SINGLE-SHELL TANK RETRIEVAL SEQUENCE

6.1.1 Single-Shell Tank Risk-Sequence Benefits

The development of the revised FY 2001 SST retrieval sequence using airborne and groundwater risk factors resulted in a number of improvements over the sequence from FY 2000. The enhanced basis for risk measures is as follows.

- DOE Final Environmental Impact Statement factors are incorporated into HTWOS, enabling easy updates if factors change.
- The FY 2000 sequence was determined solely on ^{99}Tc inventory, while the FY 2001 sequence distinguished between long-lived mobile radionuclides (^{14}C, ^{79}Se, ^{99}Tc, ^{129}I, and ^{238}U) and airborne contaminants of concern (isotopes of americium, curium, niobium, neptunium, plutonium, tin, uranium, and other transuranics).
- The increased groundwater and airborne risk reduction in early years resulted in a better approximation of the ideal risk reduction curves (Figures 4-1 through 4-6).

6.1.2 Single-Shell Tank Assumption-Based Benefits

Changing assumptions in the HTWOS model yielded the following improvements in the overall retrieval sequence.

- Retrieval of all SSTs is completed by 2027.
  - Consideration is given to the impacts of processing the high-sulfate-content waste, which could reduce feed throughput of the waste treatment plant and thereby constrain SST retrieval.
- Retrieval of assumed leaking tanks is accelerated 4 years from the FY 2000 sequence to occur in FY 2018 rather than FY 2022.
- Processing of all SST and DST waste is completed by the end of 2028, because of the change in Waste Treatment Plant operating efficiency (from 120/12 MT of glass/d at 60% TOE in FY 2000 to 120/12 MT of glass/d at 85% TOE in FY 2001).
- Allowing HTWOS to choose between high airborne-risk and high groundwater-risk tanks enabled a better balance of feeds to keep both the HLW and LAW Waste Treatment Plants running.

6.2 DOUBLE-SHELL TANK SPACE EVALUATION

Recent schedule slippages in the waste treatment start date and decreases in the waste treatment rate in the RPP Project Integration Office guidance received in March 2000 (PIO 2000) have impacted the amount of space in DSTs that will be available for SST retrieval. The delay in the start of LAW processing and the lower waste treatment rates have decreased the space available for SST retrieval. The retrieval and dilution of Tank 241-SY-101 in FY 2000 to resolve the safety issue has further decreased the space available for SST retrieval. This year the Case 1 projection incorporated a risk-based SST retrieval sequence and completes retrieval of all SSTs by 9/30/2018 (Tri-Party Agreement Milestone M-45-05; M-45-05-T05 through M-45-05-T09 not constraining) and exceeded available space in FY 2010-2023.

Options to reduce the tank space shortage include adjusting the SST retrieval schedule to match available space, increasing the waste treatment rates, and/or building additional DST space. Costs and schedule estimates to build the additional tanks have been included in Table 5-9.

The projected tank space shortage maybe avoided by a combination of the following options (see Table 5-2 for a more complete listing):

- Delay retrieval of SST wastes (would require renegotiation of Tri-Party Agreement milestones)
- Do not allow the return of wastes from the Waste Treatment Plant to DSTs
- Allow addition of wastes to early feed tank headspace
- Accelerate the treatment of waste
- Establish terms for waste treatment that will support the Tri-Party Agreement-compliant SST retrieval volumes
- Delay the SST interim stabilization effort
- Construct new DSTs.

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APPENDIX A

ASSUMPTIONS MATRIX AND SCENARIO DEFINITIONS FOR 2001 SINGLE-SHELL TANK RETRIEVAL SEQUENCE AND DOUBLE-SHELL TANK SPACE EVALUATION

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APPENDIX A

ASSUMPTIONS MATRIX AND SCENARIO DEFINITIONS FOR 2001 SINGLE-SHELL TANK RETRIEVAL SEQUENCE AND DOUBLE-SHELL TANK SPACE EVALUATION

A1.0 ASSUMPTIONS MATRIX

Table A-1 is the assumptions matrix for the three projection cases. Differences in assumptions among the three cases have been highlighted in the table.

A2.0 HTWOS MODEL SCENARIO AND SOFTWARE CHANGE SUMMARY FORMS

Table A-2 is the software change summary form for the SST retrieval case.

A3.0 REFERENCES

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A1.0 Assumption Matrix For the 2001 Single-Shell Tank Retrieval Sequence and Double-Shell Tank Space Evaluation

Differences in assumptions among the three cases have been highlighted.

Table A-1. Assumption Matrix for the 2001 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	**Case 1**	**Case 2**	**Case 3**
Brief Description	**Risk-based SST Retrieval Completion by 2018 (Ecology Case)** SST Retrieval Sequence FY 2001 Update complies with M-45-00B milestone to retrieve high risk tanks early. SST retrieval completed per M-45-05. M-45-05-T05 through M-45-05-T09 not constraining. Waste treatment complete in 2028; Balance of Mission starts 10/1/2017. Tank space options save 3 million gallons of space by 2011. All retrieved SST wastes are concentrated. Salt well liquid pumping complete 2004 to meet Consent Decree milestones.	**Risk-based SST Retrieval within Existing DST Capacity** SST Retrieval Sequence FY 2001 Update complies with M-45-00B milestone to retrieve high risk tanks early. SST retrieval completed as space in the existing DSTs will allow. Waste treatment complete in 2028; Balance of Mission starts 10/1/2017. Tank space options save 0.85 million gallons by 2011. Salt well liquid pumping complete 2004 to meet Consent Decree milestones.	**SST Retrieval Completion by 2018 with Low-Volume Retrieval First** TPA Compliant SST waste retrieval schedule that retrieves tanks with the smaller remaining volumes first to meet TPA milestones for number of tanks started each year while trying to stay within available DST space for a longer period of time. Meets TPA milestones for SST retrieval but is not risk based. Waste treatment complete in 2028; Balance of Mission starts 10/1/2017. Tank space options save 0.85 million gallons by 2011. Salt well liquid pumping complete 2004 to meet Consent Decree milestones.
Major Technical Assumptions			
Date that BBI Quarterly Update was issued	September 30, 2000 with adjustments for historical transfers through 5/31/2001	September 30, 2000 with adjustments for historical transfers through 5/31/2001	September 30, 2000 with adjustments for historical transfers through 5/31/2001
Mission Summary Diagram -Schedule float -Transfer window	None modeled explicitly Two months	None modeled explicitly Two months	None modeled explicitly Two months
Non Tank Farm Facility Generations			
Total Limit	20-52 Kgal/year	20-52 Kgal/year	20-52 Kgal/year
PUREX Yearly Rate	5 Kgal/year	5 Kgal/year	5 Kgal/year
B Plant Yearly Rate	No wastes anticipated	No wastes anticipated	No wastes anticipated
WESF Yearly Rate	No wastes anticipated	No wastes anticipated	No wastes anticipated
222-S Laboratory Yearly Rate Flush for misc. waste WVRF	10 Kgal/year 22% 99%	10 Kgal/year 22% 99%	10 Kgal/year 22% 99%

Table A-1. Assumption Matrix for the 2001 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	Case 1	Case 2	Case 3
T Plant			
Yearly Rate (FY 2001)	19 Kgal/year	19 Kgal/year	19 Kgal/year
Yearly Rate (FY 2002 on)	4 to 19 Kgal/year	4 to 19 Kgal/year	4 to 19 Kgal/year
Flush for misc. waste	22%	22%	22%
WVRF	99%	99%	99%
300 Area			
Yearly Rate	1 to 28 Kgal/year	1 to 28 Kgal/year	1 to 28 Kgal/year
Flush for misc. waste	44%	44%	44%
WVRF	94%	94%	94%
400 Area			
Yearly Rate	No wastes anticipated	No wastes anticipated	No wastes anticipated
WSCF			
Yearly Rate	No wastes anticipated	No wastes anticipated	No wastes anticipated
PFP Stabilization			
Not calculated in Yearly Avg.			
Dates	2001-2005	2001-2005	2001-2005
Total volume	35 Kgal total	35 Kgal total	35 Kgal total
Flush	22%	22%	22%
WVRF	81%	81%	81%
100 Area			
100-N			
Volume, Kgal	No wastes anticipated	No wastes anticipated	No wastes anticipated
100-K Basin Cleanout			
Volume, Kgal	No wastes anticipated	No wastes anticipated	No wastes anticipated
105-F & 105-H Basin			
Volume, Kgal	No wastes anticipated	No wastes anticipated	No wastes anticipated
Tank Farm Waste Generations			
Tank Farms			
Yearly Rate	120 Kgal/year	120 Kgal/year	120 Kgal/year
WVRF	99%	99%	99%
IMUST Wastes			
Total Volume (2011-15)	500 Kgal total	500 Kgal total	500 Kgal total
Caustic Addition, Kgal			
Tank AY-101 (FY 2001)	45 (8 M NaOH) + flush	45 (8 M NaOH) + flush	45 (8 M NaOH) + flush
Tank AY-102 (FY 2001)	72 (8 M NaOH) + flush	72 (8 M NaOH) + flush	72 (8 M NaOH) + flush
Tank AN-102 (FY 2001)	19 (19 M NaOH) + flush	19 (19 M NaOH) + flush	19 (19 M NaOH) + flush
Tank AN-107 (FY 2001)	60 (19 M NaOH) + flush	60 (19 M NaOH) + flush	60 (19 M NaOH) + flush
SST Interim Stabilization			
Volume remaining on 9/30/2000	~2.6 Mgal	~2.6 Mgal	~2.6 Mgal
Volume remaining on 6/24/2001	~2.3 Mgal	~2.3 Mgal	~2.3 Mgal
West Area Receiver	Tank SY-102	Tank SY-102	Tank SY-102
Pumping Completion, FY	2004	2004	2004
Porosity saltcake/sludge	25%/15%	25%/15%	25%/15%
Dilution/Flush for Pumping	28-275%	28-275%	28-275%
WVRF, non-complexed	47%	47%	47%
WVRF, complexed	10%	10%	10%

Table A-1. Assumption Matrix for the 2001 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	Case 1	Case 2	Case 3
DST Space Management			
Evaporator			
242-A Shutdown	After all SST wastes are evaporated	2018	2018
New Evaporator Available	Balance of mission	Balance of mission	Balance of mission
Next Outage Date	6 month Outage each year in 2002 - 2004	6 month Outage each year in 2002 - 2004	6 month Outage each year in 2002 - 2004
Training Vol. (bi-yearly)	50 Kgal	50 Kgal	50 Kgal
Average Evaporation Rate	500 Kgal/month	500 Kgal/month	500 Kgal/month
Evaporation Limit (g/ml)	1.41 g/ml	1.41 g/ml	1.41 g/ml
LERF capacity	7.8 Mgal	7.8 Mgal	7.8 Mgal
Gal. Condensate/gal. WVR	1.15	1.15	1.15
Interval between campaigns	4 months minimum	4 months minimum	4 months minimum
Yearly evaporation of dilute waste	Yes	Yes	Yes
Effluent Treatment Facility			
Total treatment capacity	24 Mgal/year	24 Mgal/year	24 Mgal/year
Rate for evaporator condensate	5 Mgal/year	5 Mgal/year	5 Mgal/year
Emergency Space/LAW or HLW			
Waste Return Space	1.14 Mgal	1.14 Mgal	1.14 Mgal
Emergency Space	1.14 Mgal	1.14 Mgal	1.14 Mgal
LAW or HLW Return Space	None	None	None
Contingency space			
Waste Segregation/DST Solids			
Total DST solids	~4 Mgal	~4 Mgal	~4 Mgal
Store DSSF on NCRW solids	Yes	Yes	Yes
Store DSSF on NCAW solids	No	No	No
Segregate Complexed wastes	If Possible	If Possible	If Possible
Loss of DST Space			
Number tanks removed from service through the Initial Quantity	None	None	None
Number tanks removed from service in balance of mission	No DST failures or replacements assumed	No DST failures or replacements assumed	No DST failures or replacements assumed
Tank Space Options Incorporated (M-45-12-T01 options)	Tank space options save 3 million gallons of space to accelerate SST retrieval. Options used --increase tank fill limits, decrease dedicated operational space, and evaporation of some DST and all retrieved SST wastes to a specific gravity of 1.4.	Dedicated operational space was decreased by 0.85 Mgal to accelerate SST retrieval No other options were incorporated	Dedicated operational space was decreased by 0.85 Mgal to accelerate SST retrieval No other options were incorporated
Major Project Assumptions			
AW-B Pit work (W-314), start date - operational date	4/2001 - 12/2001	4/2001 - 12/2001	4/2001 - 12/2001
AW-A Pit work (W-314)	6/30/2001 - 10/1/2002	6/30/2001 - 10/1/2002	6/30/2001 - 10/1/2002
AN-101-01A and AN-104-04A Pit work (W-314)	6/2001 - 10/2002	6/2001 - 10/2002	6/2001 - 10/2002
241-A-A Pit work outage (W-314)	3/2004 - 2/2005	3/2004 - 2/2005	3/2004 - 2/2005
AN Farm Outage (W-314)	10/1/2001 - 7/2003	10/1/2001 - 7/2003	10/1/2001 - 7/2003

Table A-1. Assumption Matrix for the 2001 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	**Case 1**	**Case 2**	**Case 3**
AP Farm Outage (W-314)	10/2002 - 6/2004	10/2002 - 6/2004	10/2002 - 6/2004
Cross-site line outage connects cross-site to AN farm (W-314)	2/1/2003 - 1/1/2004	2/1/2003 - 1/1/2004	2/1/2003 - 1/1/2004
Cross-site to AP farm (W-211)	7/1/2002-6/30/2005	7/1/2002-6/30/2005	7/1/2002-6/30/2005
AW Farm Outage (W-314)	10/2003 - 2/2005	10/2003 - 2/2005	10/2003 - 2/2005
SY Farm Outage (W-314)	11/2003 - 9/2004	11/2003 - 9/2004	11/2003 - 9/2004
244-S Outage (W-314) - 222-S direct routed to SY farm after 6/30/2005 - PFP can no longer use 244-S after 6/30/2005	6/2004 - 6/2005	6/2004 - 6/2005	6/2004 - 6/2005
Initial Quantity LAW Feed Delivery			
LAW Feed Delivery Sequence and Envelope Designation	Source Tank (Envelope) AP-101 (A) AZ-101 (B) AZ-102 (B) AN-102 (C) AN-104 (A) AN-107 (C) AN-105 (A) SY-101 (A) AN-103 (A) AW-101 (A) AW-103 (A) (liquid portion of AW-103 is backup)	Source Tank (Envelope) AP-101 (A) AZ-101 (B) AZ-102 (B) AN-102 (C) AN-104 (A) AN-107 (C) AN-105 (A) SY-101 (A) AN-103 (A) AW-101 (A) AW-103 (A) (liquid portion of AW-103 is backup)	Source Tank (Envelope) AP-101 (A) AZ-101 (B) AZ-102 (B) AN-102 (C) AN-104 (A) AN-107 (C) AN-105 (A) SY-101 (A) AN-103 (A) AW-101 (A) AW-103 (A) (liquid portion of AW-103 is backup)
Initiate LAW Hot Commissioning	12/31/2007	12/31/2007	12/31/2007
Initial Quantity Certification Sampling	• 270 days to certify a feed batch (HTWOS will adjust to maintain WTP operation) • Cannot complete certification more than 720 days before delivery. • Backup tanks do not need to be recertified after 720 days if contents have not changed.	• 270 days to certify a feed batch (HTWOS will adjust to maintain WTP operation) • Cannot complete certification more than 720 days before delivery. • Backup tanks do not need to be recertified after 720 days if contents have not changed.	• 270 days to certify a feed batch (HTWOS will adjust to maintain WTP operation) • Cannot complete certification more than 720 days before delivery. • Backup tanks do not need to be recertified after 720 days if contents have not changed.
Ready to deliver first batch	9/1/2005	9/1/2005	9/1/2005
First LAW Delivery	Start date - Finish date 11/1/2007 - 12/31/2007	Start date - Finish date 11/1/2007 - 12/31/2007	Start date - Finish date 11/1/2007 - 12/31/2007
LAW staging dates Source 1 Source 2 Source 3 Source 4 Source 5	 AP-101(11/1/2007) NCAW Supernate (12/2007) AN-102 (4/2011) AN-104 (10/2013) AN-107 (10/2014)	 AP-101(11/1/2007) NCAW Supernate (12/2007) AN-102 (4/2011) AN-104 (10/2013) AN-107 (10/2014)	 AP-101(11/1/2007) NCAW Supernate (12/2007) AN-102 (4/2011) AN-104 (10/2013) AN-107 (10/2014)
Backup Feed Strategy	Identify one tank as backup. No rolling backup required.	Identify one tank as backup. No rolling backup required.	Identify one tank as backup. No rolling backup required.

Table A-1. Assumption Matrix for the 2001 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	**Case 1**	**Case 2**	**Case 3**
Intermediate Feed Staging Tanks	AN-101, AN-102, AN-105, AP-104, AP-101	AN-101, AN-102, AN-105, AP-104, AP-101	AN-101, AN-102, AN-105, AP-104, AP-101
WTP Feed Tanks	WTP provides space	WTP provides space	WTP provides space
Pretreated NCAW Receipt Tanks	WTP provides space	WTP provides space	WTP provides space
Entrained Solid Receipt Tanks	WTP provides space	WTP provides space	WTP provides space
Proposed Waste Staging Actions	– Transfer SY-103 to AN-104 after delivery of LAW Batch 6 (the dissolved solids batch in AN-104) – Transfer SY-101 to AP-102 in late 10/02	– Transfer SY-103 to AN-104 after delivery of LAW Batch 6 (the dissolved solids batch in AN-104) – Transfer SY-101 to AP-102 in late 10/02	– Transfer SY-103 to AN-104 after delivery of LAW Batch 6 (the dissolved solids batch in AN-104) – Transfer SY-101 to AP-102 in late 10/02
Initial Quantity LAW Waste Treatment Plant			
Pretreatment Durations	• The difference between delivery date and facility ramp up date for first LAW batch and first two HLW batches. • One month for remainder of batches.	• The difference between delivery date and facility ramp up date for first LAW batch and first two HLW batches. • One month for remainder of batches.	• The difference between delivery date and facility ramp up date for first LAW batch and first two HLW batches. • One month for remainder of batches.
LAW Process Annual Capacity	1,100 Units per year average processing rate	1,100 Units per year average processing rate	1,100 Units per year average processing rate
LAW Melter Design Capacity	To be determined from analysis of results.	To be determined from analysis of results.	To be determined from analysis of results.
LAW Process TOE	60% TOE.	60% TOE.	60% TOE.
Target LAW Pretreatment Hot Commissioning Schedule	Included in Ramp Up	Included in Ramp Up	Included in Ramp Up
Target LAW Vit. Hot Commissioning Schedule	Included in Ramp Up	Included in Ramp Up	Included in Ramp Up
LAW Hot Commissioning Production	Included in Ramp Up	Included in Ramp Up	Included in Ramp Up
LAW Treatment Ramp Up	From - To Units LAW 12/31/07-12/31/09 300 total 12/31/09-2/28/18 1,100/year Rate for Balance of Mission to be determined by projection.	From - To Units LAW 12/31/07-1/31/11 300 total 2/1/11-2/28/18 1,100/year	From - To Units LAW 12/31/07-1/31/11 300 total 2/1/11-2/28/18 1,100/year
WTP Sulfate Removal	None	None	None
ILAW Na2O Loading	[wt% Na2O][wt% SO3]<5 and Na2O < 20 wt%	[wt% Na2O][wt% SO3]<5 and Na2O < 20 wt%	[wt% Na2O][wt% SO3]<5 and Na2O < 20 wt%
LAW Feed Receipt Tank Usage	1.5 Mgal Total Capacity; be capable of receiving 1 Mgal without interruption while feeding out of the remaining 0.5 Mgal	1.5 Mgal Total Capacity; be capable of receiving 1 Mgal without interruption while feeding out of the remaining 0.5 Mgal	1.5 Mgal Total Capacity; be capable of receiving 1 Mgal without interruption while feeding out of the remaining 0.5 Mgal

Table A-1. Assumption Matrix for the 2001 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	Case 1	Case 2	Case 3
Initial Quantity HLW Feed Delivery			
HLW Feed Delivery Sequence and Retrieval Efficiency	Source Tank / Retrieval Efficiency AZ-101 90% AZ-102 80% AY-102 90% C-104/AY-101 85%/95% SY-102 80% Proposed Post-Initial Quantity Feeds C-107/ Portion of AW-103 AW-104/ Portion of AW-103	Source Tank / Retrieval Efficiency AZ-101 90% AZ-102 80% AY-102 90% C-104/AY-101 85%/95% SY-102 80% Proposed Post-Initial Quantity Feeds C-107/ Portion of AW-103 AW-104/ Portion of AW-103	Source Tank / Retrieval Efficiency AZ-101 90% AZ-102 80% AY-102 90% C-104/AY-101 85%/95% SY-102 80% Proposed Post-Initial Quantity Feeds C-107/ Portion of AW-103 AW-104/ Portion of AW-103
Ready to Deliver First Batch	4/1/2006	4/1/2006	4/1/2006
First HLW Delivery	Start date - Finish date 11/1/2007 - 12/31/2007	Start date - Finish date 11/1/2007 - 12/31/2007	Start date - Finish date 11/1/2007 - 12/31/2007
Contingency Feed	Identify sufficient feed sources to provide 20% extra.	Identify sufficient feed sources to provide 20% extra.	Identify sufficient feed sources to provide 20% extra.
Backup Feed Strategy	Identify one tank as backup. No rolling backup required.	Identify one tank as backup. No rolling backup required.	Identify one tank as backup. No rolling backup required.
Initial Quantity HLW Treatment Plant			
Initiate HLW Vitrification Services (full capacity)	12/31/2009	2/1/2011	2/1/2011
HLW Process Annual Capacity	120 canisters/yr	120 canisters/yr	120 canisters/yr
HLW Melter Design Capacity	1.5 MT glass/d	1.5 MT glass/d	1.5 MT glass/d
HLW Process TOE (implied)	67%	67%	67%
HLW Treatment Ramp Up	From - To / Cans HLW 12/31/07-12/31/09 60 cans total 12/31/09-2/28/18 120 cans/yr Rate for Balance of Mission to be determined by projection.	From - To / Cans HLW 12/31/07-1/31/11 60 cans total 2/1/11-2/28/18 120 cans/yr	From - To / Cans HLW 12/31/07-1/31/11 60 cans total 2/1/11-2/28/18 120 cans/yr
Method for Estimating HLW Waste Oxide Loading	Glass Properties Model	Glass Properties Model	Glass Properties Model
HLW Feed Receipt Tank Usage	Sufficient space to hold feed for 60 days of operation and receive 600 m^3 without interruption	Sufficient space to hold feed for 60 days of operation and receive 600 m^3 without interruption	Sufficient space to hold feed for 60 days of operation and receive 600 m^3 without interruption
SST Retrieval			
Number of SSTs Retrieved	149	149	149
Retrievable Sludge Volume	12.2 Mgal	12.2 Mgal	12.2 Mgal
Retrievable Saltcake Volume	23.4 Mgal	23.4 Mgal	23.4 Mgal

Table A-1. Assumption Matrix for the 2001 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	Case 1	Case 2	Case 3
Early Retrieval Sequence and Durations	**C-106:** Completed FY 1999. **U-107 Saltcake Dissolution Proof of Concept:** Start: approximately 7/27/01, 49 d (approximately 105 kgal total will be retrieved into the DST system) **S-112:** Start: 10/1/04, 196 d **S-102:** Start: 1/3/06, 69 d **C-104:** Start: 1/16/08, 185d Continues risk based sequence.	**C-106:** Completed FY 1999. **U-107 Saltcake Dissolution Proof of Concept:** Start: approximately 7/27/01, 49 d (approximately 105 kgal total will be retrieved into the DST system) **S-112:** Start: 10/1/04, 196 d **S-102:** Start: 1/3/06, 69 d **C-104:** Start: 1/16/08, 185d Continues risk based sequence.	**C-106:** Completed FY 1999. **U-107 Saltcake Dissolution Proof of Concept:** Start: approximately 7/27/01, 49 d (approximately 105 kgal total will be retrieved into the DST system) **S-112:** Start: 10/1/04, 196 d **S-102:** Start: 1/3/06, 69 d **C-104:** Start: 1/16/08, 185d Start retrieving tanks with smaller remaining volumes.
SST TPA Milestone Dates	**M-45-03C**: Complete retrieval technology demonstration of S-112, 9/30/05. **M-45-05A**: Complete initial waste retrieval of S-102, 9/30/06. **M-45-03F**: Complete retrieval technology demonstration of C-104, TBE by 2/28/2004. **M-45-05**: Retrieve waste from all remaining single-shell tanks, 9/30/2018. Meets all TPA milestones except for M-45-05-T05 through T09.	**M-45-03C**: Complete retrieval technology demonstration of S-112, 9/30/05. **M-45-05A**: Complete initial waste retrieval of S-102, 9/30/06. **M-45-03F**: Complete retrieval technology demonstration of C-104, TBE by 2/28/2004. Retrieval completed to support completion of waste processing by end of 2028.	**M-45-03C**: Complete retrieval technology demonstration of S-112, 9/30/05. **M-45-05A**: Complete initial waste retrieval of S-102, 9/30/06. **M-45-03F**: Complete retrieval technology demonstration of C-104, TBE by 2/28/2004. **M-45-05**: Retrieve waste from all remaining single-shell tanks, 9/30/2018. Meets TPA milestones except for risk based retrieval.
Basis for Rest of SST Retrieval Sequence	Risk based sequencing using groundwater and airborne risk measures to prioritize retrievals. Use the requirement to keep the processing plants operating to balance between the groundwater risk measure and the airborne risk measure.	Risk based sequencing using groundwater and airborne risk measures to prioritize retrievals. Use the requirement to keep the processing plants operating to balance between the groundwater risk measure and the airborne risk measure.	Retrieves tanks with smaller remaining volumes first to meet the TPA milestones for number of tanks started each year while trying to stay within the available DST space for a longer period of time.
Problematic Tanks Requiring a Specific Disposition Strategy	A-105, A-104, AX-104, SX-115, C-202	A-105, A-104, AX-104, SX-115, C-202	NA
Tanks to be moved to the Residuals Group in closure Program	U-101, T-103, BX-108, TY-106, T-106, B-201, B-202, T-201, T-202, U-201, U-202, U-203, U-204, C-201, C-203, C-204	U-101, T-103, BX-108, TY-106, T-106, B-201, B-202, T-201, T-202, U-201, U-202, U-203, U-204, C-201, C-203, C-204	NA
High sulfate content	BY-102, BY-109, BY-111, TX-112, TX-113 are retrieved at end of SST sequence.	BY-102, BY-109, BY-111, TX-112, TX-113 are retrieved not earlier than 9/30/2018.	Sulfate content not considered in SST retrieval selection.
WRF Availability Dates	WRF need dates will be accelerated to meet waste retrieval requirements.	B WRF: 9/29/14 T WRF: 10/1/18 U WRF: 10/1/14 (Note: Project need dates for the WRFs will be determined from the projected retrieval schedule.)	WRF need dates will be accelerated to meet waste retrieval requirements.

Table A-1. Assumption Matrix for the 2001 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	**Case 1**	**Case 2**	**Case 3**
Availability Dates for Tank Farms Upgrades	Tank farm upgrades will be accelerated as required to allow completion of retrieval by the 2018 deadline.	A Farm: 10/1/04 AX Farm: 10/1/04 C Farm (100): 10/1/04 C Farm (200): 10/1/18 S Farm: 10/1/04 SX Farm: 10/1/18	Tank farm upgrades will be accelerated as required to allow completion of retrieval by the 2018 deadline.
Simultaneous retrieval	Number of simultaneous retrievals required will be determined during the projection but could exceed the number required for Case 2.	Maximum of 6 simultaneous retrievals for both T, TX and TY Maximum of 6 simultaneous retrieval for T + TX + TY tank farms Maximum of 6 simultaneous retrievals for both B, BX and BY tank farms Maximum of 6 simultaneous retrieval for B + BX + BY tank farms Maximum of 2 simultaneous retrievals for both U, S and SX Maximum of 6 simultaneous retrieval for U + S + SX tank farms SE quadrants: Maximum of 2 simultaneous retrievals for both A, AX and C tank farms Maximum of 2 simultaneous retrieval for A + AX + C tank farms Maximum of 7 simultaneous retrievals for all the tank farms.	Number of simultaneous retrievals required will be determined during the projection but will probably exceed the number required for Case 2.
Balance of Mission			
Complete Waste Treatment	By end of 2028	By end of 2028	By end of 2028
Balance of Mission Annual Design Capacities	120 MT LAW glass/d 12 MT HLW glass/d (as necessary to complete processing by 2028)	120 MT LAW glass/d 12 MT HLW glass/d (as necessary to complete processing by 2028)	120 MT LAW glass/d 12 MT HLW glass/d (as necessary to complete processing by 2028)
Balance of Mission TOE (implied)	LAW = 85%, HLW = 85%	LAW = 85%, HLW = 85%	LAW = 85%, HLW = 85%
Balance of Mission Annual Average Capacities	102 MT LAW glass/d (design*TOE) 10.2 MT HLW glass/d	102 MT LAW glass/d (design*TOE) 10.2 MT HLW glass/d	102 MT LAW glass/d (design*TOE) 10.2 MT HLW glass/d
Balance of Mission Pretreatment Start Date	10/1/17	10/1/17	10/1/17
Balance of Mission LAW Vitrification Start Date	3/1/18	3/1/18	3/1/18
Balance of Mission HLW Vitrification Start Date	3/1/18	3/1/18	3/1/18
Method for Estimating HLW Glass Waste Oxide Loading	Glass Properties Model	Glass Properties Model	Glass Properties Model

Table A-1. Assumption Matrix for the 2001 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	**Case 1**	**Case 2**	**Case 3**
ILAW Na2O Loading	20 wt%Na_2O	20 wt%Na_2O	20 wt%Na_2O
Sulfate Removal	None	None	None
Cs and Sr Capsule Processing Start Date	March 2018	March 2018	March 2018
Duration to Process Cs and Sr Capsules	5 years (the first five years of Balance of Mission)	5 years (the first five years of Balance of Mission)	5 years (the first five years of Balance of Mission)
Slurry Transfer Limitations	Stage solids through AZ, AY, and AN farms. After retrieving HLW solids from AP and AW farms, no HLW solids will be staged in AP or AW farm tanks.	Stage solids through AZ, AY, and AN farms. After retrieving HLW solids from AP and AW farms, no HLW solids will be staged in AP or AW farm tanks.	Stage solids through AZ, AY, and AN farms. After retrieving HLW solids from AP and AW farms, no HLW solids will be staged in AP or AW farm tanks.
Storage and Disposal			
ILAW Package Assumptions	1.22 m dia. X 2.28 m	1.22 m dia. X 2.28 m	1.22 m dia. X 2.28 m
ILAW Glass Density	2.66 MT/m3	2.66 MT/m3	2.66 MT/m3
ILAW Package Net Mass	6.0 MT	6.0 MT	6.0 MT
ILAW Facility Availability Dates (Project W-520)	1/31/07	12/31/07	12/31/07
ILAW Product Shipment Starts When WTP Storage is X% Full	50	50	50
Design Capacity for Interim ILAW Storage, Packages	450	450	450
IHLW Canister Assumptions	0.61 m diameter X 4.5 m	0.61 m diameter X 4.5 m	0.61 m diameter X 4.5 m
IHLW Glass Density	2.66 MT/m3	2.66 MT/m3	2.66 MT/m3
IHLW Canister Net Mass	3.06 MT	3.06 MT	3.06 MT
IHLW Facility Availability Dates (Project W-464)	2/01/07	9/30/08	9/30/08
IHLW Product Shipment Starts When WTP Storage is X% Full	50	50	50
Design Capacity for Interim IHLW Storage, Canisters	45	45	45

Notes:

BBI = Best Basis Inventory
Balance of Mission--period following Initial Quantity processing
DST = double-shell tank
HLW = high-level waste
IHLW = immobilized high-level waste
ILAW = immobilized low-activity waste
IMUST = inactive miscellaneous underground storage tanks
LAW = low-activity waste
LERF = Liquid Effluent Retention Facility
NCAW = neutralized current acid waste
NCRW = neutralized cladding removal waste
PUREX = Plutonium-Uranium Extraction Plant
TCO = Terminal Clean-Out
TBD = to be determined
TBE = to be established
TOE = Total Operating Efficiency
TPA = Tri-Party Agreement (Hanford Federal Facility Agreement and Consent Order)
WESF = Waste Encapsulation and Storage Facility
WTP = Waste Treatment Plant
WSCF = Waste Sampling and Characterization Facility
WVR = waste volume reduction
WVRF = waste volume reduction factor

Table A-2. Software Change Summary Form for SST Retrieval Case.

Case Name/Identifier:	FY 2001 SST Retrieval Sequence Update / FY2001SSTSeq_4-16-2001c1	4/18/01

Objective: Update the SST retrieval sequence (from the sequence reported in RPP-7087) based on a new chemical inventory, the Bechtel National, Inc., contract, and more detailed risk measures. The updated sequence will serve as input to modify future planning and to revise the *Operational Waste Volume Projection* and *Tank Farm Contractor Operation and Utilization Plan* documents (HNF-SD-WM-ER-029 and HNF-SD-WM-SP-012, respectively).

Scenario Change Summary - This section is focused on changes in key assumptions or key inputs to the model.

1. Use the Initial Quantity processing schedule and assumptions from the CH2M HILL Hanford Group, Inc., contract extension case. Lock out the use of AP-101 and AZ-101 until the end of hot commissioning to simulate partial delivery.
2. Keep the schedule for waste retrieval from single-shell tanks (SST) S-112, S-102, and C-104 to meet Tri-Party Agreement milestones and to be consistent with current planning. Assume that the waste in SY-101 will be moved to an East Area double-shell tank (DST) before the cross-site transfer line outage (07/01/04 to 06/30/05).
3. Update the basis for sequencing retrieval of waste for the remaining SSTs (from that reported in the FY 2000 update) by incorporating the following information:
    a. Best-basis inventory data representing the chemical inventory of the wastes as of July 31, 2000. (Note: This is the latest best-basis inventory data set available that is partitioned for input to the Hanford tank waste operation simulator (HTWOS) model)
    b. Risk measures developed by Jacobs Engineering for the groundwater (long-lived, mobile radionuclides) and for airborne releases (radionuclides present mainly in the insoluble sludges)
    c. The ratio of the risk to the volume of low-activity waste (LAW) glass produced (using the rule of five) as a criterion to push back until 2018 some tanks with a high sulfate content (BY-101, BY-102, BY-109, TX-112, TX-113)
    d. Problematic tanks requiring a specific disposition strategy (A-105, A-104, AX-104, SX-115, C-202)
    e. Tanks to be moved to the residuals group in the closure program (U-101, T-103, BX-108, TY-106, T-106, B-201, B-202, T-201, T-202, U-201, U-202, U-203, U-204, C-201, C-203, C-204).
4. Use the groundwater risk and the airborne risk measures to prioritize the retrieval of tanks. Use the requirement of keeping the plants operating at peak capacity to merge the priorities of the two risk measure lists.
5. Use the following schedule for increasing the total processing capacity and making a transition from Initial Quantity to the balance of mission (BOM) processing. Adjust the total BOM rate to complete retrieval and processing by 2028.
    a. Increase the LAW capacity of the Initial Quantity Waste Treatment Plant on 03/01/2018 to 85 metric tonnes of glass (MTG)/d of LAW. Add a second LAW Waste Treatment Plant with the same expanded capacity. Increase the high-level waste (HLW) capacity of the Initial Quantity Waste Treatment Plant on 03/01/2018 to 17 MTG/d of HLW. The total BOM capacity is 170 MTG/d LAW and 17 MTG/d HLW after 03/01/2018. Both of those have a TOE of 60% during Initial Quantity and Balance of Mission.
    b. BOM pretreatment starts on 10/01/2017, and vitrification starts on 03/01/2018.
6. Adjust the SST retrieval sequence as necessary to keep the processing plants operating at, or nearly at, peak capacity. Accelerate the retrieval schedule to keep the DST system as full as possible with retrieved waste.

Software Change Summary - This section is focused on changes in the HTWOS model functionality. Reference the item in the Scenario Change Summary section when an assumption change leads to a model function change.

1. Constrain the retrieval dates for Tanks S-112, S-102, and C-104 per the detail in Table A-1. Transfer waste from SY-101 to AP-102 in October 2002 to make space in the West Area DSTs for receiving S-112 while the cross-site transfer line is out of service.
2. Incorporate a detailed method for estimating risk measures associated with SST waste.
3. Modify the model to reflect the BOM processing schedule in item 5 above.

Requestor Information - For reporting modeling status and resolving issues.

Table A-2. Software Change Summary Form for SST Retrieval Case.

Requestor/Contact: SST Retrieval Program/Eric Pacquet	
Reference for Request: 1. Meeting held on Tuesday, March 13, 2001, between Eric Pacquet, Gerald Senentz, Bill Stokes, and Randy Kirkbride. Ted Hohl and Jim Strode attended part-time. 2. Email messages and follow-up meetings.	
Deliverable(s): 1. Complete the HTWOS runs and develop the final sequence. 2. Present the revised SST sequence and schedule as a retrieval sequence plot and in tabular format. 3. Draft a revision of the mission summary diagram. 4. Draft a report documenting the results.	
Due Date: (Format the presentation of due dates to correspond with deliverables section.) 1. April 18, 2001 2. April 18, 2001 3. To be determined April 26, 2001	
Change Approval	
Team Lead: G. H. SENENTZ Signed Copy on File	**Manager:** N. W. KIRCH Signed Copy on File
Customer:	**CACN:** 106495

APPENDIX B

HANFORD TANK WASTE OPERATION SIMULATOR MODEL DESCRIPTION

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B1.0. HANFORD TANK WASTE OPERATION SIMULATOR MODELING ASSUMPTIONS

B1.1 BEST BASIS INVENTORY

The volume inventory is based on HNF-EP-0182-148, *Waste Tank Summary Report for Month Ending July 31, 2000*. The inventory information for radiological and nonradiological hazardous constituent content is based on the October 1, 2000, best basis inventory (BBI) data. The October 1, 2000, inventory accounts for saltwell transfers through July 31, 2000. Saltwell transfers occurring between August 1 and October 31, 2000, were input manually into the model. Other data modifications necessary for final input into the Hanford Tank Waste Operations Simulator (HTWOS) are documented in Hohl and Seidl (letter to R. A. Kirkbride, "Documentation of HTWOS DST and SST Inventory Input and Retrieval Water Additions for SST Retrieval"). The supporting data for the figures in this appendix are included in Appendix A of this document.

The BBI is a detailed source for tank content information. The BBI is generated by scientists and engineers at the Hanford Site and in the National Laboratory System and provides their best estimate of the contents of the tank waste. Process knowledge and actual sample data are used to generate the BBI. The BBI has been extensively peer-reviewed by experts across the nation. Staff from the Washington State Department of Ecology and the U.S. Environmental Protection Agency have been involved in these reviews and have required public access to the data. The BBI is posted in a relational database on the Tank Waste Information Network System (TWINS) and is accessible for review at http://twins.pnl.gov:8001/. The BBI is updated routinely as new laboratory data are obtained. While the BBI is updated on a regular basis, the inventory data used for the HTWOS model is updated annually to ensure consistency of output throughout the fiscal year. The last inventory update was performed in October 2000. An update to the BBI is currently being performed; however, the data necessary to support this document will not be available until after the FY 2001 publish date.

B 1.2 SINGLE-SHELL TANK RETRIEVAL RATES

The model used available data for retrieval rates for the three planned technology deployments shown in Table 1-1 of this document. For the balance of the SST retrievals, the model assumes the parameters for past-practice sluicing as the baseline retrieval technology for planning purposes. The complete modeling basis is documented in HNF-SD-WM-SP-012, Rev. 3, *Tank Farm Contractor Operation and Utilization Plan.*

B 1.3 WASTE TREATMENT PLANT ASSUMPTIONS

The U.S. Department of Energy, Office of River Protection, provided the key interface assumptions listed in Table B-1 regarding Initial Quantity vitrification operations dates. These assumptions were provided as the basis for the integrated baseline schedule as detailed in HNF-SD-WM-SP-012.

Table B-1. Waste Treatment Plant Assumptions

Assumption	Date
Ready to deliver first LAW batch	September 1, 2005
Ready to deliver first HLW batch	April 1, 2006
Start LAW facility hot commissioning	December 31, 2007
Start HLW facility hot commissioning	December 31, 2007
Start LAW full-scale production	February 1, 2011
Start HLW full-scale production	February 1, 2011

Note: Facility commissioning refers to complete construction of facility and full-scale production initiated. Hot commissioning implies the ability to receive waste and start processing.

B.1.4. REFERENCES

HNF-EP-0182-148, 2000, *Waste Tank Summary Report for Month Ending July 31, 2000*, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-WM-SP-012, 2001, *Tank Farm Contractor Operation and Utilization Plan*, Rev. 3, prepared by Numatec Hanford Corporation for CH2M HILL Hanford Group, Inc., Richland, Washington.

Hohl, T. M., and J. A. Seidl, 2001, (Letter 7KN00-01-NWK-007, "Documentation of HTWOS DST and SST Inventory Input and Retrieval Water Additions for SST Retrieval," to R. A. Kirkbride, Numatec Hanford Corporation), CH2M HILL Hanford Group, Inc., Richland, Washington, April 9.

APPENDIX C

SINGLE-SHELL TANK RISK FACTORS, CALCULATIONS, AND RANKINGS

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C1.0. FINAL ENVIRONMENTAL IMPACT STATEMENT RISK FACTORS

Table C-1 lists, by analyte, the groundwater, airborne, and chemical risk factors from DOE/EIS-0189, *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement*: Groundwater Factors, Table D.2.1.23; Airborne Factors, Table D.7.3.1; Chemical Factors, Table D.2.1.21.

Table C-1. Risk Factors.

Analyte	Groundwater Factor [mrem/(Ci*mL)]	Airborne Factor [mrem/Ci]	Chemical Factor [Risk/(kg*mL)]
14-C	5.23 E+06		
129-I	9.33 E+08		
79-Se	3.22 E+07		
99-Tc	7.11 E+06		
238-U	2.84 E+08	2.51 E+02	
241-Am		6.45 E+02	
242m-Am		6.94 E+02	
243-Am		1.29 E+03	
243-Cm		7.42 E+01	
244-Cm		9.80 E+00	
245-Cm		1.05 E+03	
246-Cm		7.25 E+02	
247-Cm		1.81 E+03	
248-Cm		2.60 E+03	
94-Nb		5.54 E+03	
237-Np		1.67 E+03	
236-Pu		1.04 E+02	
238-Pu		2.82 E+02	
239-Pu		6.96 E+02	
240-Pu		6.91 E+02	
241-Pu		2.21 E+01	
242-Pu		6.60 E+02	
244-Pu		1.83 E+03	
126-Sn		6.93 E+03	
232-Th		1.07 E+04	
NO_2^-			9.92 E+03
NO_3^-			6.20 E+03
$CrOH_4^-$			3.31 E+06

C2.0 SAMPLE CALCULATIONS

i = analyte

AF_i = analyte airborne risk factor [mrem/Ci]

GF_i = analyte groundwater risk factor [mrem/(Ci*mL)]

CF_i = analyte chemical risk factor [Risk/(kg*mL)]

C_i = analyte inventory (Ci)

K_i = analyte inventory (kg)

C2.1 Groundwater Risk

$$\text{Groundwater Risk} = \sum_{i={}^{14}C\ldots{}^{238}U} (GF_i \cdot C_i)$$

C2.3 Airborne Risk

$$\text{Airborne Risk} = \sum_{i={}^{238}U\ldots{}^{232}Th} (AF_i \cdot C_i)$$

C2.3 Chemical Risk

$$\text{Chemical Risk} = \sum_{i=NO_2^-\ldots CrO_4^-} (CF_i \cdot K_i)$$

C3.0 SINGLE-SHELL TANK RISK RANKINGS

Table C-2 lists the risk ratings for the single-shell tanks as of October 1, 2000.

Table C-2. Tank Risk Rankings. (5 sheets)

Risk Rankings - Prepared from Best Basis Inventory 10/01/2000 by Ted Hohl

SST Tank	Waste Volume July 2000 [kgal]	Ground Water Risk [mrem/mL]	Ground Water Rank	Percent Ground Water Risk	Airborne Risk [mrem]	Airborne Rank	Percent Airborne Risk	Chemical Risk [kg/mL]	Chemical Rank	Percent Chemical Risk	Long-lived mobile Radionuclides* [Ci]	Percent
A-101	8.77E+02	3.66E+08	95	0.17%	4.16E+05	34	0.59%	2.82E+10	22	1.40%	9.92E+02	4.40%
A-102	4.10E+01	7.42E+08	78	0.34%	5.86E+05	24	0.83%	6.59E+09	74	0.33%	4.31E+01	0.19%
A-103	3.71E+02	2.02E+09	40	0.92%	3.86E+05	37	0.55%	1.23E+10	58	0.61%	2.50E+02	1.11%
A-104	2.30E+01	1.02E+08	120	0.05%	7.47E+05	21	1.06%	2.85E+08	134	0.01%	1.01E+01	0.04%
A-105	5.10E+01	6.98E+08	82	0.32%	3.77E+06	5	5.35%	1.81E+09	108	0.09%	6.97E+01	0.31%
A-106	1.25E+02	1.13E+09	68	0.52%	2.40E+06	6	3.41%	1.33E+10	55	0.66%	1.16E+02	0.52%
AX-101	6.83E+02	2.25E+08	108	0.10%	3.53E+05	40	0.50%	1.95E+10	41	0.97%	8.05E+02	3.57%
AX-102	3.00E+01	3.29E+08	101	0.15%	2.37E+06	7	3.37%	7.19E+08	125	0.04%	3.35E+01	0.15%
AX-103	1.12E+02	1.17E+09	66	0.54%	8.17E+05	19	1.16%	9.55E+09	63	0.47%	1.53E+02	0.68%
AX-104	8.00E+00	7.05E+08	80	0.32%	8.93E+05	17	1.27%	1.13E+08	140	0.01%	9.59E+01	0.43%
B-101	1.13E+02	1.07E+09	71	0.49%	2.10E+06	9	2.98%	2.20E+09	102	0.11%	1.19E+01	0.05%
B-102	3.20E+01	1.18E+08	118	0.05%	1.99E+03	142	0.00%	5.72E+08	128	0.03%	1.70E+00	0.01%
B-103	5.90E+01	1.63E+08	113	0.07%	5.44E+04	106	0.08%	8.04E+08	123	0.04%	2.05E+00	0.01%
B-104	3.71E+02	3.67E+08	94	0.17%	5.82E+04	102	0.08%	4.55E+09	86	0.23%	4.20E+00	0.02%
B-105	1.58E+02	2.04E+08	110	0.09%	2.52E+04	121	0.04%	4.35E+09	87	0.22%	4.61E+00	0.02%
B-106	1.17E+02	7.09E+08	79	0.32%	1.50E+04	132	0.02%	1.54E+09	112	0.08%	6.96E+00	0.03%
B-107	1.65E+02	3.40E+08	99	0.16%	3.29E+04	118	0.05%	1.92E+09	107	0.10%	1.96E+01	0.09%
B-108	9.40E+01	3.64E+08	96	0.17%	2.81E+03	139	0.00%	1.03E+09	122	0.05%	3.58E+00	0.02%
B-109	1.27E+02	1.68E+09	53	0.77%	3.85E+04	113	0.05%	6.43E+09	75	0.32%	5.02E+01	0.22%
B-110	2.46E+02	2.27E+08	106	0.10%	1.37E+05	70	0.19%	4.97E+09	82	0.25%	2.27E+01	0.10%
B-111	2.37E+02	9.57E+08	75	0.44%	1.83E+05	58	0.26%	4.92E+09	83	0.24%	1.24E+02	0.55%
B-112	3.30E+01	8.40E+07	122	0.04%	1.22E+03	144	0.00%	6.80E+08	127	0.03%	1.08E+01	0.05%
B-201	2.90E+01	4.15E+06	135	0.00%	1.12E+05	82	0.16%	1.58E+09	111	0.08%	3.24E-01	0.00%
B-202	2.70E+01	3.80E+06	136	0.00%	1.94E+04	126	0.03%	1.19E+09	120	0.06%	3.29E-02	0.00%
B-203	5.10E+01	4.20E+06	134	0.00%	3.43E+04	116	0.05%	2.43E+09	99	0.12%	3.25E-02	0.00%
B-204	5.00E+01	1.37E+06	141	0.00%	3.66E+04	114	0.05%	2.44E+09	98	0.12%	1.21E-02	0.00%
BX-101	4.30E+01	1.08E+09	70	0.50%	2.00E+05	56	0.28%	5.94E+09	76	0.29%	1.73E+01	0.08%
BX-102	9.60E+01	1.24E+08	117	0.06%	1.52E+05	65	0.22%	5.15E+09	79	0.26%	6.77E+00	0.03%
BX-103	7.10E+01	2.94E+08	102	0.13%	3.36E+05	42	0.48%	1.16E+10	59	0.57%	1.77E+01	0.08%
BX-104	9.30E+01	2.50E+09	30	1.15%	4.38E+05	31	0.62%	1.39E+10	52	0.69%	4.22E+01	0.19%

Table C-2. Tank Risk Rankings. (5 sheets)

Risk Rankings - Prepared from Best Basis Inventory 10/01/2000 by Ted Hohl

SST Tank	Waste Volume July 2000 [kgal]	Ground Water Risk [mrem/mL]	Ground Water Rank	Percent Ground Water Risk	Airborne Risk [mrem]	Airborne Rank	Percent Airborne Risk	Chemical Risk [kg/mL]	Chemical Rank	Percent Chemical Risk	Long-lived mobile Radionuclides* [Ci]	Percent
BX-105	5.10E+01	2.19E+08	109	0.10%	2.49E+05	48	0.35%	8.57E+09	67	0.43%	1.33E+01	0.06%
BX-106	3.80E+01	1.64E+08	112	0.08%	9.78E+04	89	0.14%	6.83E+09	71	0.34%	9.72E+00	0.04%
BX-107	3.45E+02	1.36E+09	61	0.62%	9.20E+04	91	0.13%	7.75E+09	69	0.38%	7.59E+01	0.34%
BX-108	2.60E+01	2.00E+08	111	0.09%	4.75E+03	136	0.01%	3.92E+08	133	0.02%	6.16E+00	0.03%
BX-109	1.93E+02	1.70E+09	52	0.78%	1.53E+04	130	0.02%	1.98E+09	106	0.10%	1.37E+01	0.06%
BX-110	2.07E+02	1.14E+09	67	0.52%	8.75E+04	95	0.12%	2.06E+10	39	1.02%	4.40E+01	0.20%
BX-111	1.62E+02	1.04E+09	73	0.48%	4.06E+04	112	0.06%	8.76E+09	64	0.44%	1.18E+02	0.53%
BX-112	1.65E+02	9.71E+07	121	0.04%	1.02E+05	87	0.14%	4.06E+09	88	0.20%	2.55E+00	0.01%
BY-101	3.87E+02	3.56E+09	18	1.63%	1.37E+05	70	0.19%	1.96E+10	40	0.97%	3.13E+02	1.39%
BY-102	2.77E+02	2.37E+09	36	1.09%	1.13E+05	81	0.16%	1.11E+10	61	0.55%	2.75E+02	1.22%
BY-103	4.00E+02	2.97E+09	24	1.36%	2.22E+05	52	0.32%	2.30E+10	30	1.14%	3.43E+02	1.52%
BY-104	3.26E+02	2.42E+09	32	1.11%	2.15E+05	54	0.31%	3.70E+10	14	1.84%	2.28E+02	1.01%
BY-105	5.03E+02	1.96E+09	45	0.90%	4.31E+05	33	0.61%	1.35E+10	53	0.67%	1.53E+02	0.68%
BY-106	5.62E+02	3.93E+09	14	1.80%	1.25E+05	76	0.18%	2.24E+10	34	1.11%	4.66E+02	2.07%
BY-107	2.66E+02	1.88E+09	49	0.86%	4.94E+04	109	0.07%	2.52E+10	26	1.25%	1.57E+02	0.69%
BY-108	2.28E+02	1.63E+09	54	0.75%	5.78E+04	103	0.08%	3.08E+09	92	0.15%	1.29E+02	0.57%
BY-109	2.90E+02	3.98E+09	12	1.82%	7.54E+04	98	0.11%	1.29E+10	56	0.64%	2.57E+02	1.14%
BY-110	3.98E+02	2.84E+09	27	1.30%	9.08E+04	94	0.13%	2.72E+10	23	1.35%	2.24E+02	1.00%
BY-111	4.59E+02	5.57E+09	6	2.55%	1.80E+05	59	0.26%	2.16E+10	36	1.07%	4.16E+02	1.85%
BY-112	2.91E+02	2.96E+09	25	1.36%	5.99E+04	101	0.08%	9.42E+10	1	4.68%	2.86E+02	1.27%
C-101	8.80E+01	8.15E+08	77	0.37%	1.00E+06	15	1.42%	1.38E+09	115	0.07%	4.44E+01	0.20%
C-102	3.16E+02	1.24E+07	132	0.01%	6.12E+06	2	8.69%	3.56E+09	91	0.18%	1.06E+01	0.05%
C-103	1.98E+02	1.63E+09	55	0.75%	4.51E+06	4	6.40%	1.34E+09	117	0.07%	2.16E+02	0.96%
C-104	2.63E+02	5.40E+09	7	2.47%	9.25E+06	1	13.13%	5.40E+09	78	0.27%	1.58E+02	0.70%
C-105	1.34E+02	1.30E+09	63	0.60%	1.04E+06	13	1.48%	2.48E+09	96	0.12%	9.00E+01	0.40%
C-106	7.40E+01	2.63E+08	104	0.12%	5.41E+04	107	0.08%	2.17E+08	137	0.01%	3.00E+01	0.13%
C-107	2.57E+02	1.21E+09	64	0.55%	2.16E+06	8	3.07%	3.61E+09	90	0.18%	1.11E+02	0.49%
C-108	6.60E+01	1.85E+07	131	0.01%	2.44E+03	141	0.00%	4.94E+08	130	0.02%	6.41E-01	0.00%
C-109	6.60E+01	5.73E+08	88	0.26%	1.08E+05	83	0.15%	4.28E+08	131	0.02%	3.32E+01	0.15%
C-110	1.78E+02	4.88E+08	90	0.22%	5.47E+04	105	0.08%	2.25E+09	100	0.11%	3.57E+01	0.16%
C-111	5.70E+01	4.04E+08	93	0.19%	1.75E+05	61	0.25%	2.27E+08	136	0.01%	3.14E+00	0.01%

Table C-2. Tank Risk Rankings. (5 sheets)

Risk Rankings - Prepared from Best Basis Inventory 10/01/2000 by Ted Hohl

SST Tank	Waste Volume July 2000 [kgal]	Ground Water Risk [mrem/mL]	Ground Water Rank	Percent Ground Water Risk	Airborne Risk [mrem]	Airborne Rank	Percent Airborne Risk	Chemical Risk [kg/mL]	Chemical Rank	Percent Chemical Risk	Long-lived mobile Radionuclides* [Ci]	Percent
C-112	1.04E+02	4.04E+09	11	1.85%	1.97E+05	57	0.28%	1.28E+09	118	0.06%	1.09E+02	0.48%
C-201	2.00E+00	4.31E+05	148	0.00%	1.27E+05	75	0.18%	1.80E+07	146	0.00%	3.02E-02	0.00%
C-202	1.00E+00	2.00E+05	149	0.00%	3.46E+04	115	0.05%	1.34E+07	149	0.00%	1.04E-02	0.00%
C-203	5.00E+00	9.95E+05	146	0.00%	2.64E+04	120	0.04%	4.06E+07	144	0.00%	8.90E-02	0.00%
C-204	3.00E+00	5.14E+05	147	0.00%	3.37E+02	146	0.00%	1.63E+07	147	0.00%	4.91E-02	0.00%
S-101	4.27E+02	3.37E+09	20	1.54%	6.62E+05	22	0.94%	6.49E+10	3	3.22%	2.74E+02	1.21%
S-102	4.92E+02	3.29E+09	21	1.51%	2.37E+05	50	0.34%	2.34E+10	28	1.16%	4.82E+02	2.14%
S-103	2.37E+02	1.99E+09	42	0.91%	2.50E+05	47	0.35%	2.28E+10	32	1.13%	2.29E+02	1.02%
S-104	2.94E+02	1.60E+09	57	0.73%	4.39E+05	30	0.62%	1.68E+10	47	0.84%	5.52E+01	0.25%
S-105	4.56E+02	3.13E+09	22	1.43%	1.22E+05	77	0.17%	5.31E+10	7	2.64%	3.49E+02	1.55%
S-106	4.79E+02	2.41E+09	33	1.10%	7.54E+04	97	0.11%	4.92E+10	10	2.44%	2.81E+02	1.25%
S-107	3.76E+02	2.34E+09	37	1.07%	1.58E+06	11	2.24%	2.85E+10	21	1.41%	1.22E+02	0.54%
S-108	4.32E+02	2.71E+09	29	1.24%	5.81E+05	26	0.82%	5.02E+10	9	2.49%	3.07E+02	1.36%
S-109	5.07E+02	2.76E+09	28	1.26%	9.13E+04	93	0.13%	2.63E+10	24	1.31%	4.25E+02	1.89%
S-110	3.90E+02	3.49E+09	19	1.60%	5.84E+05	25	0.83%	6.20E+10	4	3.08%	3.29E+02	1.46%
S-111	4.72E+02	1.45E+09	59	0.67%	4.78E+04	110	0.07%	3.65E+10	15	1.81%	3.84E+02	1.70%
S-112	5.23E+02	4.63E+09	10	2.12%	2.14E+05	55	0.30%	5.61E+10	5	2.79%	5.57E+02	2.47%
SX-101	4.48E+02	1.57E+09	58	0.72%	7.84E+05	20	1.11%	9.01E+10	2	4.47%	1.53E+02	0.68%
SX-102	5.14E+02	6.23E+09	3	2.85%	3.99E+05	35	0.57%	5.34E+10	6	2.65%	7.22E+02	3.21%
SX-103	6.34E+02	6.45E+09	2	2.95%	5.63E+05	27	0.80%	5.26E+10	8	2.61%	7.45E+02	3.30%
SX-104	4.46E+02	2.38E+09	35	1.09%	8.86E+05	18	1.26%	4.29E+10	12	2.13%	2.36E+02	1.05%
SX-105	6.37E+02	7.66E+09	1	3.51%	1.05E+06	12	1.49%	3.15E+10	18	1.56%	8.90E+02	3.95%
SX-106	3.97E+02	3.77E+09	16	1.73%	4.35E+05	32	0.62%	3.71E+10	13	1.84%	4.38E+02	1.95%
SX-107	1.04E+02	3.52E+08	97	0.16%	3.94E+05	36	0.56%	8.57E+09	66	0.43%	1.21E+01	0.05%
SX-108	8.70E+01	6.99E+08	81	0.32%	2.98E+05	44	0.42%	1.69E+10	46	0.84%	1.36E+01	0.06%
SX-109	2.50E+02	1.04E+09	74	0.48%	4.82E+05	29	0.68%	2.43E+10	27	1.21%	7.06E+01	0.31%
SX-110	6.20E+01	3.46E+08	98	0.16%	3.65E+05	39	0.52%	4.98E+09	81	0.25%	2.05E+01	0.09%
SX-111	1.22E+02	5.99E+08	86	0.27%	5.32E+05	28	0.76%	9.80E+09	62	0.49%	3.15E+01	0.14%
SX-112	1.08E+02	4.61E+08	91	0.21%	3.50E+05	41	0.50%	8.65E+09	65	0.43%	2.03E+01	0.09%
SX-113	3.10E+01	6.81E+06	133	0.00%	2.98E+03	138	0.00%	1.61E+08	138	0.01%	1.78E-01	0.00%
SX-114	1.81E+02	6.81E+08	83	0.31%	3.33E+05	43	0.47%	1.60E+10	49	0.79%	4.55E+01	0.20%

Table C-2. Tank Risk Rankings. (5 sheets)

Risk Rankings - Prepared from Best Basis Inventory 10/01/2000 by Ted Hohl

SST Tank	Waste Volume July 2000 [kgal]	Ground Water Risk [mrem/mL]	Ground Water Rank	Percent Ground Water Risk	Airborne Risk [mrem]	Airborne Rank	Percent Airborne Risk	Chemical Risk [kg/mL]	Chemical Rank	Percent Chemical Risk	Long-lived mobile Radionuclides* [Ci]	Percent
SX-115	1.20E+01	7.99E+07	124	0.04%	1.84E+06	10	2.61%	2.74E+09	93	0.14%	3.20E+00	0.01%
T-101	1.02E+02	1.85E+09	50	0.85%	5.93E+05	23	0.84%	1.37E+09	116	0.07%	2.50E+01	0.11%
T-102	3.20E+01	5.97E+08	87	0.27%	2.74E+04	119	0.04%	7.04E+08	126	0.03%	1.30E+01	0.06%
T-103	2.70E+01	8.22E+07	123	0.04%	1.74E+05	62	0.25%	4.06E+08	132	0.02%	3.37E+00	0.01%
T-104	3.17E+02	1.36E+08	115	0.06%	1.49E+05	67	0.21%	4.83E+09	84	0.24%	1.96E+00	0.01%
T-105	9.80E+01	1.38E+09	60	0.63%	1.39E+05	69	0.20%	1.50E+09	113	0.07%	1.56E+02	0.69%
T-106	2.10E+01	4.34E+07	127	0.02%	4.80E+03	135	0.01%	2.54E+08	135	0.01%	4.05E-01	0.00%
T-107	1.73E+02	2.48E+09	31	1.13%	1.14E+05	79	0.16%	1.74E+09	110	0.09%	6.52E+01	0.29%
T-108	4.40E+01	4.05E+07	128	0.02%	1.31E+04	133	0.02%	7.86E+08	124	0.04%	6.38E-01	0.00%
T-109	5.80E+01	2.48E+07	129	0.01%	1.05E+04	134	0.01%	1.02E+08	141	0.01%	9.23E-01	0.00%
T-110	3.69E+02	1.26E+08	116	0.06%	1.14E+05	79	0.16%	5.14E+09	80	0.26%	1.03E+00	0.00%
T-111	4.46E+02	8.49E+08	76	0.39%	2.71E+05	45	0.38%	1.47E+10	50	0.73%	2.24E+01	0.10%
T-112	6.70E+01	1.04E+08	119	0.05%	5.20E+04	108	0.07%	2.22E+09	101	0.11%	2.91E+00	0.01%
T-201	2.90E+01	1.01E+06	145	0.00%	6.64E+04	99	0.09%	2.51E+09	95	0.12%	5.13E-02	0.00%
T-202	2.10E+01	1.13E+06	144	0.00%	1.51E+04	131	0.02%	1.27E+09	119	0.06%	3.92E-02	0.00%
T-203	3.50E+01	1.25E+06	143	0.00%	1.98E+04	125	0.03%	2.11E+09	105	0.10%	6.08E-02	0.00%
T-204	3.80E+01	1.35E+06	142	0.00%	1.55E+04	129	0.02%	2.65E+09	94	0.13%	6.47E-02	0.00%
TX-101	8.70E+01	3.37E+08	100	0.15%	2.71E+05	45	0.38%	6.62E+09	73	0.33%	1.60E+01	0.07%
TX-102	2.17E+02	1.36E+09	62	0.62%	5.74E+04	104	0.08%	1.14E+10	60	0.56%	1.48E+02	0.65%
TX-103	1.57E+02	5.08E+08	89	0.23%	1.89E+04	127	0.03%	8.10E+09	68	0.40%	5.16E+01	0.23%
TX-104	6.50E+01	2.93E+08	103	0.13%	1.34E+05	73	0.19%	3.95E+09	89	0.20%	3.17E+01	0.14%
TX-105	6.09E+02	3.82E+09	15	1.75%	1.50E+05	66	0.21%	3.19E+10	17	1.58%	4.16E+02	1.85%
TX-106	3.41E+02	2.29E+09	38	1.05%	9.17E+04	92	0.13%	1.79E+10	44	0.89%	2.33E+02	1.03%
TX-107	3.60E+01	6.89E+07	125	0.03%	1.52E+03	143	0.00%	2.11E+09	104	0.10%	3.96E+00	0.02%
TX-108	1.34E+02	6.72E+08	84	0.31%	2.42E+04	122	0.03%	6.78E+09	72	0.34%	6.81E+01	0.30%
TX-109	3.84E+02	1.18E+09	65	0.54%	1.79E+05	60	0.25%	7.29E+09	70	0.36%	1.14E+02	0.51%
TX-110	4.62E+02	2.39E+09	34	1.10%	1.05E+05	85	0.15%	2.30E+10	31	1.14%	2.54E+02	1.13%
TX-111	3.70E+02	2.01E+09	41	0.92%	3.34E+04	117	0.05%	1.80E+10	43	0.89%	2.13E+02	0.95%
TX-112	6.49E+02	3.95E+09	13	1.81%	1.59E+05	64	0.23%	3.30E+10	16	1.64%	4.33E+02	1.92%
TX-113	6.07E+02	5.77E+09	4	2.64%	1.08E+05	83	0.15%	1.73E+10	45	0.86%	6.52E+02	2.89%
TX-114	5.35E+02	2.95E+09	26	1.35%	1.32E+05	74	0.19%	2.54E+10	25	1.26%	3.19E+02	1.42%

Table C-2. Tank Risk Rankings. (5 sheets)

Risk Rankings - Prepared from Best Basis Inventory 10/01/2000 by Ted Hohl

SST Tank	Waste Volume July 2000 [kgal]	Ground Water Risk [mrem/mL]	Ground Water Rank	Percent Ground Water Risk	Airborne Risk [mrem]	Airborne Rank	Percent Airborne Risk	Chemical Risk [kg/mL]	Chemical Rank	Percent Chemical Risk	Long-lived mobile Radionuclides* [Ci]	Percent
TX-115	5.68E+02	3.56E+09	17	1.63%	1.40E+05	68	0.20%	2.98E+10	19	1.48%	3.92E+02	1.74%
TX-116	6.31E+02	2.25E+09	39	1.03%	1.21E+05	78	0.17%	1.40E+10	51	0.69%	2.38E+02	1.06%
TX-117	6.26E+02	1.97E+09	43	0.90%	1.03E+05	86	0.15%	2.28E+10	33	1.13%	2.03E+02	0.90%
TX-118	2.86E+02	1.61E+09	56	0.74%	5.37E+06	3	7.62%	1.28E+10	57	0.64%	1.78E+02	0.79%
TY-101	1.18E+02	2.36E+08	105	0.11%	9.95E+04	88	0.14%	2.11E+10	37	1.05%	7.23E+00	0.03%
TY-102	6.40E+01	2.12E+07	130	0.01%	3.18E+03	137	0.00%	1.09E+09	121	0.05%	8.64E-01	0.00%
TY-103	1.62E+02	1.93E+09	46	0.88%	1.61E+05	63	0.23%	4.65E+09	85	0.23%	3.11E+01	0.14%
TY-104	4.30E+01	6.14E+08	85	0.28%	4.41E+04	111	0.06%	1.49E+09	114	0.07%	1.39E+01	0.06%
TY-105	2.31E+02	1.05E+09	72	0.48%	2.37E+04	123	0.03%	2.14E+09	103	0.11%	5.00E+01	0.22%
TY-106	2.10E+01	1.45E+08	114	0.07%	2.54E+03	140	0.00%	1.40E+08	139	0.01%	1.13E+01	0.05%
U-101	2.50E+01	6.47E+07	126	0.03%	9.50E+04	90	0.13%	1.77E+09	109	0.09%	8.66E-01	0.00%
U-102	3.29E+02	1.90E+09	47	0.87%	3.72E+05	38	0.53%	1.88E+10	42	0.94%	2.62E+02	1.16%
U-103	3.69E+02	1.83E+09	51	0.84%	2.36E+05	51	0.34%	2.16E+10	35	1.07%	2.04E+02	0.91%
U-104	1.22E+02	4.55E+08	92	0.21%	1.58E+04	128	0.02%	5.47E+09	77	0.27%	3.87E+01	0.17%
U-105	3.31E+02	4.85E+09	9	2.22%	9.78E+05	16	1.39%	2.10E+10	38	1.04%	4.11E+02	1.82%
U-106	2.26E+02	2.97E+09	23	1.36%	1.04E+06	13	1.48%	1.33E+10	54	0.66%	3.41E+02	1.51%
U-107	4.08E+02	5.32E+09	8	2.44%	2.21E+05	53	0.31%	1.66E+10	48	0.82%	1.10E+03	4.89%
U-108	4.68E+02	5.59E+09	5	2.56%	1.36E+05	72	0.19%	4.37E+10	11	2.17%	6.24E+02	2.77%
U-109	4.19E+02	1.90E+09	48	0.87%	6.26E+04	100	0.09%	2.31E+10	29	1.15%	3.17E+02	1.41%
U-110	1.86E+02	1.13E+09	69	0.52%	2.38E+05	49	0.34%	2.46E+09	97	0.12%	1.54E+01	0.07%
U-111	3.29E+02	1.97E+09	44	0.90%	8.38E+04	96	0.12%	2.88E+10	20	1.43%	2.70E+02	1.20%
U-112	4.90E+01	2.27E+08	107	0.10%	2.08E+04	124	0.03%	5.38E+08	129	0.03%	2.18E+00	0.01%
U-201	5.00E+00	2.92E+06	138	0.00%	5.63E+01	147	0.00%	8.06E+07	142	0.00%	3.44E-02	0.00%
U-202	5.00E+00	2.81E+06	139	0.00%	2.08E+01	149	0.00%	8.06E+07	142	0.00%	3.35E-02	0.00%
U-203	3.00E+00	3.07E+06	137	0.00%	3.03E+01	148	0.00%	4.04E+07	145	0.00%	2.15E-01	0.00%
U-204	3.00E+00	1.38E+06	140	0.00%	6.72E+02	145	0.00%	1.39E+07	148	0.00%	1.66E-02	0.00%

C4.0 REFERENCE

DOE/EIS-0189, 1996, *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement*, U.S. Department of Energy, Washington, D.C.

APPENDIX D

ADDITIONAL DOUBLE SHELL TANK SPACE EVALUATION MODELING ASSUMPTIONS

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Table D-1: Software Change Summary Form for Projection Cases 1, 2, and 3.

Case Name/Scenario Identifier	FY 2001 Operational Waste Volume Projection Cases 1, 2, & 3

Objective: Update the OWVP projections and document with the latest inventory and assumptions. Updated assumptions will serve as a basis for the OWVP, SST Retrieval, and TFCO & UP projections.

Scenario Change Summary - This section is focused on changes in key assumptions or key inputs to the model.

1. Incorporate the yearly update of waste generations, salt well liquid pumping volumes, and other assumptions into the OWVP projections. The assumption changes listed in the tables below will be used as the basis for OWVP Case 1, 2, and 3.
   a. Table 1 Assumption Matrix for the 2001 Single-Shell Tank Retrieval Sequence and Double-Shell Tank Space Evaluation.
   b. Table 2 Waste Generation (Kgal/year) Spreadsheet for the 2001 OWVP.
   c. Table 3 Draft Transfer and Evaporator Campaign Schedule through 12/2002.
   d. Table 4 Salt Well Liquid Volumes and Flushes Updated for the 2001 OWVP Projections.
   e. Table 5 Historical transfers from 7/31/2000 through 5/31/2001.
2. Case 1 will incorporate an SST Retrieval Sequence that retrieves high risk tanks early (M-45-00B) and completes SST retrieval by the end of 2018 (M-45-05); an accelerated waste treatment plant schedule; and saves 3 Mgal of space via tank space options.
3. Case 2 will use the same SST retrieval sequence as Case 1 but adjusts the retrieval schedule to fit available DST space; waste treatment is complete by the end of 2028; and saves 0.85 Mgal of space via tank space options.
4. Case 3 will use the same SST retrieval schedule as Case 2 through FY 2006 but will then develop a schedule to retrieve tanks with the smaller remaining volumes first to meet TPA milestones dates for number of tanks started each year while trying to stay within the available DST space for a longer period of time (completes SST retrieval in 2018). Case 3 incorporates the same waste treatment schedule and tank space options as Case 2.
5. W-314 project assumptions:
   a. AW-B pit work will occur from 4/2001 to 10/2001; AW-B assumed to be useable by 12/1/2001.
   b. AW-A pit work will occur from ~6/30/2001 to 6/2002; AW-A assumed to be useable by 10/1/2002.
   c. 244-A by pass will not interfere with the cross-site transfer of waste needed to support salt well liquid pumping and retrieval milestones. Approximate cross-site dates are shown in Table D-3.
   d. Other project assumptions and outage dates are listed in the assumption matrix (Table A-1).
6. The failed SN-247 line will not allow salt well liquid from tanks A-101 and AX-101 to be routed to AN farm. Use of the SN-650 line will re-route these wastes to tank AP-102 through 9/30/2002. After 10/1/2002, these wastes will go to AP-108. Transfers for this option are listed in Table D-3.
7. Tank SY-101 will be transferred to tank AP-102 in approximately 11/2002 to make room for S-112 retrieval.

Software Change Summary - This section is focused on changes in the HTWOS model functionality. Reference the item in the Scenario Change Summary section when an assumption change leads to a model function change.

Requestor Information - For reporting modeling status and resolving issues.

Requestor/Contact:

Reference for Request:

Deliverable(s):

1.

Due Date: (Format the presentation of due dates to correspond with deliverables section.)

1.

Change Approval

Team Lead: J. N. Strode Signed Copy on File	**Manager:** N. Kirch Signed Copy on File
Customer: T. W. Crawford Signed Copy on File	**CACN:**

Table D-2: Waste Generation (Kgal/yr) Spreadsheet

PERCENT FLUSH TO APPLY IS SHOWN AT THE BOTTOM OF THE TABLE.
OWVP01WG.XLS SHEET 1 36984.00
TOT=PUREX+ 222-S+ T PLANT+ TANK FARM+ WESF+ 300+ 400

Fiscal Year	PUREX Baseline Case (Kgal/yr)	222-S Baseline Case (Kgal/yr)	T PLANT Baseline Case (Kgal/yr)	TANK FARM (Kgal/yr)	WESF (Kgal/yr)	300 Baseline Case (Kgal/yr)	400 Baseline Case (Kgal/yr)	TOTAL (Kgal/yr)	
2001	5.00	10.00	19.50	120.00	0.00	0.90	0.00	155.40	
2002	5.00	10.00	19.00	120.00	0.00	1.80	0.00	155.80	
2003	5.00	10.00	16.50	120.00	0.00	1.80	0.00	153.30	
2004	5.00	10.00	13.50	120.00	0.00	19.18	0.00	167.68	
2005	5.00	10.00	10.50	120.00	0.00	17.72	0.00	163.22	
2006	5.00	10.00	7.50	120.00	0.00	28.74	0.00	171.24	*
2007	5.00	10.00	4.70	120.00	0.00	8.19	0.00	147.89	
2008	5.00	10.00	3.00	120.00	0.00	2.70	0.00	140.70	*
2009	5.00	10.00	3.00	120.00	0.00	2.70	0.00	140.70	
2010	5.00	10.00	3.00	120.00	0.00	4.02	0.00	142.02	
2011	5.00	10.00	3.00	120.00	0.00	3.60	0.00	141.60	
2012	5.00	10.00	3.00	120.00	0.00	3.60	0.00	141.60	
2013	5.00	10.00	3.00	120.00	0.00	3.60	0.00	141.60	
2014	5.00	10.00	3.00	120.00	0.00	3.60	0.00	141.60	
2015	5.00	10.00	3.00	120.00	0.00	3.60	0.00	141.60	
2016	5.00	10.00	3.00	120.00	0.00	3.60	0.00	141.60	
2017	5.00	10.00	3.00	120.00	0.00	3.60	0.00	141.60	
2018	5.00	10.00	3.00	120.00	0.00	3.60	0.00	141.60	
2019	5.00	10.00	3.00	120.00	0.00	3.60	0.00	141.60	
2020	5.00	10.00	3.00	120.00	0.00	3.60	0.00	141.60	
2021	5.00	10.00	3.00	120.00	0.00	4.00	0.00	142.00	
2022	5.00	10.00	3.00	120.00	0.00	4.00	0.00	142.00	
2023	5.00	10.00	3.00	120.00	0.00	4.00	0.00	142.00	
2024	5.00	10.00	3.00	120.00	0.00	4.00	0.00	142.00	
2025	5.00	10.00	3.00	120.00	0.00	4.00	0.00	142.00	
2026	5.00	10.00	3.00	120.00	0.00	4.00	0.00	142.00	
2027	5.00	10.00	3.00	120.00	0.00	4.00	0.00	142.00	
2028	5.00	10.00	3.00	120.00	0.00	4.00	0.00	142.00	
TOT(KGA	140.00	280.00	154.20	3360.00	0.00	155.75	0.00		

Total is in kgal summed over all years

RANGE =		11.7	-	14.3	KGAL/MO
RANGE =		140.7	-	171.2	KGAL/YR
% FLUSH	0	22	22	0	0	44	44

Table D-3. Draft Transfer and Evaporator Campaign Schedule through 12/2002. Transfers, cross-sites, and evaporator campaigns needed if Tank AP-102 is used to receive SWL from A-101 and AX-101 in addition to BY farm waste, cross-sites from SY-102, and miscellaneous waste through 9/2002 (SN-650 Alternative). A-101 and AX-101 pumping restart 7/15/2001. Dates will vary depending on wastes receipts.

Transfer or Event	Start Date	Volume (Kgal)	Comment
SY-102 to AP-108	6/15/2001	~ 470	Cross-site to support salt well liquid pumping.
AP-106 to AP-108	6/25/2001	~ 528	Must empty AP-106 to receive AP-102; drawdown limit 94 Kgal
AP-102 to AP-106	6/28/2001	~1040	Empty AP-102 to serve as dilute receiver 6/30/2001 to 9/30/2002.
AP-107 to AW-102	8/6/2001	~ 950	Empties tank AP-107 to receive waste transfer from tank AP-102; stages waste for Evaporator Campaign 02-1 (starts late in 12/2001).
AP-102 to AP-107	8/28/2001	~ 550	Need space in tank AP-102 to make room for a cross-site in September 2001.
SY-102 to AP-102	9/2001	~ 500	Cross-site to support salt well liquid pumping.
AP-102 to AP-107	11/2001	~ 560	Need space in tank AP-102; tops off tank AP-107 for characterization; can't transfer remainder of tank AP-102 to tank AP-108 because AP-108 is still full.
Evaporator Campaign 02-1	late 12/2001		Must evaporate waste in AW-102 to make room for waste transfer in 1/2002. Concentrated waste sent to tank AP-103.
AP-108 to AW-102	1/2002	~1100	Must empty AP-108 so that waste from AP-102 can be transferred to AP-108 in February 2002. Evaporation of waste already in projection.
AP-102 to AP-108	2/2002	~1000	Need space in tank AP-102 to receive cross-site waste.
SY-102 to AP-102	3/2002	~ 500	Cross-site to support salt well liquid pumping.
AW-106 to AP-103	4/2002	TBD	Remove concentrated waste from AW-106 prior to Evaporator Campaign 02-2 (starts 5/2002).
Evaporator Campaign 02-2	5/2002		Concentrated sent to tank AW-103 and AW-104.
AP-107 to AW-102	5/2002-8/2002	~1100	Need space in tank AP-107 for waste transfer in 9/2002.
AP-102 to AP-107	9/2002	~1000	Empties AP-102 to receive SY-101 (10/2002 to 12/2002)
AW-106 to AW-103 and AW-104	8/2002-9/2002	TBD	Remove concentrated waste from AW-106 prior to Evaporator Campaign 03-1 (starts 10/2002).
Evaporator Campaign 03-1	10/2002		Concentrated waste sent to AW-104 and AN-106.
SY-101 to AP-102	11/2002	TBD	Cross-site contents of tank SY-101 to make room for S-112 retrieval waste. Assume the volume of saltcake and heel left in SY-101 will be ~ 303 Kgal.
SY-102 to AP-108	12/2002	TBD	

Table D-4. Saltwell Volumes and Flushes Updated for the 2001 DST Projections

HTWOSF4.XLS 08/24/01. Updated flush factors through 5/31/2001.
SWL UPDATE FORM DAVE VLADIMIROFF ON 8/28/2001; USE FOR 2001 OWVP.

200 EAST AREA

TANK	VOL. (KGAL) FROM REFR 1	% FLUSH	PUMP DUR @100% EFFIC. (DAYS) REFR 1	PUMP EFFIC %	PUMP DUR @ LEFT PUMP EFFIC. (DAYS)	PUMP DUR @ LEFT PUMP EFFIC. (MOS)	START DATE	END DATE	WASTE TYPE	RETRIEVE TO TANK	ORIGIN NAME	MO VOL (KGAL) 9/99	10/99	11/99	12/99	1/00	2/00	3/00
A-101		0.8							DN			0	0	0	0	0	0	0
AX-101		0.8							DN			0	0	0	0	0	0	0
SY-105		0.6							DN			0	0	0	0	0	0	0
SY-106		0.6							DN			0	0	0	0	0	0	0
C-103		0.6							DC			0	0	0	0	0	0	0
106-AP												0	0	0	0	0	0	0
FLUSH												0	0	0	0	0	0	0
106-AP												0	0	0	0	0	0	0
FLUSH												0	0	0	0	0	0	0
101-AN												0	0	0	0	0	0	0
FLUSH												0	0	0	0	0	0	0
TOT W/O FLUSH												0	0	0	0	0	0	0
TOT WITH FLUSH												0	0	0	0	0	0	0

FLUSHES FOR A-101& AX-101 ARE SWAG'S FOR NOW
FLUSHES FOR SY, S, & SX ARE SWAGS FOR NOW

200 WEST AREA

TANK	VOL. (KGAL) FROM REFR 1	% FLUSH	PUMP DUR @100% EFFIC. (DAYS) REFR 1	PUMP EFFIC %	PUMP DUR @ LEFT PUMP EFFIC. (DAYS)	PUMP DUR @ LEFT PUMP EFFIC. (MOS)	START DATE	END DATE	WASTE TYPE	RETRIEVE TO TANK	ORIGIN NAME	MO VOL (KGAL) 9/99	10/99	11/99	12/99	1/00	2/00	3/00
S-101		0.40							DN			0	0	0	0	0	0	0
S-102		2.21							DN			3	3	3	3	3	3	3
S-103		0.73							DN			3	3	3	3	0	0	0
S-106		0.31							DN			12	13	12	13	1	0	0
S-107		0.40							DN			0	0	0	0	0	0	0
S-109		0.40							DN			0	0	0	0	0	0	0
S-111		0.40							DN			0	0	0	0	0	0	0
S-112		0.40							DN			0	0	0	0	0	0	0
SX-101		1.32							DN			0	0	0	0	0	0	0
SX-102		0.40							DN			0	0	0	0	0	0	0
SX-103		1.06							DN			0	0	0	0	0	0	0
SX-104		0.40							DN			0	0	0	0	0	0	0
SX-105		1.43							DN			0	0	0	0	0	0	0
SX-106		0.96							DN			10	10	10	7	0	0	0
T-104		0.28							DN			0	0	0	0	0	0	0
T-110		0.28							DN			0	0	0	0	0	0	0
U-102		2.75							DC			0	0	0	0	3	7	7
U-103		1.54							DC			2	13	13	13	13	13	13
U-105		1.22							DC			0	0	0	0	13	12	13
U-106		1.65							DC&TRU			0	0	0	0	0	0	0
U-107		0.40							DN			0	0	0	0	0	0	0
U-108		0.40							DN			0	0	0	0	0	0	0
U-109		1.98							DC			0	0	0	0	0	0	0
U-111		0.40							DN			0	0	0	0	0	0	0
DN-SWL												29	30	29	26	4	3	3
FLUSH												23	24	23	20	6	7	7
DC-SWL												2	13	13	21	29	31	40
FLUSH												3	21	20	30	43	53	69
TOT W/O FLUSH												31	43	42	46	33	34	43
TOT WITH FLUSH												56	88	84	98	84	94	120
												31						
GRAND TOTAL W/O FLUSH												31	43	42	46	33	34	43
GRAND TOTAL WITH FLUSH												56	88	85	98	84	94	120
												9/99	10/99	11/99	12/99	1/00	2/00	3/00

Table D-4. Saltwell Volumes and Flushes Updated for the 2001 DST Projections

4/00	5/00	6/00	7/00	8/00	9/00	10/00	11/00	12/00	1/01	2/01	3/01	4/01	5/01	6/01	7/01	8/01	9/01	10/01
0	3	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	84
0	0	0	1	8	0	0	0	0	0	0	0	10	3	0	0	0	0	54
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	16	13	11
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	16	13	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	31	26	23
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	19	16	14
0	3	4	4	11	0	0	0	0	0	0	0	10	3	0	0	0	0	0	167
0	3	3	4	8	0	0	0	0	0	0	0	8	3	0	0	0	0	0	134
0	3	4	4	11	0	0	0	0	0	0	0	10	3	0	0	23	31	26	190
0	6	7	8	21	0	0	0	0	0	0	0	17	6	0	0	37	50	42	338
					23													93	
					41													152	

4/00	5/00	6/00	7/00	8/00	9/00	10/00	11/00	12/00	1/01	2/01	3/01	4/01	5/01	6/01	7/01	8/01	9/01	10/01
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	5	17	11	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	19	0	0	0	0	0	0	0	0	0	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
0	0	0	0	0	0	1	18	18	14	11	11	9	8	29	3	3	2	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	40	13	12	11	9	8	7	6	5	5	38	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	7	7	7	7	4	4	4	4	3	3	3	2	2	0	3	2	2	2
13	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	13	12	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	13	17	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	22	18
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	21
9	10	9	10	8	5	5	4	4	2	0	0	0	0	1	4	4	3	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0
3	3	3	3	43	19	31	40	44	22	18	17	14	13	65	3	17	37	87
7	7	7	7	64	21	28	40	55	27	21	20	17	15	82	3	9	16	47
42	34	29	22	28	26	18	8	8	5	3	3	2	2	0	7	6	5	5
73	62	53	45	59	49	36	19	18	13	7	6	7	6	0	15	13	12	11
45	38	32	26	72	45	49	49	52	28	20	20	17	15	65	10	23	42	82
125	107	92	78	194	115	110	107	125	68	49	48	40	37	148	28	45	70	150

Table D-4. Saltwell Volumes and Flushes Updated for the 2001 DST Projections

11/01	12/01	1/02	2/02	3/02	4/02	5/02	6/02	7/02	8/02	9/02	10/02	11/02	12/02	1/03	2/03	3/03	4/03	5/03
86	86	86	81	80	12	11	9	8	7	5	5	4	3	3	2	2	2	1
86	86	86	24	11	8	7	5	3	4	3	2	2	2	1	0	0	0	0
9	8	7	6	5	4	4	3	3	2	2	2	1	1	1	0	0	0	0
10	9	8	6	6	5	4	4	3	3	2	2	2	2	1	1	0	0	0
0	0	0	0	0	0	0	0	0	7	55	16	4	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	7	55	16	4	1	0	0	0	0	0
0	0	0	0	0	0	0	0	0	4	33	10	3	0	0	0	0	0	0
19	17	15	11	11	9	8	7	6	5	4	4	3	3	2	1	0	0	0
12	10	9	7	7	5	5	4	4	3	3	2	2	2	1	1	0	0	0
173	179	179	105	80	21	18	14	12	10	8	7	6	5	4	2	2	2	1
138	143	143	84	64	17	14	11	10	8	7	6	5	4	3	2	2	1	1
192	198	193	118	90	30	26	21	18	22	88	27	13	9	6	3	2	2	1
342	349	345	207	161	52	45	38	32	37	110	44	22	16	11	6	4	3	3
										1162								
										2053								

11/01	12/01	1/02	2/02	3/02	4/02	5/02	6/02	7/02	8/02	9/02	10/02	11/02	12/02	1/03	2/03	3/03	4/03	5/03
0	0	0	0	0	0	0	14	14	11	9	7	6	5	4	3	3	2	2
9	8	7	5	5	4	4	3	3	2	2	2	1	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	12	9	6	6	5	4	3	3	2	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	21	16	12	10	7	6	4	4	3	2	2	1	0	0	0	0	0	0
0	0	0	0	0	8	17	12	10	7	5	4	3	2	2	1	0	0	0
10	9	8	6	6	5	4	4	3	3	2	2	2	2	1	1	0	0	0
27	21	16	12	10	7	6	4	4	3	2	2	1	0	0	0	0	0	0
2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	11	9	8	5	4	3	3	2	2	1	0	0	0	0	0	0	0	0
17	14	12	9	8	6	5	4	4	3	2	2	2	1	0	0	0	0	0
3	3	3	2	2	2	2	2	2	2	1	1	1	1	1	0	0	0	0
0	0	4	16	13	10	8	6	6	3	3	2	1	1	0	0	0	0	0
105	87	73	66	56	51	53	54	52	48	37	30	23	16	12	8	6	4	3
60	50	50	42	36	32	32	30	29	28	20	17	13	9	6	4	2	2	1
4	4	3	2	2	2	2	2	2	2	1	1	1	1	1	0	0	0	0
10	9	6	4	5	4	4	4	3	3	3	3	3	2	2	0	0	0	0
109	91	76	68	60	53	55	56	54	50	38	31	25	17	13	8	6	4	3
188	159	132	115	102	89	91	90	86	79	61	51	40	29	21	12	8	6	5
										804								
302	267	259	185	151	83	81	77	72	72	107	58	38	26	18	11	8	6	5
530	506	477	322	263	141	136	126	117	116	172	96	62	43	32	18	12	10	7
11/01	12/01	1/02	2/02	3/02	4/02	5/02	6/02	7/02	8/02	9/02	10/02	11/02	12/02	1/03	2/03	3/03	4/03	5/03

Table D-4. Saltwell Volumes and Flushes Updated for the 2001 DST Projections

6/03	7/03	8/03	9/03	10/03	11/03	12/03	1/04	2/04		CROSS CHECK TOTAL (KGAL)	TANK
	1	0	0	0	0	0	0	0	0	587	A-101
	0	0	0	0	0	0	0	0	0	444	AX-101
	0	0	0	0	0	0	0	0	0	111	BY-105
	0	0	0	0	0	0	0	0	0	119	BY-106
	0	0	0	0	0	0	0	0	0	83	C-103
	0	0	0	0	0	0	0	0	0		106-AP
	0	0	0	0	0	0	0	0	0		FLUSH
	0	0	0	0	0	0	0	0	0		106-AP
	0	0	0	0	0	0	0	0	0		FLUSH
	1	0	0	0	0	0	0	0	0		101-AN
	1	0	0	0	0	0	0	0	0		FLUSH
	1	0	0	0	0	0	0	0	0		TOT W/O FLUSH
	2	0	0	0	0	0	0	0	0		TOT WITH FLUSH
				65						0	
				111							

6/03	7/03	8/03	9/03	10/03	11/03	12/03	1/04	2/04		CROSS CHECK TOTAL (KGAL)	TANK
	1	0	0	0	0	0	0	0	0	80	S-101
	0	0	0	0	0	0	0	0	0	94.057	S-102
	0	0	0	0	0	0	0	0	0	13.858	S-103
	0	0	0	0	0	0	0	0	0	50.219	S-106
	1	1	0	0	0	0	0	0	0	60.987	S-107
	0	0	0	0	0	0	0	0	0	34.146	S-109
	0	0	0	0	0	0	0	0	0	132	S-111
	0	0	0	0	0	0	0	0	0	70	S-112
	0	0	0	0	0	0	0	0	0	99	SX-101
	0	0	0	0	0	0	0	0	0	132	SX-102
	0	0	0	0	0	0	0	0	0	132	SX-103
	0	0	0	0	0	0	0	0	0	0	SX-104
	0	0	0	0	0	0	0	0	0	152.938	SX-105
	0	0	0	0	0	0	0	0	0	37.511	SX-106
	0	0	0	0	0	0	0	0	0	0	T-104
	0	0	0	0	0	0	0	0	0	0	T-110
	0	0	0	0	0	0	0	0	0	93	U-102
	0	0	0	0	0	0	0	0	0	98.858	U-103
	0	0	0	0	0	0	0	0	0	67.539	U-105
	0	0	0	0	0	0	0	0	0	38.911	U-106
	0	0	0	0	0	0	0	0	0	115	U-107
	0	0	0	0	0	0	0	0	0	124	U-108
	0	0	0	0	0	0	0	0	0	116.031	U-109
	0	0	0	0	0	0	0	0	0	71	U-111
	3	1	0	0	0	0	0	0	0		DI-SWL
	1	0	0	0	0	0	0	0	0		FLUSH
	0	0	0	0	0	0	0	0	0		DC-SWL
	0	0	0	0	0	0	0	0	0		FLUSH
	3	1	0	0	0	0	0	0	0		TOT W/O FLUSH
	4	2	0	0	0	0	0	0	0		TOT WITH FLUSH
				111						0	
	4	1	0	0	0	0	0	0	0		GRAND TOTAL W/O FLUSH
	6	2	0	0	0	0	0	0	0		GRAND TOTAL WITH FLUSH
6/03	7/03	8/03	9/03	10/03	11/03	12/03	1/04	2/04			

Table D-4. Saltwell Volumes and Flushes Updated for the 2001 DST Projections

VOLUME IN KILOGALLONS

SWL VOLUMES W/O FLUSH
200 EAST AREA

FY	DN	DC	TOT
1996	22	0	22
1997	23	0	23
1998	0	0	0
1999	1	0	1
2000	82	0	82
2001	93	0	93
2002	1100	62	1162
2003	44	21	65
2004	0	0	0
TOT 01-04	1238	83	1321

SWL VOLUMES WITH FLUSH
200 EAST AREA

FY	DN	DC	TOT	
1996	22	0	22	actuals with flush
1997	23	0	23	actuals with flush
1998	0	0	0	actuals with flush
1999	1	0	1	actuals with flush
2000	82	0	82	actuals with flush
2001	152	0	152	
2002	1954	99	2053	
2003	77	34	111	
2004	0	0	0	
TOT 01-04	2183	133	2315	

GRAND TOTAL SWL VOLUMES W/O FLUSH

	**** 200 EAST ****		**** 200 WEST ****			
FY	DN	DC	DN	DC	TOT	
TOT 89-95	830	105	87	17	1039	
1996	22	0	218	0	240	actuals with flush
1997	23	0	140	0	163	actuals with flush
1998	0	0	98	0	98	actuals with flush
1999	1	0	872	22	895	actuals with flush
2000	82	0	327	800	1209	actuals with flush
2001	93	0	321	68	482	
2002	1100	62	772	32	1966	
2003	44	21	108	5	177	
2004	0	0	0	0	0	
TOT 96-04	1366	83	2654	927	5230	includes flushes for 1998-2000
TOT 98-04	1321	83	2496	927	4827	includes flushes for 1998-2000
TOT 01-04	1238	83	1199	105	2625	<--OK (3.6 MGAL-1.0 MGAL=2
TOT 89-04	2198	188	2941	944	6268	<--DOCUMENT
TOTAL CALC FROM SHEET 1— 10/1/98 TO END->					3147	ok

SWL VOLUMES W/O FLUSH
200 WEST AREA

FY	DN	DC	TOT
1996	218	0	218
1997	140	0	140
1998	98	0	98
1999	872	22	894
2000	327	800	1127
2001	321	68	389
2002	772	32	804
2003	106	5	111
2004	0	0	0
TOT 01-04	1199	105	1304

SWL VOLUMES WITH FLUSH
200 WEST AREA

FY	DN	DC	TOT	
1996	218	0	218	actuals with flush
1997	140	0	140	actuals with flush
1998	98	0	98	actuals with flush
1999	872	22	894	actuals with flush
2000	327	800	1127	actuals with flush
2001	652	222	875	
2002	1246	98	1344	
2003	161	16	177	
2004	0	0	0	
TOT 01-04	2060	336	2395	

GRAND TOTAL SWL VOLUMES WITH FLUSH

	**** 200 EAST ****		**** 200 WEST ****			
FY	DN	DC	DN	DC	TOT	
TOT 89-95	830	105	87	17	1039	
1996	22	0	218	0	240	actuals with flush
1997	23	0	140	0	163	actuals with flush
1998	0	0	98	0	98	actuals with flush
1999	1	0	872	22	895	actuals with flush
2000	82	0	327	800	1209	actuals with flush
2001	152	0	652	222	1027	
2002	1954	99	1246	98	3397	
2003	77	34	161	16	287	
2004	0	0	0	0	0	
TOT 96-04	2311	133	3715	1158	7318	includes flushes for 1998-2000
TOT 98-04	2289	133	3357	1158	6913	includes flushes for 1998-2000
TOT 01-04	2183	133	2060	336	4711	
TOT 89-04	3141	238	3802	1175	8355	
TOTAL CALC FROM SHEET 1 10/1/98 TO END-> WITH FLUSH						
			average flush for 2001-2004 =		79.4 percent	

Table D-5. Historical Transfers from 07/30/2000 through 05/31/2001
Transactions have been summarized to reduce the number of records and still explain net inventory changes.

Tank Involved	Gain, Loss, Transfer, or Evaporations	From or Source Tank	To or Receipt Tank	Start Date	End Date	Transaction Volume (Kgal)	Tank Volume (Kgal)
AY-101							142
	Loss	AY-101	Unknown	8/01/2000	5/31/2001	-19	123
	Gain	Caustic	AY-101	12/19/2000	1/13/2001	45	168
	Gain	Water	AY-101	1/4/2001	1/13/2001	15	183
AY-102							598
	Loss	AY-102	Unknown	8/1/2000	5/31/2001	-36	562
	Gain	Caustic	AY-102	2/7/2001	2/14/2001	72	634
	Gain	Water	AY-102	2/7/2001	3/1/2001	2	636
AZ-101							910
	Loss	AZ-101	Unknown	8/1/2000	8/31/2000	-1	909
	Gain	Water	AZ-101	12/1/2000	4/24/2001	27	936
	Gain	Water	AZ-101	5/30/2001	5/31/2001	8	944
AZ-102							973
	Gain	Water	AZ-102	8/1/2000	9/30/2000	17	990
	Gain	Water	AZ-102	10/26/2000	5/31/2001	6	996
SY-101							972
	Loss	SY-101	Unknown	8/1/2000	5/31/2001	-2	970
SY-102							847
	Gain	U-102	SY-102	8/1/2000	8/31/2000	7	854
	Gain	U-106	SY-102	8/1/2000	8/31/2000	25	879
	Gain	U-109	SY-102	8/1/2000	8/31/2000	7	886
	Gain	SX-105	SY-102	8/1/2000	8/31/2000	44	930
	Gain	Water	SY-102	8/1/2000	8/31/2000	109	1039
	Transfer	SY-102	AP-107	9/12/2000	9/22/2000	-381	658
	Gain	U-102	SY-102	9/23/2000	9/30/2000	3	661
	Gain	U-106	SY-102	9/23/2000	9/30/2000	8	669
	Gain	U-109	SY-102	9/23/2000	9/30/2000	5	674
	Gain	S-109	SY-102	9/23/2000	9/30/2000	3	677
	Gain	SX-105	SY-102	9/23/2000	9/30/2000	35	712
	Gain	Water	SY-102	9/23/2000	9/30/2000	72	784
	Gain	U-102	SY-102	10/1/2000	10/31/2000	5	789
	Gain	U-106	SY-102	10/1/2000	10/31/2000	4	793
	Gain	U-109	SY-102	10/1/2000	10/31/2000	4	797
	Gain	S-109	SY-102	10/1/2000	10/31/2000	18	815
	Gain	SX-103	SY-102	10/1/2000	10/31/2000	12	827
	Gain	SX-105	SY-102	10/1/2000	10/31/2000	45	872
	Gain	Water	SY-102	10/1/2000	10/31/2000	125	997
	Transfer	SY-102	AP-107	11/10/2000	11/18/2000	-516	481
	Gain	U-102	SY-102	11/11/2000	11/30/2000	5	486
	Gain	U-106	SY-102	11/11/2000	11/30/2000	2	488
	Gain	U-109	SY-102	11/11/2000	11/30/2000	3	491
	Gain	S-109	SY-102	11/11/2000	11/30/2000	10	501
	Gain	SX-101	SY-102	11/11/2000	11/30/2000	12	513
	Gain	SX-103	SY-102	11/11/2000	11/30/2000	53	566
	Gain	SX-105	SY-102	11/11/2000	11/30/2000	13	579
	Gain	Water	SY-102	11/11/2000	11/30/2000	131	710

Table D-5. Historical Transfers from 07/30/2000 through 05/31/2001
Transactions have been summarized to reduce the number of records and still explain net inventory changes.

Tank Involved	Gain, Loss, Transfer, or Evaporations	From or Source Tank	To or Receipt Tank	Start Date	End Date	Transaction Volume (Kgal)	Tank Volume (Kgal)
	Gain	U-102	SY-102	12/1/2000	12/1/2000	5	715
	Gain	U-106	SY-102	12/1/2000	12/1/2000	1	716
	Gain	U-109	SY-102	12/1/2000	12/1/2000	1	717
	Gain	S-109	SY-102	12/1/2000	12/1/2000	3	720
	Gain	SX-101	SY-102	12/1/2000	12/1/2000	7	727
	Gain	SX-103	SY-102	12/1/2000	12/1/2000	29	756
	Gain	SX-105	SY-102	12/1/2000	12/1/2000	6	762
	Gain	Water	SY-102	12/1/2000	12/1/2000	68	830
	Gain	U-102	SY-102	1/1/2001	1/31/2001	3	833
	Gain	S-109	SY-102	1/1/2001	1/31/2001	1	834
	Gain	SX-103	SY-102	1/1/2001	1/31/2001	10	844
	Gain	SX-105	SY-102	1/1/2001	1/31/2001	7	851
	Gain	Water	SY-102	1/1/2001	1/31/2001	31	882
	Gain	SX-103	SY-102	2/1/2001	2/28/2001	6	888
	Gain	SX-105	SY-102	2/1/2001	2/28/2001	2	890
	Gain	Water	SY-102	2/1/2001	2/28/2001	12	902
	Gain	U-102	SY-102	3/1/2001	3/31/2001	2	904
	Gain	SX-103	SY-102	3/1/2001	3/31/2001	3	907
	Gain	Water	SY-102	3/1/2001	3/31/2001	14	921
	Gain	U-102	SY-102	4/1/2001	4/30/2001	4	925
	Gain	U-109	SY-102	4/1/2001	4/30/2001	2	927
	Gain	SX-103	SY-102	4/1/2001	4/30/2001	3	930
	Gain	SX-105	SY-102	4/1/2001	4/30/2001	2	932
	Gain	Water	SY-102	4/1/2001	4/30/2001	52	984
	Gain	U-102	SY-102	5/1/2001	5/31/2001	1	985
	Gain	U-109	SY-102	5/1/2001	5/31/2001	1	986
	Gain	Water	SY-102	5/1/2001	5/31/2001	18	1004
SY-103							745
	Loss	SY-103	Unknown	9/1/2000	9/30/2000	-1	744
AW-101							1126
	Gain	Unknown	AW-101	9/1/2000	9/30/2000	1	1127
AW-102							63
	Gain	Water	AW-102	8/1/2000	9/30/2000	2	65
	Transfer	AW-104	AW-102	1/18/2001	1/25/2001	801	866
	Gain	Water	AW-102	2/15/2001	3/12/2001	21	887
	Evaporate	AW-102	AW-102	3/13/2001	3/27/2001	-682	205
	Transfer	AW-102	AW-106	3/27/2001	3/28/2001	-156	49
	Gain	Water	AW-102	3/29/2001	3/30/2001	36	85
	Gain	Water	AW-102	4/3/2001	4/30/2001	1	86
	Gain	Water	AW-102	5/6/2001	5/12/2001	2	88
AW-103							510
	Loss	AW-103	Unknown	10/1/2000	3/31/2001	-2	508
	Transfer	AW-106	AW-103	3/31/2001	4/3/2001	597	1105
	Loss	AW-103	Unknown	4/1/2001	5/31/2001	-3	1102
AW-104							1118
	Loss	AW-104	Unknown	10/1/2000	1/31/2001	-1	1117
	Transfer	AW-104	AW-102	1/18/2001	1/25/2001	-801	316

Table D-5. Historical Transfers from 07/30/2000 through 05/31/2001
Transactions have been summarized to reduce the number of records and still explain net inventory changes.

Tank Involved	Gain, Loss, Transfer, or Evaporations	From or Source Tank	To or Receipt Tank	Start Date	End Date	Transaction Volume (Kgal)	Tank Volume (Kgal)
AW-105							427
	Loss	AW-105	Unknown	2/1/2001	2/28/2001	-1	426
AW-106							742
	Loss	AW-106	Unknown	10/1/2000	3/31/2001	-2	740
	Transfer	AW-102	AW-106	3/27/2001	3/28/2001	156	896
	Transfer	AW-106	AW-103	3/31/2001	4/3/2001	-597	299
	Loss	AW-106	Unknown	4/1/2001	5/31/2001	-1	298
AN-101							201
	Gain	AX-101	AN-101	8/29/2000	8/31/2000	7	208
	Gain	Water	AN-101	8/29/2000	8/31/2000	17	225
	Gain	AX-101	AN-101	3/23/2001	3/31/2001	10	235
	Gain	Water	AN-101	3/24/2001	3/31/2001	12	247
	Gain	AX-101	AN-101	4/1/2001	4/3/2001	4	251
	Gain	Water	AN-101	4/2/2001	4/3/2001	2	253
AN-102							1055
	Loss	AN-102	Unknown	11/1/2000	5/31/2001	-1	1054
AN-103							958
	Loss	AN-103	Unknown	9/1/2000	5/31/2001	-1	957
AN-104							1052
AN-105							1127
	Gain	Unknown	AN-105	8/1/2000	8/31/2000	1	1128
AN-106							39
	Loss	AN-106	Unknown	10/1/2000	5/31/2001	-1	38
AN-107							1042
	Loss	AN-107	Unknown	11/1/2000	5/31/2001	-3	1039
AP-101							1114
	Loss	AP-101	Unknown	10/1/2000	5/31/2001	-1	1113
AP-102							1089
	Loss	AP-102	Unknown	10/1/2000	5/31/2001	-1	1088
AP-103							283
	Loss	AP-103	Unknown	10/1/2000	5/31/2001	-1	282
AP-104							1110
	Loss	AP-104	Unknown	10/1/2000	5/31/2001	-2	1108
AP-105							1136
	Loss	AP-105	Unknown	10/1/2000	5/31/2001	-3	1133
AP-106							624
	Loss	AP-106	Unknown	10/1/2000	5/31/2001	-3	621
AP-107							38
	Transfer	SY-102	AP-107	9/12/2000	9/22/2000	381	419
	Gain	Water	AP-107			26	445
	Transfer	SY-102	AP-107	11/10/2000	11/18/2000	516	961
	Gain	Water	AP-107	11/10/2000	11/18/2000	27	988
	Loss	AP-107	Unknown	12/1/2000	5/31/2001	-8	980
AP-108							34
	Loss	AP-108	Unknown	10/1/2000	5/31/2001	-2	32
	Gain	WESF	AP-108	1/4/2001	1/4/2001	3	35
	Gain	Water	AP-108	1/5/2001	1/5/2001	2	37

APPENDIX E

GENERAL FACILITY DESCRIPTIONS

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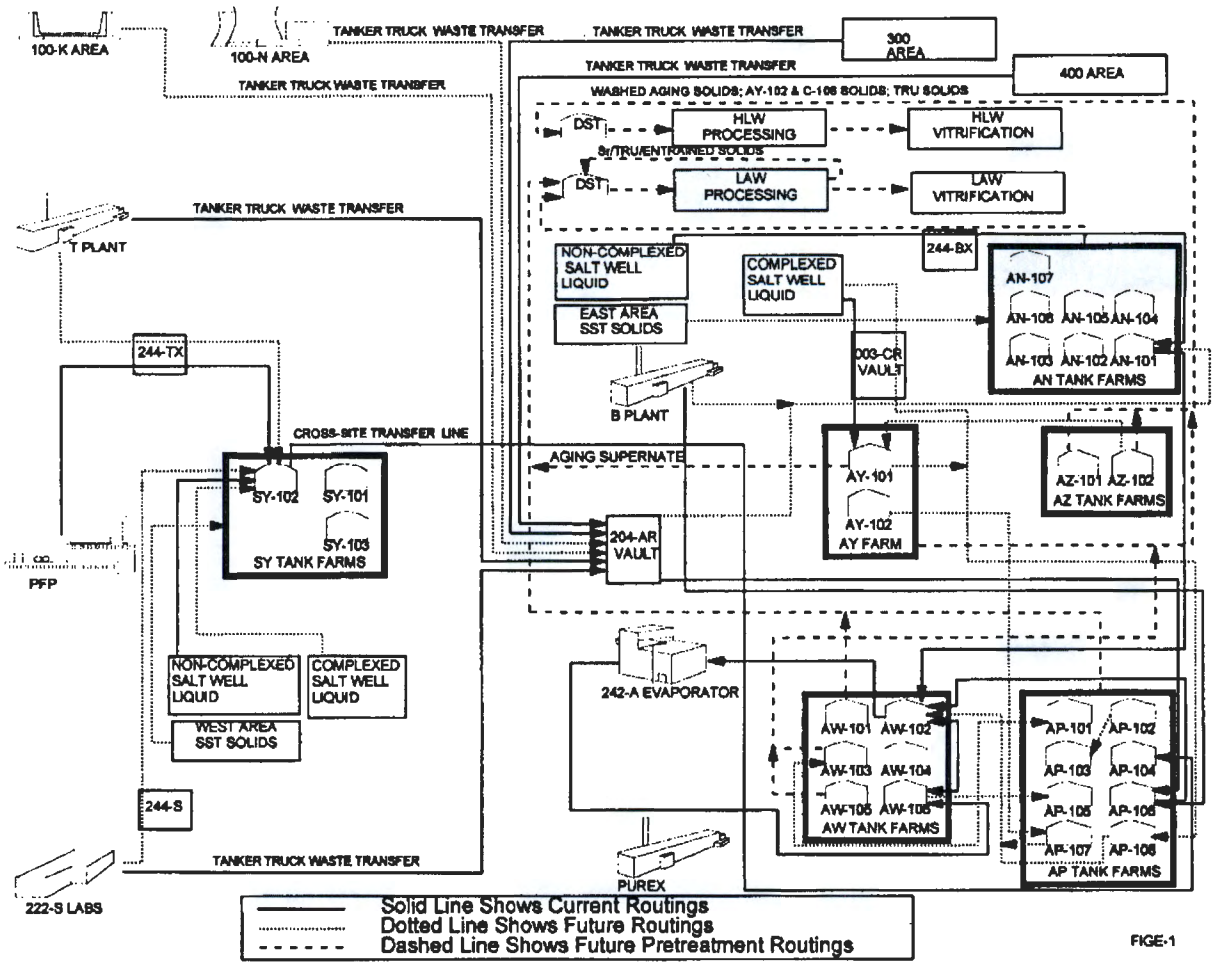
E1.0 SINGLE-SHELL TANKS

Figure E-1. Simplified Schematic of Current and Planned Routings.



E2.0 DOUBLE-SHELL TANKS

Information in this appendix briefly describes the facilities and projects pertinent to the Case 2 projection and includes facility operating dates, waste generation volumes, waste volume reduction factors, flushes, and other pertinent assumptions. Assumptions unique to the Case 1 and Case 3 projections are described in Section 5.1. This information has been summarized for each of the three cases in the Assumptions Matrix which is in Table A-1. The spreadsheet for the Case 2 projection (Table 5-7) lists the waste generations for each year for facilities that presented a range of waste generation rates (e.g., T-Plant varied from 4 to 19 Kgal/year during the period from fiscal year 2001 through 2018). Some waste additions to double-shell tanks (DST) require a flush after the transfer has been completed. If a flush is required, it is reported in the following sections and in Table A-1.

This year the Operational Waste Volume Projection (OWVP) and Single-Shell Tank (SST) Retrieval assumptions have been integrated into a single document. In the 2000 version of HNF-SD-WM-ER-029 (Revision 26A) of the OWVP document, 1.14 million gallons of space have been designated as emergency space. However, the tank farm contractor also has been requested to provide the capability to receive up to one tank of waste returns (either low-activity waste [LAW] or high-level waste [HLW]) from the waste treatment plant on an emergency basis (Taylor 1999). Accordingly, 1.14 million gallons of space has been reserved for the possibility of a LAW or HLW return (this space is labeled as "LAW/HLW Return" in Section 3.20).

E2.1 B PLANT/WASTE ENCAPSULATION AND STORAGE FACILITY

B Plant was constructed in 1945 to recover plutonium by the bismuth phosphate process. B Plant deactivation was completed in fiscal year (FY) 1998 and B Plant will not be sending any future waste to tank farms (McGuire 2000).

The Waste Encapsulation and Storage Facility's current mission is to receive and store the cesium and strontium capsules manufactured at the Waste Encapsulation and Storage Facility safely and in compliance with all applicable rules and regulations (Brist 2001). Waste projection estimates for the Waste Encapsulation and Storage Facility varied from 0 to 20 Kgal/year. If the integrity of a capsule is lost, up to 90 Kgal of waste could be transferred to the tank farms. For all three projection cases the Waste Encapsulation and Storage Facility is not expected to be sending any waste to the tank farms.

E2.2. 242-A EVAPORATOR AND LIQUID EFFLUENT RETENTION FACILITY

The 242-A Evaporator was restarted on April 15, 1994. The 242-A Evaporator's mission is to concentrate dilute tank farm waste. To understand the projection model for the 242-A Evaporator, understanding the waste flow during evaporator operation and the simulation model is necessary. During operation, waste from the dilute holding tanks is transferred into the evaporator feed tank (tank AW-102). Waste in the feed tank then is transferred to the 242-A Evaporator for boil-down. Major assumptions for the evaporator operation are listed as follows:

- This projection model assumed that the 242-A Evaporator would operate in a "linked run" process mode (Guthrie 1993). A "linked run" is continuous operation of the 242-A Evaporator, made possible by simultaneously transferring waste from the DSTs to the Evaporator feed tank (tank AW-102).

- Four months is required from the time a holding tank is filled with dilute waste before the waste can be evaporated (Von Bargen 1995). This period allows time for sampling and analysis in accordance with the Evaporator data quality objective (DQO), documentation, and facility preparation. All projections assumed that evaporator campaigns could be no less than 4 months apart. Some of the projected evaporator campaigns included two tanks of dilute waste for evaporation in a single campaign. Campaign scheduling should be limited to two campaigns per year with a maximum of two tanks per campaign.

- Previous projections assumed that the 242-A Evaporator would require a 1-year outage for maintenance and or upgrades every 10 years based on a 10-year design life of the 242-A Evaporator (Miskho 1990). For the 2001 projection cases, a 1-year outage in FY 2004 will not be required. Completion of the facility life extension upgrades can be accomplished with approximately 6 months of outage time each year during FYs 2002, 2003, and 2004 (Smith 2001). These outages generally will not require that the evaporator campaigns be constrained to 6 months apart. At the request of the Liquid Waste Processing Facilities, this document will supply projected annual campaign schedules to assist in the scheduling of upgrade activities.

- The desired waste volume reduction for each 242-A Evaporator campaign is determined by boil-down studies, computer simulation, and/or process control sampling. The concentration of waste increases after each pass through the Evaporator until it reaches a concentration level consistent with engineering studies. The waste volume projection model of the 242-A Evaporator operation used in these projections cases produced double-shell slurry feed with a specific gravity of 1.41 (concentrated waste with a specific gravity of 1.36 to 1.4 have been produced). After about 50 percent of the volume evaporates, the concentrated waste is transferred to the evaporator receiver tank (Tank AW-106). If additional evaporation is required, the waste in tank AW-106 is transferred back to the evaporator feed tank (tank AW-102). At the end of a campaign, the waste is in Tank AW-106. At a later date the concentrated waste is transferred from tank AW-106 to another DST holding tank.

- The Liquid Effluent Retention Facility Basin 42 has a 7.8-million-gal storage capacity (Basin 42) for evaporator process condensate (Smith 2001).

- The ratios of process condensate sent to the Liquid Effluent Retention Facility for every gallon of waste volume reduction for Evaporator Campaigns 99-1 and 00-1, was 1.15 and 1.14, respectively. This projection used a value of 1.15 gal of condensate per gallon of waste volume reduction (Smith 2001). Because the Effluent Treatment Facility has a capacity of approximately 5 Mgal/year for condensate (Bowman 2000), the Effluent Treatment Facility capacity was assumed to not limit future evaporator operations.

- The maximum monthly waste volume reduction during Evaporator operation should be approximately 1,400 Kgal/month based on the new steam boiler capacity (Smith 2001).

- An average evaporation rate of 330 Kgal/month was used in this simulation, taking into consideration the following:

  - The 242-A Evaporator historical processing rates
  - Down time between campaigns
  - Waste characterization
  - Staging and tank transfers.

- The simulation used in this projection evaporates all dilute waste to a concentrated interim storage form in the same year that a tank has been filled. This assumption is valid if the evaporator is operating and the yearly waste generation rate has not exceeded the annual waste volume reduction limit of the evaporator. Historically, dilute waste was concentrated to near the aluminate boundary, which would produce concentrated waste with a specific gravity ranging from 1.3 to 1.67. However, it has been noted that all the DSTs currently on the Flammable Gas Watch List (i.e., tanks with safety concerns related to hydrogen build up) have specific gravities greater than 1.4 (Reynolds 1994). To avoid creating conditions that will put other tanks on the Flammable Gas Watch List, all future waste concentrations will be limited to a specific gravity of 1.41 unless additional technical evaluation shows flammable gas will not build up (Fowler 1999 and Mulkey 1997).

- The waste volume projection model of the 242-A Evaporator operation used in OWVP reports through 1994 typically produced double-shell slurry feed with a specific gravity of 1.50 to 1.55. Reducing this waste to a specific gravity of 1.41 increases waste storage volumes by approximately 22 to 35 percent, depending on the chemical composition of the waste. Although the evaporation limit for concentrated waste is a specific gravity of 1.41, the first five evaporator campaigns in shown in Table E-1 (94-1 through 97-1) produced concentrated waste with a specific gravity close to 1.3 (Guthrie 1997a). Evaporator campaign 97-2 did evaporate waste to a specific gravity of approximately 1.4. This document projects DST needs based on the evaporation of waste to a specific gravity limit of 1.41.

- The waste volume reductions achieved by the 242-A Evaporator since its restart in 1994 are summarized in Table E-1.

- The life of the 242-A Evaporator will be extended through the end of 2018 (Schaus 2001). The evaporator condenser replacement will be completed in 2004 and all evaporator upgrades will be completed by 2006.

- Evaporator certification training runs before evaporator operation will add approximately 50 Kgal to tank farms and 50 Kgal to the Liquid Effluent Retention Facility and will occur biyearly (Guthrie 1997b). The training run in April 1995 added 57 Kgal to DSTs.

Table E-1. Historical Evaporator Campaigns Since the 1994 Restart.[1]

Campaign	Start Date	Waste Source	Waste Feed Type	Approximate Waste Volume Processed (Mgal)
94-1	4/94	AW-102, AW-106, and AP-103	dilute non-complexed	2.42
94-2	9/94	AW-102, AW-106, AP-101, AP-107, and AP-108	dilute non-complexed	2.79
95-1	6/95	AW-102, AW-106, AP-107, and AP-108	dilute non-complexed	2.16
96-1	5/96	SY-102, AW-105, & AY-102	dilute non-complexed	1.12
97-1	3/97	AN-101	dilute non-complexed	0.4
97-2	9/97	AY-101 and AN-106	dilute complexed	0.7
99-1	7/99	AY-102 and AP-108	dilute non-complexed	0.82
00-1	4/00	AP-107 and AP-108	dilute non-complexed	0.68
01-1	3/01	AW-104	dilute non-complexed	0.68

[1] No evaporator campaign in FY 1998 (cold run completed)

- Evaporator flushing after each campaign is projected to add 35 Kgal/campaign (Haigh 1992). Actual flushes for Campaigns 97-1, 99-1, and 00-1 were 30, 31, and 33 Kgal/campaign, respectively.

- For the years 2001 through 2003, 1 to 2 campaigns were estimated to be required each year, based on waste generations, segregation requirements, and tank space availability. The additional yearly campaigns would be needed to evaporate the anticipated increased saltwell liquid (complexed and non-complexed) and terminal clean-out waste. The waste volume reduction for evaporation of these flushes to double-shell slurry feed was 99 percent (Sederburg 1995).

E2.3 GROUT

No additional grout vaults are scheduled to be poured at the Hanford Site. River Protection Project (RPP) planning requires that all tank waste be separated into low-activity and high-activity fractions and each fraction be immobilized into waste forms suitable for ultimate disposal. Tanks originally designated and set aside as grout feed tanks were used for other purposes.

E2.4 EFFLUENT TREATMENT FACILITY

The Effluent Treatment Facility started operation in November 1995 to process the stored evaporator condensate from the Liquid Effluent Retention Facility, newly generated evaporator condensate, and aqueous waste water containing low specific radioactivity (Wagner 1996). Treated effluent is discharged to the State-Approved Land Disposal Site, north of the 200 West Area. This site was chosen to allow tritium to decay away before migrating groundwater reaches the Columbia River. The Effluent Treatment Facility does not remove tritium because no feasible production-scale tritium removal technology presently exists. Because the Effluent Treatment Facility has a capacity to treat 24 Mgal/year, including 5 Mgal/year of condensate from the evaporator (Bowman 2000), Effluent Treatment Facility capacity should not limit future evaporator operations. The Effluent Treatment Facility should not send any waste streams to DSTs.

E2.5 PLUTONIUM FINISHING PLANT

The Plutonium Finishing Plant (PFP) is a facility in the 200 West Area that houses the processes and supporting operations for the following (Hirzel 2001):

- Stabilization of plutonium residues by muffle furnace calcination
- Stabilization of plutonium solutions by magnesium hydroxide precipitation process
- Shipping, receiving, and storage of special nuclear materials
- Analytical and development laboratories
- Effluent treatment facilities for wastewater and radioactive liquid waste streams.

An environmental impact statement (EIS) was issued for public comment in November 1995 covering the PFP facility stabilization and clean out. The waste volume projections are based on the preferred alternatives identified in the EIS for facility cleanout and stabilization. Based on current PFP operations, the magnesium hydroxide precipitation process and the laboratories are the only liquid waste generators. The magnesium hydroxide precipitation process removes plutonium from process feeds and the laboratories generate an intermittent waste stream based on analytes used in routine laboratory procedures.

Waste volumes for the baseline planning case were developed from existing production schedules. All projection cases projected that PFP stabilization and clean out would generate 35 Kgal of additional waste from 2001 through 2005 (Hirzel 2001). The waste volume reduction factor to evaporate PFP waste to double-shell slurry feed is 81 percent (Sederburg 1995). Flush volumes for PFP stabilization waste streams is 22 percent (flushes of waste transfer lines from PFP to Tank 244-TX, from Tank 244-TX to Tank 244-S, and from Tank 244-S to Tank SY-102).

The percent solids experienced in past PFP waste generations are as follows (Barrington 1991):

- % Solids in Plutonium Reclamation Facility waste 3.5%
- % Solids in Remote Mechanical C Line waste 4.4%
- % Solids in laboratory waste 4.5%.

E.2.6 Plutonium Uranium Extraction facility

The Plutonium Uranium Extraction (PUREX) Facility was used to separate irradiated N Reactor fuel into plutonium nitrate, uranyl nitrate hexahydrate, neptunium nitrate, and waste products. The main processing operations involved dissolution of cladding and irradiated fuel, solvent extraction, and conversion of plutonium nitrate to plutonium oxide. Acid recovery, solvent treatment systems, and off-gas treatment supported the major processes.

The PUREX deactivation was completed in FY 1997 and the waste transfer system has been deactivated. However, condensate is collected in the PUREX main stack catch tank (216-A-TK-2) and the Number 2 Filter catch tank (V11-1). This accumulation could result in approximately 5 Kgal of dilute waste being transferred to tank farms once per year (Eiholzer 1997).

All three projection cases projected 5 Kgal/year of waste additions from PUREX. Based on the average waste composition presented for PUREX waste, the waste volume reduction factor for evaporation of PUREX waste to double-shell slurry feed is 99 percent (Sederburg 1995). Flush volumes for PUREX waste streams are 10 percent.

E.2.7. 222-S Laboratory

The 222-S Laboratory is a dedicated laboratory facility that currently provides analytical chemistry services in support of Hanford Site processing plants and tank characterization. Emphasis at the laboratory is on supporting the waste management processing plant, environmental monitoring programs, tank farms, the 242-A Evaporator, the Waste Encapsulation Storage Facility, the Plutonium Finishing Plant (PFP), and research activities. Most of the radioactive liquid waste generated at the laboratory complex originates from analytical activities performed within the 222-S Laboratory in support of tank characterization (Borneman 2001). Radioactive and radioactive hazardous (mixed) waste generated by the 222-S Laboratory is discharged to the 219-S Waste Handling Facility. Dilute, noncomplexed waste currently is being transferred via pipeline to Tank SY-102. The projected waste generation rate for the 222-S Laboratory was 10 Kgal/year for FY 2001 through 2018 for all projection cases (Borneman 2001). Based on the waste composition presented for 222-S Laboratory waste, the waste volume reduction factor for evaporation of 222-S Laboratory miscellaneous waste to double-shell slurry feed is 99 percent (Sederburg 1995). The flush volume for 222-S Laboratory waste streams s 22 percent.

E.2.8. SALT WELL LIQUID PUMPING

Saltwell liquid pumping will occur for SSTs containing 50,000 gal or more of drainable interstitial liquid. Pumping is scheduled to stop when the output rate decreases to 0.05 gal per minute. Saltwell liquid pumping assumptions for all three projection cases are as follows:

- The drainable porosity was reevaluated in 1999 based on actual pumping experience and core sample analytical results (Field and Vladimiroff 1999). This reevaluation reduced the average saltcake drainable porosity to 25 percent and the average sludge drainable

porosity to 15 percent. The reevaluations of the drainable porosity has decreased the estimated (as of June 1998) saltwell liquid volume from 6.2 Mgal to 4.0 Mgal without flush and dilution. For all projection cases, all saltwell liquid was assumed to be pumped from FY 2001 through the end of FY 2004 to meet the Consent Decree milestones. Projected saltwell liquid pumping volumes are based on the pumping sequence obtained from the latest project plan and updated through June 24, 2001 (Vladimiroff 2001). Historical pumping volumes and the projected pumping volumes for all projection cases are presented in Table E-2. The waste volume reduction factor for evaporation of dilute noncomplexed saltwell liquid to double-shell slurry feed is 47 percent (Sederburg 1995). The waste volume reduction factor for evaporation of dilute complexed saltwell liquid to complexant concentrate waste is 10 percent (Sederburg 1995).

- The projected average dilution and flush used for saltwell liquid pumping from 2001 through 2003 was approximately 79 percent. The percentage dilution and flush used with each tank was based either on actual dilution and flushing volumes observed to date for the tank or on process knowledge. The projected total volume of dilution and flush liquid added from 2001 through 2003 was approximately 2.1 Mgal. The waste volume reduction factor used for this flush is 99 percent (Sederburg 1995).

- Approximately 1 Mgal (25 percent) of the total saltwell liquid volume is complexed based on available analytical information.

- Pumping saltwell liquid in the 200 West Area presents special problems because of the limited tank space available. Tank SY-101 is full of complexed waste designated as a feed to the WTP. Tank SY-103 contains complexed waste and is designated as a Watch List Tank. Addition of waste to a Watch List Tank or to waste designated as feed to the WTP is prohibited unless a safer alternative cannot be found.

Therefore, Tank SY-102 was designated as the West Area saltwell-liquid receiver for both noncomplexed and complexed saltwell liquid. Tank SY-102 contains approximately 71 Kgal of transuranic (TRU) solids (Table E-4) that are not scheduled to be retrieved until after the completion of saltwell liquid pumping. Historically, complexed waste and TRU waste have been segregated to minimize the amount of waste requiring more expensive disposal and to comply with U.S. Department of Energy (DOE) Order 435.1, *Radioactive Waste Management*. The Hanford Site has implemented this order by segregating waste that was considered complexed (more than 10 g/L total organic carbon when concentrated; waste with chelating agents also is designated as complexed) from TRU waste sludge (Reynolds 1995). The schedule presented in Table E-2 would require pumping complexed saltwell liquid over the sludge in Tank SY-102 to meet Tri-Party Agreement milestones for the years 2001 through 2003. Commingling studies completed in FY 1999 (Kirch 1999), indicate that no TRU waste will be solubilized by commingling complexed saltwell liquid with the TRU solids in Tank SY-102. Furthermore, the DOE has allowed the commingling of noncomplexed and complexed saltwell liquid as necessary to allow the stabilization of SSTs (Kinzer 1998). In this projection, the complexed waste is shown being pumped to Tank SY-102 to meet the current Tri-Party Agreement schedule.

Table E-2. Saltwell Pumping Schedule for All Projections. (Kgal)

SaltwWell Pumping Schedule for 25% Saltcake/15% Sludge Porosity (Field and Vladimiroff 1999)					
Fiscal Year	East Area		West Area		Total
	DN	DC	DN	DC	
Historical Saltwell Liquid Pumping from 1989 to 1999					
1989	55	0	0	17	72
1990	44	0	0	0	44
1991	227	0	0	0	227
1992	121	0	0	0	121
1993	01	0	37	0	37
1994	189	0	32	0	221
1995	194	105	18	0	317
1996	22	0	218	0	240
1997	23	0	140	0	163
1998	0	0	98	0	98
1999	1	0	872	22	895
2000	82	0	327	800	1,209
1989-2000 Total	958	105	1,742	839	3,644
Projected Saltwell Liquid Pumping from 2001 to 2004 (without flush)					
2001	93	0	321	68	482
2002	1,100	62	772	32	1,966
2003	44	21	106	5	177
2004	0	0	0	0	0
2001-2004 Total	1,237	83	1,199	105	2,624
Grand Total	2,1951	188	2,641	944	6,268

Notes:

DC = dilute complexed waste

DN = dilute non-complexed waste

E2.9 SINGLE-SHELL TANK WASTE RETRIEVAL

The waste volume projection values for SST retrieval assume 99 percent retrieval by volume of all waste estimated in each SST. A dilution factor of approximately three is assumed to be necessary to remove the waste and transfer it to the DST system. This dilution factor is typical of the factor from previous sluicing activities (in both DSTs and SSTs). Also, the dilution factor is not unreasonable for other retrieval options under consideration, in that this level of dilution is required for pumping most of the SST waste in the present piping system. Hence even a retrieval system that adds little water to the tank likely would dilute the waste when it was sent from the waste collection system via the piping system to the DSTs.

The 99-percent retrieval rate is based on the goal established in the M-45 series of the Tri Party Agreement of retrieving 99-percent or more of the waste from the SST system. The Tri-Party Agreement requires the SST waste to be retrieved to the limits of the technology applied. The Tri-Party Agreement includes a formal process for DOE to request a change to this limit based on demonstrations of technology and retrieval performance risk assessments. Demonstrations are planned and will be evaluated for both saltcake and sludge-type SSTs. Once these demonstrations are completed, a more accurate retrieval effectiveness value can be selected.

The retrieval and transfer of Tank C-106 solids to Tank AY-102 was completed in FY 1999. Approximately 194 Kgal of solids were retrieved into Tank AY-102. Retrieving the remainder of the waste from the SSTs will consist of retrieving approximately 11.5 Mgal of sludge and 20.7 Mgal of saltcake (HNF-EP-0182-148, 2000). Dilution of these solids for retrieval and processing results in a total retrieved volume of approximately 102 Mgal (HNF-SD-WM-SP-012, 2001). Saltcake would be diluted to 5 M sodium and sludge will be diluted to 10 weight-percent solids. A further assumption is that all solids will be removed from the SSTs.

Case 3 (Tri-Party Agreement-compliant) is meant to project DST needs based on established Tri-Party Agreement milestones (Consent Decree milestones for saltwell liquid pumping), RPP planning, and the most realistic operational assumptions (described in Section 3.0 of this document). The near-term SST retrieval schedule for the Case 3 projection was based on retrieving waste from Tanks S-112, S-102, and C-104 by the end of FY 2006. Details of these retrievals areas follows:

- Waste from Tank S-112 would be retrieved by September 30, 2005, to satisfy Tri-Party Agreement Milestone M-45-03C (saltcake dissolution demonstration).
- Waste from Tank S-102 would be retrieved by September 30, 2006, to satisfy Tri-Party Agreement Milestone M-45-05A (first full-scale retrieval).
- Waste from Tank C-104 would be retrieved by September 30, 2006, to satisfy Tri-Party Agreement Milestone M-45-03I (robotic technology demonstration).

The remaining SST retrieval sequence for the Case 3 projection was created to retrieve the smaller volumes of waste from SSTs first to meet the Tri-Party Agreement milestones for the number of tanks started each year while trying to stay within the available DST space for a longer period of time.

The as-retrieved volumes for the remaining SST waste are shown in the spreadsheet for the Tri-Party Agreement-Compliant Case (Section 5.1 of this document) and are based on retrieval at 5 M sodium. The retrieval sequence, durations, and volumes for both Case 1 and Case 3 projections are shown in Appendix G and H.

E2.10 T PLANT

The T Plant's primary mission is decontamination and treatment of radiologically and chemically contaminated waste and equipment located throughout the Hanford Site (McDonald 1997).

T Plant also provides inspection and repackaging services to various Hanford Site facilities. The 2706-T Low-Level Decontamination Facility (where equipment with low-level contamination is decontaminated) is an approved decontamination facility that commenced operation in September 1994. Limited 221-T canyon decontamination activities (primarily tank farms long-length contaminated equipment) were initiated in 1995.

T Plant has adopted decontamination techniques (ice blasting and CO_2 decontamination systems) that have reduced liquid waste generations from those reported previously. Dilute, non-complexed wastes collected at T Plant during decontamination, repackaging, or condensate collection, currently are being transported to the 204-AR vault via tanker truck. This waste contains approximately 5 volume percent solids (McDonald 1997). Projected T Plant waste generations were based on a combination of anticipated work loads and actual observed generation rates. T Plant tank systems have been determined to contain *Toxic Substances Control Act* (TSCA)-regulate polychlorinated biphenyls (PCB) in the solids. The liquid fraction is at or below detection limits (Barmettlor 2001). Negotiations are in progress with the U. S. Environmental Protection Agency and the Washington State Department of Ecology on TSCA applicability to the DSTs. This projection assumed that T Plant waste would be transferred to the DST system. Based on information supplied by T Plant engineers (Barmettlor 2001), the projected volume for T Plant is 20 Kgal in FY 2001 decreasing to 3 Kgal/ year by FY 2008. The exact waste volume generation projected for each year is shown in the spreadsheet for Case 3 in Section 5.1. All three projection cases used the same generation rates. The waste volume reduction factor for evaporation of T Plant miscellaneous waste to double-shell slurry feed is 99 percent (Sederburg 1995). Flush volumes for T Plant waste streams are 22 percent.

E2.11 TANK FARMS

Currently, 28 DSTs are used to receive, store, and evaporate the liquid waste generated at the Hanford Site facilities to an interim waste form. The interim waste form (e.g., double-shell slurry feed) is stored in tank farms awaiting processing and vitrification for final disposal. Tank Farm waste generation sources and operational considerations are listed in Sections E2.11.1 E2.11.2 for the aging and non-aging waste tanks. Tank Farm waste generations are primarily from line, cross-site, and air-lift circulator flushes.

E2.11.1 Double-Shell Tanks for Aging Waste

Four of the DSTs (AY and AZ farms) are designated as aging waste tanks and were designed to store high-heat waste (e.g., neutralized current acid waste or waste containing high-heat loads caused by the presence of ^{90}Sr or ^{137}Cs). The aging waste tanks are equipped with condensers and air-lift circulators. The condensers handle the vapors from primary tank vent systems when hot liquid is present. Condensates are collected in catch tanks (e.g., Tank AZ-151) and returned either to an aging waste tank or to a dilute receiver tank. The air-lift circulators aid in suspending neutralized current acid waste solids and in heat removal. Air-lift circulators require periodic flushing (approximately once a week) to prevent clogging when they are operating. When the air-lift circulators are not operating, flushing is less frequent.

The following assumptions for aging waste tank operation are used in all three projections.

- Aging waste tanks can be used for storing dilute non-aging waste.
- No additional aging waste will be produced by the Hanford Site facilities. However, certain waste containing high levels of ^{90}Sr or ^{137}Cs may require storage in aging waste tanks because of their radioactivity. Any HLW returns to DSTs during the balance of mission processing will be stored in three aging waste tanks.
- All SST solids retrieved from Tank C-106 were stored in aging waste Tank AY-102 in FY 1999 because of their high heat content.
- Tank AY-102 was designated as the 200 East Area dilute receiver for noncomplexed waste through mid FY 1996. Tank AY-102 currently is being used to store the solids retrieved from Tank C-106.

E.2.11.2 Double-Shell Tanks for Non-Aging Waste

The remaining 24 DSTs are called non-aging waste tanks and, in accordance with applicable operational and waste segregation policies, are used to store waste that does not contain high-heat loads. The following assumptions apply to non-aging waste tank operation.

- Caustic will be added to four non-aging waste tanks in FYs 2001 and 2002 to mitigate low caustic conditions in the tanks. Table E-3 summarizes those additions (Carothers 2001).
- Current operational tank use for this projection is summarized in Table E-4. Projected tank use is covered in Section 5.

  The TRU solids in Tank SY-102 will be retrieved into Tank AW-105 starting in FY 2011. The neutralized cladding removal waste solids in Tank AW-105 were not combined with the solids in Tank AW-103 in this projection.
- Flushes are generated during the receipt of waste transfers either from tanker trucks or after tank to tank transfers. Percent flushes are included with the facility generation assumptions.
- Tank AP-108 currently is receiving tanker truck shipments via the 204-AR waste unloading facility from T Plant and 300 Area.
- Tank AP-108 will be used to receive saltwell liquid in 200 East Area (Vladimiroff 1999). Tank AP-102 will be used temporarily to receive saltwell liquid in the 200 East Area from June 2001 until October 2002 because Project W-314 work on the AW-A and AW-B valve pits precludes transfers to Tank AP-108. Tank SY-102 will receive saltwell liquid in the 200 West Area.

- Waste from PFP is transferred through the 244-TX double-contained receiver tank to Tank SY-102. Wastes from the 222-S Laboratory are transferred through the 244-S double contained receiver tank to Tank SY-102.

Table E-3. Caustic Additions for FYs 2001 and 2002.

Tank	Caustic Addition, Kgal	Date
Tank AY-101	45 Kgal of 8 M NaOH plus flush	Completed in Jan 2001
Tank AY-102	72 Kgal of 8 M NaOH plus flush	Completed in Feb 2001
Tank AN-102	19 Kgal of 19 M NaOH plus flush	To be completed by Sept 2001
Tank AN-107	60 Kgal of 19 M NaOH plus flush	To be completed by Sept 2001

Table E-4. Current Operational Tanks and Use.

Operation	Designated Tank
Evaporator Feed Tank	Tank AW-102
Evaporator Receiver Tank	Tank AW-106
200 East Dilute Receiver Tank	Tank AW-105 (PUREX direct transfers; 100 Area waste)
200 East Dilute Receiver Tank	Tank AP-108 (until 7/2001; and 10/2002-2028) Tank AP-102 from 7/2001 until 10/2002 because of work on the AW-A and AW-B valve pits.
200 West Dilute Receiver Tank	Tank SY-102 (FY 2001-2028)
200 East Saltwell Liquid Receivers	Tank AP-108 (until 7/2001; and 10/2002-2028) Tank AP-102 from 7/2001 until 10/2002 because of work on the AW-A and AW-B valve pits.
200 West Saltwell Liquid Receiver	Tank SY-102
Waste Treatment Plant Feed Tanks	Waste treatment plant supplies feed tanks
Intermediate Staging Tanks	Tanks AN-101, AN-102, AN-105, AP-104, AP-101
Entrained Solids Return Waste	Waste treatment plant supplies space
Dilute Feed Staging	Tanks AP-107 and AP-108

PUREX = Plutonium Uranium Extraction (Plant)

Projected waste generations for tank farms were based on a combination of previously observed waste generation rates, anticipated operational needs, and the following chemical additions.

- **Tank Farm Water Additions to DSTs**. Tank Farms waste generation rates and flushing activities generally increase with the restart of the 242-A Evaporator because of the additional waste transfers. The 242-A Evaporator was restarted in April 1994. From April 1994 through May 1995, the average monthly waste generation rate for tank farms was 10.92 Kgal/month. The average monthly waste generation rate for tank farms during FY 1999, 2000, and 2001 (through May 2001) was 4.8, 6.3, and 3.4 Kgal/month,

respectively. The target rate set for waste generated from tank farms was 10 Kgal/month. All three projection cases estimated that tank farms would generate 10 Kgal/month or 120 Kgal/year to cover transfer line and air-lift circulator flushes and chemical additions. The waste volume reduction for evaporation of these flushes to double-shell slurry feed was 99 percent (Sederburg 1995).

- **Cross-Site Transfers.** All projection cases assumed the cross-site transfer line would continue to be available to allow cross-site transfer of saltwell liquid, facility generations, DST solids from Tank SY-102, and/or SST solids. A cross-site outage from February 1, 2003, to January 1, 2004, is planned to connect the cross-site line to the AN tank farm. All waste containing solids is assumed to be transferred cross site via the new line, which has inline pumps to Tank AN-104. Without operable cross-site lines many of the Tri-Party Agreement (and/or Consent Decree) milestones involving 200 West Area waste could not be met.

All three projection cases assumed that approximately 35 Kgal of water would be needed to flush after each cross-site transfer. From 2001 through 2003, approximately two to three cross-site transfers would be needed each year to accommodate the volume of saltwell liquid being pumped. Based on the projected cross-site testing and transfers anticipated, a pumping volume of 70 Kgal/year was projected for FY 2001 through 2003. All three projection cases used the same volumes for cross-site transfer line tests and flushes. The waste volume reduction for evaporation of these flushes to double-shell slurry feed was 99 percent (Sederburg 1995). The projected tank fill limits and considerations are as follows:

- Tank Fill Limits For Cases 2 and 3 (except for special tank fill considerations):
  - AY, AZ Tanks: 1000 Kgal
  - Tank AW-102: 1128 Kgal
  - All other DSTs: 1144 Kgal
- The special tank fill considerations used to simulate tank transfers in this projection are
  - Tank SY-102, 1,082 Kgal maximum operational fill limit; minimum

    The drawdown level is 358 Kgal until TRU solids have been removed. The minimum practical drawdown level is 550 Kgal. The 550 Kgal minimum was used in the projection models.
  - Tank AW-102, 1,113 Kgal maximum.
  - Tank AY-102, start transfer at 900 Kgal.
  - Dilute receivers are projected to be pumped down to 28 Kgal above solids.

E2.12 URANIUM OXIDE FACILITY

Deactivation of the Uranium Oxide (UO_3) Facility is complete and, therefore, no waste will be sent to DSTs.

E2.13 WASTE SAMPLING AND CHARACTERIZATION FACILITY

The Waste Sampling and Characterization Facility was started in FY 1994. This projection assumed that the Waste Sampling and Characterization Facility would send its waste to the Effluent Treatment Facility and not to DSTs (Borneman 2001).

E2.14 100 AREA

E2.14.1 100-N Basin

The 100-N Basin was constructed in 1963 to receive irradiated fuel assemblies discharged from the N Reactor for inspection, storage, and preparation for shipment. In 1988 the N Reactor was placed in a "cold standby" status (shut down but capable of being restarted). In 1989 all nuclear fuel was removed from N Basin and transferred to K Basin. In 1991 DOE directed Westinghouse Hanford Company to begin deactivation activities. Deactivation of the N Basin was assumed to not send any waste to DSTs; instead, waste would be transferred to the Environmental Restoration Disposal Facility (Logan 1998).

E.2.14.2 100-K Basin

Fuel handling operations have resulted in some cladding damage to N-Reactor fuel. Subsequent fuel oxidation resulted in fuel and fission products accumulating in fuel canisters and in the 100-K Basin where the fuel handling occurred. Aluminum oxide, iron oxide, concrete grit, and other debris have accumulated and mixed with the fuel corrosion products to form a sludge on the basin floor. Approximately 430 Kgal of water and sediment (approximately 98 Kgal of sediment) will need to be removed. Based on the latest studies, the waste from the 100-K Basin cleanout will not be sent to DSTs (Jones 2000). The sludge would be sent to T Plant for interim storage. Final treatment and disposal of the sludge would be coordinated with that of other TRU waste at the Site (Jones 2000). The sludge will not be sent to tank farms.

E2.14.3 105-F & 105-H Basins

Plans to clean out the 105-F and 105-H Basins are being reviewed and the cleanout date is uncertain because of funding uncertainties. Based on the latest studies, the waste from 105-F and 105-H basin cleanout will be sent to the Effluent Treatment Facility and will not be sent to DSTs (Griffin 2001).

E2.15 300 AREA

Facilities in the 300 Area are used primarily for research and development activities or for analytical support. Waste from the Pacific Northwest National Laboratory facilities will be collected at the Radioactive Liquid Waste Tank and then transferred to the DSTs. Liquid waste collected in 300 Area will be shipped to the 204-AR vault via a tanker truck (LR-56) because Hanford Site rail service has been discontinued.

The 324 Facility projected that it would not be sending any liquid waste to tank farms (Erickson 2001). The 325 Facility projected that it would send 1 to 4 Kgal/year to tank farms for the baseline case (Waller 2001). The 327 Facility projected that it would send 0 to 26 Kgal/year to tank farms (Hoober 2001). The 340 Facility projected that it would send 1.32 Kgal/year to tank farms in FYs 2004 and 2010 (McBride 2001). Facilities in the 300 Area sent 15 Kgal of waste (including flush) to DSTs (~1.3 Kgal/month) in FY 1998 and no waste in FYs 1999 and 2000. Based on the facility inputs, all three projection cases estimated that 1 to 28 Kgal/year of miscellaneous waste would be sent from 300 Area Facilities to tank farms. See the spreadsheet in Section 5.1 for a listing of the volume of waste projected for each year for 300 Area facilities. Based on the chemical composition supplied for 300 Area waste streams, the waste volume reduction factor for evaporation of 300 Area miscellaneous waste to double-shell slurry feed is 94 percent (Sederburg 1995). Flush volume for 300 Area waste streams is 44 percent.

E2.16 400 AREA

The 400 Area contains three major facilities (Dillhoff 1997). These are the Fast Flux Test Facility, the Maintenance and Storage Facility, and the Fuel and Material Examination Facility. Radioactive liquid waste is generated primarily in conjunction with the removal of residual sodium from reactor components or with decontamination activities. Approximately 11 Kgal of waste were received from the 400 Area in FY 1994-1995 (~0.5 Kgal/month). The 400 Area facilities send their radioactive waste to the Effluent Treatment Facility in the 200 Area (Dahl 1999). All three projection cases projected that no waste would be sent from the 400 Area facilities to tank farms.

E2.17 INITIAL QUANTITY PROCESSING

Final details of waste treatment and vitrification will not be developed until later in the process; the following assumptions are subject to change. As currently proposed, waste treatment and vitrification would be divided into two phases. Initial Quantity would include waste tank supernatant processing, LAW immobilization, and HLW immobilization (Washenfelder 1996a). The scale of processing during Initial Quantity has been established to demonstrate the technical and commercial capability of the plant. The balance of mission processing would include additional tank waste retrieval, supernatant processing, sludge and solid processing, LAW immobilization, HLW immobilization, and interim storage of immobilized waste (Washenfelder 1996b and HNF-SD-WM-SP-012, 2001). The following schedule was developed to allow completion of all waste processing by the end of 2028. The waste treatment schedule used for the three projections is presented in the following sections.

Initial Quantity Schedule. The facility startup schedule will be as follows:

• Ready to deliver first LAW batch	September 1, 2005
• Ready to deliver first HLW batch	April 1, 2006
• Start LAW facility hot commissioning	December 31, 2007
• Start HLW facility hot commissioning	August 1, 2008
• Start pretreatment facility services	January 1, 2008
• Start LAW vitrification services (full capacity)	February 11, 2011
• Start HLW vitrification services (full capacity)	February 11, 2011.

Intermediate Feed Staging Tanks. Tanks AN-101, AN-102, AN-105, AP-104, and AP-101 were used for intermediate staging of waste by the tank farm contractor (HNF-SD-WM-SP-012, 2001).

Waste Treatment Plant Feed Tanks. Waste from the intermediate feed staging tanks will be transferred to feed tanks that will be built by the waste treatment plant contractor (Taylor 1999).

High-Level Waste Treatment and Immobilization. Initial Quantity processing of tank waste sludge would involve sludge in Tanks AZ-101, AZ-102, AY-102 (includes C-106 solids), AY-101 (includes C-104 solids). The Initial Quantity extended order would process sludge from Tanks SY-102 (retrieved to AZ-101), C-107, AW-103, and AW-104.

In Revision 21 of this document, the assumption was that all neutralized current acid waste solids and the C-106 solids would be combined into one aging waste tank (Tank AZ-102) and that all neutralized current acid waste supernatant liquids would be concentrated in one aging waste tank (Tank AZ-101). Since that document was published, studies have been completed that looked at numerous sludge washing and combination options (Powell 1996). The alternatives for consolidating high-heat sludge have been reviewed by a decision board consisting of Hanford Site contractor management, a DOE representative, and a representative from the Washington State Department of Ecology. The decision board concluded that consolidating all the high-heat sludge into a single tank would require modifying the tank farm safety basis. The preliminary decision reached was to not consolidate all the high-heat sludge into a single tank.

Low-Activity Waste Treatment. The current DOE strategy calls for a demonstration of LAW treatment and immobilization at a rate dependent on the type of waste being processed. Envelope A feed typically is double-shell slurry feed, double-shell slurry, or dilute non-complexed waste. Envelope B feed is untreated neutralized current acid waste supernatant liquid. Envelope C feed typically is complexant concentrate waste. The processing schedule, sequence of waste processed, and the approximate sodium quantity processed for projection Cases 2 and 3 are listed in Table E-5 (HNF-SD-WM-SP-012, 2001). The LAW and HLW treatment ramp up rates used for Cases 2 and 3 are listed in Section 5.2.

Storage of Separated TRU and Entrained Solids. For all projection cases, the entrained solids and TRU elements removed from LAW waste by the waste treatment plant were not returned to tank farms.

Table E-5. Projected LAW Processing Schedule for the Case 2 and 3 Projections.

Tank	Waste Type	Envelope	Volume With solids (Kgal)	Approximate Quantity of Sodium Delivered (MT Na)	Existing or Future Waste	Modeled Delivery Range
AP-101	DSSF	A	1,086	~615	Existing	01/01/2008
Vendor	NCAW Supernate	B	1,895	~503	Existing	12/31/2007 - 03/12/2011
AN-102	CC	C	1,012	~968	Existing	04-16/2011 - 06/23/2013
AN-104	DSSF	A	1,295	~845	Existing	11/01/2010 - 02/07/2014
AN-107	CC	C	803	~703	Existing	12/24/2014
AN-105	DSSF	A	1,162	~839	Existing	06/23/2013 - 06/15/2016
SY-101	CC	A	2,094	~827	Existing	02/14/2014 - 08/11/2014
AN-103	DSS	A	1,425	~1084	Existing	11/04/2015 - 05/16/2018
AW-101	DSSF	A	1,502	~1070	Existing	06/15/2016 - 11/26/2018
Start of Initial Quantity extended order						
AW-104	DSSF	A	527	~390	Future	11/11/2016 - 11/15/2016
SY-103	CC	C	1,117	~258	Existing	10/07/2019 - 10/13/2019

CC = complexant concentrate waste

DSS = double-shell slurry

DSSF = double-shell slurry feed

NCAW = neutralized current acid waste

E2.18 BALANCE OF MISSION PROCESSING

The scale of processing during the Initial Quantity period has been established to demonstrate the technical and commercial capability of the plant. The balance of mission processing would include the remaining tank waste retrieval, supernatant liquid processing, sludge and solid processing, LAW immobilization, HLW immobilization, disposition of encapsulated cesium and strontium, and interim storage of immobilized waste (Washenfelder 1996b). The processing rate in the balance of mission processing has been increased to allow completion of all processing by the end of FY 2028.

E2.19 WATCH LIST/SAFETY

Paperwork is being prepared that will eliminate the Watch List Category in FY 2002. However, removal of the Watch List designation alone will not allow use of all the headspace in the Watch List tanks. The existing waste in a Watch List tank may require dilution and/or treatment before the designation can be removed. The reclassification and treatment of Watch List Tank SY-103 could allow dilution of the waste in the tank with saltwell liquid, which would gain approximately 390 Kgal of storage space. The feasibility of taking similar actions with other tanks would need to be studied, but could save tank space.

Tank SY-101 Remediation. Increases in the waste level in Tank SY-101 led to a need to remediate the flammable gas buildup in the tank by retrieving and diluting the waste rather than relying on mitigation of the gas buildup by use of a mixer pump. Tank SY-101 was diluted in FY 2000 and a portion of the diluted waste was transferred to Tank AP-104 to serve as contingency LAW feed. Tank SY-101 has been removed from the watch list (Huntoon 2001).

Tank SY-103 Retrieval. The waste in Tank SY-103 will be diluted to approximately 7 M sodium and transferred via Tank AN-104 to Tank AN-101. The transfer to Tank AN-104 will occur in FY 2020.

All three projection cases assume that timely permission is obtained to remove waste from the watch list tanks used as LAW feed sources and to remove the watch list designation from each tank immediately after retrieval or dilution of waste in that tank.

All three cases assume that the authorization basis is amended to support all activities related to Initial Quantity activities (LAW feed staging and delivery, HLW feed staging and delivery, etc.)

E.2.20 EMERGENCY SPACE/LAW AND HLW RETURN

Emergency space is space reserved in case of a leak in a double-shell tank in accordance with DOE Order 435.1. Contingency space has historically been set aside to account for possible inaccuracies in the WVP software when projecting waste generations and/or waste volume reduction factors.

In revision 25 of the OWVP document, 2.28 Mgal of emergency space was reserved in case of a double-shell leak per DOE Order 435.1. In revision 26 of the OWVP document, the emergency space was reduced to 1.14 Mgal. However, the tank farm contractor also has been requested to provide the capability to receive up to the equivalent of one tank volume of either LAW or HLW return from the waste treatment plant on an emergency basis (Taylor 1999). Accordingly, 1.14 Mgal of space have been reserved for the possibility of a LAW or HLW return. To meet the requirements for storing HLW returns, the space in Tank AY-101 was designated as dedicated emergency space in all three projections (Strode 2000). Tank AY-101 is undergoing a tank integrity evaluation that could affect its capacity. In FY 2007, Tank AY-101 will be used to receive Tank C-104 waste and Tank AZ-102 will be designated as the dedicated emergency tank through the end of the projection. The remaining 1 Mgal of emergency space are distributed primarily within the waste receiver tanks (AP-108, AP-107, AW-105, and SY-102).

E.2.21 WASTE SEGREGATION

Waste segregation and compatibility are requirements of DOE Order 435.1 (DOE 1999) and *Washington Administrative Code* (WAC) 173-303-395, "Dangerous Waste Regulations". The overriding purpose of waste segregation and compatibility are to ensure the safety of waste storage and tank farms operations; to minimize future processing costs; and to comply with DOE Order 435.1 and WAC 173-303-393. Waste types that typically are segregated include

- **Phosphate Waste.** Dilute phosphate or concentrated phosphate
- **Waste Containing High Organic Concentrations.** Dilute complexed or complexant concentrate waste
- **TRU-Containing waste.** Neutralized cladding removal waste or PFP solids
- **Watch List Tank Waste.** Included to prevent inadvertent commingling with other types of waste
- **Pretreated Waste Streams.**
- **Washed Neutralized Current Acid Waste Solids**, etc.
- **Concentrated Interim Waste Types.** E.g., double-shell slurry feed or double-shell slurry need to be separated from dilute waste to prevent the need to reconcentrate.
- **Waste Exhibiting Exothermic Reactions.**
- **Characterized Waste.** Waste that has been characterized and designated as feed for the waste treatment plant are segregated by feed envelope type.

All three projections assume that current waste segregation practices are observed (if possible) with the exception of salt well liquid pumping in 200 West Area as discussed in Section 3.8. Waste segregation practices are summarized in Table E-6. For all projection cases, noncomplexed and complexed saltwell liquid waste in the 200 East Area were mixed for evaporation purposes beginning in FY 2001. The DOE has allowed the commingling of noncomplexed and complexed saltwell liquid waste as necessary to allow the stabilization of SSTs (Kinzer 1998).

Table E-6. Waste Compatibility Matrix.

Source Waste Type	Receiver Waste Type							
	DN	DSSF	DC	CC	(PD) NCRW	PT	NCAW	CP
DN	X	X	X	X	X	X	X	X
DSSF	X	X						
DC			X	X*				
CC			X*	X				
(PD) NCRW Solids	X				X	X		
(PT) PFP Solids	X				X	X		
NCAW							X	
CP								X

(*) Adding CC to DC is permitted but would not ordinarily be done. The volume of combined waste which would need to be evaporated would be increased, resulting in increased evaporation costs.

CC = complexant concentrate waste

CP = concentrated phosphate waste

DC = dilute complexed waste

DN = dilute non-complexed waste

DSSF = double-shell slurry feed

NCAW = neutralized current acid waste

NCRW = neutralized cladding removal waste

PD = PUREX decladding sludge

PT = PFP TRU solids

E2.22 LOSS OF DOUBLE-SHELL TANK SPACE

Corrosion studies completed to date (Anantatmula and Ohl 1996) show a 40 to 60 percent chance of a pit corrosion failure occurring in a DST by FY 2028. Some of the corrosion potential could be mitigated by maintaining a corrosion control program for the DSTs. The RPP key planning assumptions (Barrett 2000) have acknowledged that DSTs will reach the end of their design life and could fail at the rate of one for each 5 years past their design life. Based on this information, one DST is expected to fail and be replaced in 2017 and one is expected to fail and be replaced every 5 years thereafter. The assumption is that additional DST space will be built to replace tanks removed from service in time to meet the failure without a loss of overall space.

E2.23 NEW DOUBLE-SHELL TANK CONSTRUCTION ASSUMPTIONS

Projection Cases 2 and 3 assume that 28 DSTs will be available and then determine whether additional DSTs will be needed by the end of FY 2018. The results of this determination are presented in Section 5. Projection Case 1 assumed that four tanks would be built in 2010. For additional information on DST construction, see Section 5.6.

E2.24 DOUBLE-SHELL TANK SOLIDS LEVELS

Solids levels in the DSTs on September 30, 1999, are shown in Table E-7 (HNF-EP-0182-148, 2000). Tanks with no solids level listed either have not been measured or have a minimal solids volume. The total DST solids used for this projection was approximately 4.5 Mgal.

Table E-7. Double-Shell Tank Solids Levels (Kgal).

TANK	SOLIDS	TANK	SOLIDS	TANK	SOLIDS	TANK	SOLIDS
AY-101	94	AN-101		AP-101		AP-108	
AY-102	216	AN-102	89	AP-102		AW-101	306
AZ-101	46	AN-103	457	AP-103		AW-102	36
AZ-102	88	AN-104	449	AP-104		AW-103	363
SY-101	585	AN-105	489	AP-105	89	AW-104	231
SY-102	71	AN-106	17	AP-106		AW-105	255
SY-103	366	AN-107	247	AP-107		AW-106	225

E.2.25 INACTIVE MISCELLANEOUS UNDERGROUND STORAGE TANK WASTES

Approximately 500 Kgal of waste are projected to be received from inactive miscellaneous underground storage tanks between FYs 2011 and 2015 (Wacek 1996).

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APPENDIX F.

WASTE TRANSFER REQUIREMENTS

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Table F-1. Acronyms Used in Transfer Lists

Acronym	Meaning
242-A	242-A EVAPORATOR
244-BX	244-BX DOUBLE CONTAINED RECEIVER TANK
244-CR	244-CR DOUBLE CONTAINED RECEIVER TANK
34L87	300 AREA LAB WASTE
EVAPF	EVAPORATOR FLUSH AND TANK FARM WATER
PXTCO	PUREX TERMINAL CLEANOUT WASTES
SPN87	S PLANT DILUTE NON-COMPLEXED
TAL88	T PLANT SUPERNATE
TNS88	T PLANT SOLIDS
WASH-CAUSTIC	CAUSTIC ADDED TO TANKS
WATER	FLUSH OR DILUTION WATER
WESF	WESF WASTES
ZNL87	COMBINED PFP WASTE STREAM (NO TRUEX)

Table F-2. Transactions for Fiscal Year 2001.

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
U-102	SY-102	10/31/00	10/31/00	5	0	0
U-106	SY-102	10/31/00	10/31/00	4	0	0
U-109	SY-102	10/31/00	10/31/00	4	0	0
SX-103	SY-102	10/31/00	10/31/00	12	0	0
S-109	SY-102	10/31/00	10/31/00	18	0	0
SX-105	SY-102	10/31/00	10/31/00	45	0	0
WATER	SY-102	10/31/00	10/31/00	126	0	0
WATER	AP-107	11/10/00	11/10/00	19	0	0
SY-102	AP-107	11/10/00	11/12/00	459	0	0
SX-105	SY-102	11/30/00	11/30/00	13	0	0
U-109	SY-102	11/30/00	11/30/00	3	0	0
U-106	SY-102	11/30/00	11/30/00	2	0	0
U-102	SY-102	11/30/00	11/30/00	5	0	0
SX-101	SY-102	11/30/00	11/30/00	12	0	0
S-109	SY-102	11/30/00	11/30/00	10	0	0
WATER	AZ-102	11/30/00	11/30/00	9	0	0
SX-103	SY-102	11/30/00	11/30/00	53	0	0
WATER	SY-102	11/30/00	11/30/00	134	0	0
WATER	AZ-101	12/31/00	12/31/00	8	0	0
U-109	SY-102	12/31/00	12/31/00	1	0	0
SX-105	SY-102	12/31/00	12/31/00	6	0	0
U-106	SY-102	12/31/00	12/31/00	1	0	0
S-109	SY-102	12/31/00	12/31/00	3	0	0
U-102	SY-102	12/31/00	12/31/00	5	0	0
SX-101	SY-102	12/31/00	12/31/00	7	0	0
SX-103	SY-102	12/31/00	12/31/00	29	0	0
WATER	SY-102	12/31/00	12/31/00	77	0	0
WATER	AW-102	12/31/00	12/31/00	1	0	0
WESF	AP-108	1/4/01	1/4/01	3	0	0
AW-104	AW-102	1/18/01	1/22/01	801	0	0
U-102	SY-102	1/31/01	1/31/01	3	0	0
SX-105	SY-102	1/31/01	1/31/01	7	0	0
SX-103	SY-102	1/31/01	1/31/01	10	0	0
S-109	SY-102	1/31/01	1/31/01	1	0	0
WATER	SY-102	1/31/01	1/31/01	33	0	0
WASH-CAUSTIC	AY-101	1/31/01	1/31/01	45	0	0
WASH-CAUSTIC	AY-102	2/14/01	2/14/01	72	0	0
WATER	SY-102	2/28/01	2/28/01	12	0	0
SX-105	SY-102	2/28/01	2/28/01	2	0	0

Table F-2. Transactions for Fiscal Year 2001.

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
SX-103	SY-102	2/28/01	2/28/01	6	0	0
AW-102	242-A	3/3/01	3/6/01	622	0	0
AW-106	AW-102	3/6/01	3/10/01	871	0	0
AW-102	242-A	3/10/01	3/15/01	1057	0	0
AW-106	AW-102	3/15/01	3/19/01	680	0	0
AW-102	242-A	3/19/01	3/22/01	680	0	0
U-102	SY-102	3/31/01	3/31/01	2	0	0
SX-103	SY-102	3/31/01	3/31/01	3	0	0
AX-101	AN-101	3/31/01	3/31/01	10	0	0
WATER	AW-102	3/31/01	3/31/01	22	0	0
WATER	SY-102	3/31/01	3/31/01	17	0	0
WATER	AW-106	4/3/01	4/3/01	36	0	0
AW-106	AW-103	4/4/01	4/7/01	595	0	0
WATER	AZ-101	4/24/01	4/24/01	21	0	0
WATER	AN-101	4/30/01	4/30/01	3	0	0
AX-101	AN-101	4/30/01	4/30/01	4	0	0
U-109	SY-102	4/30/01	4/30/01	2	0	0
U-102	SY-102	4/30/01	4/30/01	4	0	0
SX-105	SY-102	4/30/01	4/30/01	1	0	0
SX-103	SY-102	4/30/01	4/30/01	3	0	0
WATER	SY-102	4/30/01	4/30/01	43	0	0
WATER	AW-102	5/12/01	5/12/01	1	0	0
WATER	AP-107	5/15/01	5/15/01	0	0	0
WATER	AP-108	5/15/01	5/15/01	2	0	0
WATER	AZ-101	5/31/01	5/31/01	4	0	0
U-109	SY-102	5/31/01	5/31/01	1	0	0
U-102	SY-102	5/31/01	5/31/01	1	0	0
TAL88	AP-102	6/1/01	6/1/01	2	0	0
SPN87	SY-102	6/1/01	6/1/01	3	0	0
EVAPF	AP-102	6/1/01	6/1/01	10	0	0
34L87	AP-102	6/1/01	6/1/01	0	0	0
PXTCO	AP-102	6/1/01	6/1/01	5	0	0
WATER	SY-102	6/2/01	6/2/01	1	0	0
WATER	AP-102	6/2/01	6/2/01	0	0	0
WATER	AP-102	6/2/01	6/2/01	1	0	0
WATER	AP-102	6/2/01	6/2/01	0	0	0
SX-103	SY-102	6/24/01	11/8/01	11	0	12
U-109	SY-102	6/24/01	11/8/01	18	0	7
U-102	SY-102	6/24/01	11/8/01	10	0	28
EVAPF	AP-102	7/1/01	7/1/01	10	0	0
TAL88	AP-102	7/1/01	7/1/01	2	0	0

Table F-2. Transactions for Fiscal Year 2001.

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
34L87	AP-102	7/1/01	7/1/01	0	0	0
WATER	AP-102	7/2/01	7/2/01	0	0	0
WATER	AP-102	7/2/01	7/2/01	0	0	0
SY-102	AP-108	7/9/01	7/11/01	400	0	0
BY-106	244-BX	7/11/01	7/20/01	5	0	3
BY-105	244-BX	7/13/01	7/20/01	4	0	2
AP-106	AP-108	7/17/01	7/20/01	594	0	0
244-BX	AP-102	7/20/01	7/20/01	15	0	0
AP-102	AP-106	7/20/01	7/25/01	1000	0	0
BY-105	244-BX	7/20/01	7/29/01	5	0	3
BY-106	244-BX	7/20/01	7/29/01	5	0	3
AP-102	AP-107	7/25/01	7/25/01	105	0	0
AP-107	AW-102	7/25/01	7/30/01	1001	0	0
244-BX	AP-102	7/29/01	7/29/01	15	0	0
BY-105	244-BX	7/29/01	8/7/01	5	0	3
BY-106	244-BX	7/29/01	8/7/01	5	0	3
AN-101	AN-106	7/31/01	7/31/01	100	0	0
WATER	AN-102	8/1/01	8/1/01	2	0	0
EVAPF	AP-102	8/1/01	8/1/01	10	0	0
34L87	AP-102	8/1/01	8/1/01	0	0	0
TAL88	AP-102	8/1/01	8/1/01	2	0	0
WATER	AP-102	8/2/01	8/2/01	0	0	0
WATER	AP-102	8/2/01	8/2/01	0	0	0
WASH-CAUSTIC	AN-102	8/2/01	8/2/01	19	0	0
244-BX	AP-102	8/7/01	8/7/01	15	0	0
BY-105	244-BX	8/7/01	8/16/01	5	0	3
BY-106	244-BX	8/7/01	8/16/01	5	0	3
244-BX	AP-102	8/16/01	8/16/01	15	0	0
BY-105	244-BX	8/16/01	8/26/01	5	0	3
BY-106	244-BX	8/16/01	8/26/01	5	0	3
U-107	SY-102	8/16/01	10/4/01	99	1	0
244-BX	AP-102	8/26/01	8/26/01	15	0	0
BY-105	244-BX	8/26/01	9/5/01	5	0	3
BY-106	244-BX	8/26/01	9/5/01	5	0	3
WATER	AN-107	9/1/01	9/1/01	6	0	0
EVAPF	AP-102	9/1/01	9/1/01	10	0	0
SPN87	SY-102	9/1/01	9/1/01	3	0	0
TAL88	AP-102	9/1/01	9/1/01	2	0	0
34L87	AP-102	9/1/01	9/1/01	0	0	0
WATER	SY-102	9/2/01	9/2/01	1	0	0
WATER	AP-102	9/2/01	9/2/01	0	0	0

Table F-2. Transactions for Fiscal Year 2001.

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
WATER	AP-102	9/2/01	9/2/01	0	0	0
WASH-CAUSTIC	AN-107	9/3/01	9/3/01	60	0	0
244-BX	AP-102	9/5/01	9/5/01	15	0	0
BY-105	244-BX	9/5/01	9/16/01	5	0	3
BY-106	244-BX	9/5/01	9/16/01	5	0	3
244-BX	AP-102	9/16/01	9/16/01	15	0	0
BY-105	244-BX	9/16/01	9/27/01	5	0	3
BY-106	244-BX	9/16/01	9/27/01	5	0	3
U-108	SY-102	9/16/01	11/8/01	38	0	73
244-BX	AP-102	9/27/01	9/28/01	15	0	0
BY-105	244-BX	9/28/01	10/10/01	5	0	3
BY-106	244-BX	9/28/01	10/10/01	5	0	3

Table F-3. Transactions for Fiscal Year 2002

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
EVAPF	AP-102	10/1/01	10/1/01	10	0	0
ZNL87	SY-102	10/1/01	10/1/01	7	0	0
TAL88	AP-102	10/1/01	10/1/01	2	0	0
34L87	AP-102	10/1/01	10/1/01	0	0	0
TNS88	AP-102	10/1/01	10/1/01	0	0	0
WATER	SY-102	10/2/01	10/2/01	2	0	0
WATER	AP-102	10/2/01	10/2/01	0	0	0
WATER	AP-102	10/2/01	10/2/01	0	0	0
WATER	AP-102	10/2/01	10/2/01	0	0	0
SX-101	SY-102	10/3/01	11/8/01	14	0	19
AX-101	AP-102	10/3/01	11/19/01	199	0	159
A-101	AP-102	10/3/01	11/19/01	271	0	217
244-BX	AP-102	10/10/01	10/10/01	15	0	0
BY-105	244-BX	10/10/01	10/22/01	5	0	3
BY-106	244-BX	10/10/01	10/22/01	5	0	3
S-111	SY-102	10/16/01	11/8/01	25	0	10
SX-102	SY-102	10/16/01	11/8/01	25	0	10
244-BX	AP-102	10/22/01	10/22/01	15	0	0
BY-105	244-BX	10/22/01	11/5/01	5	0	3
BY-106	244-BX	10/22/01	11/5/01	5	0	3
34L87	AP-102	11/1/01	11/1/01	0	0	0
TAL88	AP-102	11/1/01	11/1/01	2	0	0
EVAPF	AP-102	11/1/01	11/1/01	10	0	0
AP-102	AP-107	11/1/01	11/3/01	500	0	0
WATER	AP-102	11/2/01	11/2/01	0	0	0
WATER	AP-102	11/2/01	11/2/01	0	0	0
S-102	SY-102	11/2/01	11/8/01	2	0	5
244-BX	AP-102	11/5/01	11/5/01	15	0	0
BY-105	244-BX	11/5/01	11/19/01	5	0	3
BY-106	244-BX	11/5/01	11/19/01	5	0	3
SY-102	AP-102	11/8/01	11/10/01	532	1	0
U-102	SY-102	11/10/01	1/5/02	2	0	6
SX-103	SY-102	11/10/01	2/19/02	5	0	5
S-102	SY-102	11/10/01	2/25/02	26	0	58
S-111	SY-102	11/10/01	2/25/02	66	0	27
SX-102	SY-102	11/10/01	2/25/02	66	0	27
SX-101	SY-102	11/10/01	2/25/02	30	0	39
U-108	SY-102	11/10/01	2/25/02	46	0	87
U-109	SY-102	11/10/01	2/25/02	10	0	4

Table F-3. Transactions for Fiscal Year 2002

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
244-BX	AP-102	11/19/01	11/19/01	15	0	0
AP-102	AP-107	11/19/01	11/23/01	616	0	0
BY-105	244-BX	11/19/01	12/5/01	5	0	3
BY-106	244-BX	11/19/01	12/5/01	5	0	3
AX-101	AP-102	11/23/01	1/29/02	128	0	103
A-101	AP-102	11/23/01	1/29/02	166	0	133
TAL88	AP-102	12/1/01	12/1/01	2	0	0
SPN87	SY-102	12/1/01	12/1/01	3	0	0
34L87	AP-102	12/1/01	12/1/01	0	0	0
EVAPF	AP-102	12/1/01	12/1/01	10	0	0
WATER	SY-102	12/2/01	12/2/01	1	0	0
WATER	AP-102	12/2/01	12/2/01	0	0	0
WATER	AP-102	12/2/01	12/2/01	0	0	0
244-BX	AP-102	12/5/01	12/5/01	15	0	0
BY-105	244-BX	12/5/01	12/22/01	5	0	3
BY-106	244-BX	12/5/01	12/22/01	5	0	3
244-BX	AP-102	12/22/01	12/22/01	15	0	0
BY-105	244-BX	12/22/01	1/9/02	5	0	3
BY-106	244-BX	12/22/01	1/9/02	5	0	3
AW-102	242-A	12/30/01	1/4/02	1024	0	0
34L87	AP-102	1/1/02	1/1/02	0	0	0
TAL88	AP-102	1/1/02	1/1/02	2	0	0
EVAPF	AP-102	1/1/02	1/1/02	10	0	0
WATER	AP-102	1/2/02	1/2/02	0	0	0
WATER	AP-102	1/2/02	1/2/02	0	0	0
AW-106	AW-102	1/4/02	1/7/02	694	0	0
AW-102	242-A	1/7/02	1/11/02	694	0	0
244-BX	AP-102	1/9/02	1/9/02	15	0	0
BY-105	244-BX	1/9/02	1/28/02	5	0	3
BY-106	244-BX	1/9/02	1/28/02	5	0	3
AP-107	AW-102	1/15/02	1/20/02	1070	0	0
U-111	SY-102	1/26/02	2/25/02	18	0	7
244-BX	AP-102	1/28/02	1/29/02	15	0	0
AP-102	AP-107	1/29/02	2/3/02	1070	0	0
BY-105	244-BX	1/29/02	2/19/02	5	0	3
BY-106	244-BX	1/29/02	2/19/02	5	0	3
34L87	AP-102	2/1/02	2/1/02	0	0	0
EVAPF	AP-102	2/1/02	2/1/02	10	0	0
TAL88	AP-102	2/1/02	2/1/02	2	0	0
WATER	AP-102	2/2/02	2/2/02	0	0	0
WATER	AP-102	2/2/02	2/2/02	0	0	0

Table F-3. Transactions for Fiscal Year 2002

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
AX-101	AP-102	2/3/02	6/19/02	71	0	57
A-101	AP-102	2/3/02	6/19/02	85	0	68
AW-106	AP-103	2/15/02	2/17/02	490	0	0
244-BX	AP-102	2/19/02	2/19/02	15	0	0
BY-105	244-BX	2/19/02	3/15/02	4	0	3
BY-106	244-BX	2/19/02	3/15/02	5	0	3
SY-102	AP-102	2/25/02	2/27/02	532	0	0
U-111	SY-102	2/27/02	8/20/02	45	0	18
S-102	SY-102	2/27/02	8/20/02	20	0	44
S-111	SY-102	2/27/02	8/20/02	35	0	14
SX-102	SY-102	2/27/02	8/20/02	35	0	14
SX-101	SY-102	2/27/02	8/20/02	25	0	33
U-108	SY-102	2/27/02	8/20/02	31	0	59
U-109	SY-102	2/27/02	8/20/02	12	0	5
34L87	AP-102	3/1/02	3/1/02	0	0	0
SPN87	SY-102	3/1/02	3/1/02	3	0	0
EVAPF	AP-102	3/1/02	3/1/02	10	0	0
TAL88	AP-102	3/1/02	3/1/02	2	0	0
WATER	SY-102	3/2/02	3/2/02	1	0	0
WATER	AP-102	3/2/02	3/2/02	0	0	0
WATER	AP-102	3/2/02	3/2/02	0	0	0
244-BX	AP-102	3/15/02	3/16/02	15	0	0
BY-105	244-BX	3/16/02	4/12/02	4	0	3
BY-106	244-BX	3/16/02	4/12/02	5	0	3
34L87	AP-102	4/1/02	4/1/02	0	0	0
EVAPF	AP-102	4/1/02	4/1/02	10	0	0
TAL88	AP-102	4/1/02	4/1/02	2	0	0
WATER	AP-102	4/2/02	4/2/02	0	0	0
WATER	AP-102	4/2/02	4/2/02	0	0	0
244-BX	AP-102	4/12/02	4/12/02	15	0	0
BY-105	244-BX	4/12/02	5/13/02	4	0	3
BY-106	244-BX	4/12/02	5/13/02	5	0	3
EVAPF	AP-102	4/15/02	4/15/02	50	0	0
S-112	SY-102	4/21/02	8/20/02	49	0	20
TAL88	AP-102	5/1/02	5/1/02	2	0	0
34L87	AP-102	5/1/02	5/1/02	0	0	0
EVAPF	AP-102	5/1/02	5/1/02	10	0	0
WATER	AP-102	5/2/02	5/2/02	0	0	0
WATER	AP-102	5/2/02	5/2/02	0	0	0
244-BX	AP-102	5/13/02	5/13/02	15	0	0
BY-105	244-BX	5/13/02	6/19/02	4	0	3

Table F-3. Transactions for Fiscal Year 2002

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
BY-106	244-BX	5/13/02	6/19/02	5	0	3
AW-102	242-A	5/29/02	6/3/02	1070	0	0
TAL88	AP-102	6/1/02	6/1/02	2	0	0
SPN87	SY-102	6/1/02	6/1/02	3	0	0
34L87	AP-102	6/1/02	6/1/02	0	0	0
EVAPF	AP-102	6/1/02	6/1/02	10	0	0
PXTCO	AP-102	6/1/02	6/1/02	5	0	0
WATER	SY-102	6/2/02	6/2/02	1	0	0
WATER	AP-102	6/2/02	6/2/02	1	0	0
WATER	AP-102	6/2/02	6/2/02	0	0	0
WATER	AP-102	6/2/02	6/2/02	0	0	0
AP-107	AW-102	6/3/02	6/8/02	1070	0	0
S-101	SY-102	6/5/02	8/20/02	35	0	14
AW-102	242-A	6/8/02	6/9/02	218	0	0
AW-106	AW-104	6/9/02	6/14/02	828	0	0
AW-102	242-A	6/11/02	6/15/02	852	0	0
244-BX	AP-102	6/19/02	6/19/02	15	0	0
AP-102	AP-107	6/19/02	6/24/02	1012	0	0
BY-105	244-BX	6/19/02	8/2/02	4	0	3
BY-106	244-BX	6/19/02	8/2/02	5	0	3
AP-107	AW-102	6/24/02	6/29/02	1059	0	0
A-101	AP-102	6/24/02	10/16/02	11	0	9
AX-101	AP-102	6/24/02	10/16/02	10	0	8
34L87	AP-102	7/1/02	7/1/02	0	0	0
TAL88	AP-102	7/1/02	7/1/02	2	0	0
EVAPF	AP-102	7/1/02	7/1/02	10	0	0
WATER	AP-102	7/2/02	7/2/02	0	0	0
WATER	AP-102	7/2/02	7/2/02	0	0	0
S-107	SY-102	7/19/02	8/20/02	13	0	5
EVAPF	AP-102	8/1/02	8/1/02	10	0	0
34L87	AP-102	8/1/02	8/1/02	0	0	0
TAL88	AP-102	8/1/02	8/1/02	2	0	0
WATER	AP-102	8/2/02	8/2/02	0	0	0
WATER	AP-102	8/2/02	8/2/02	0	0	0
244-BX	AP-102	8/2/02	8/2/02	15	0	0
BY-105	244-BX	8/2/02	9/27/02	4	0	3
BY-106	244-BX	8/2/02	9/27/02	5	0	3
C-103	244-CR	8/3/02	8/5/02	9	0	6
244-CR	AP-103	8/5/02	8/5/02	15	0	0
C-103	244-CR	8/5/02	8/9/02	9	0	6
244-CR	AP-103	8/9/02	8/9/02	15	0	0

Table F-3. Transactions for Fiscal Year 2002

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
C-103	244-CR	8/9/02	8/12/02	9	0	6
244-CR	AP-103	8/12/02	8/12/02	15	0	0
C-103	244-CR	8/12/02	8/17/02	9	0	6
244-CR	AP-103	8/17/02	8/17/02	15	0	0
C-103	244-CR	8/17/02	8/22/02	9	0	6
SY-102	AP-102	8/20/02	8/22/02	532	0	0
244-CR	AP-103	8/22/02	8/22/02	15	0	0
C-103	244-CR	8/22/02	8/29/02	9	0	6
SX-102	SY-102	8/22/02	12/6/02	6	0	2
S-111	SY-102	8/22/02	12/6/02	6	0	2
S-102	SY-102	8/22/02	12/17/02	6	0	13
U-111	SY-102	8/22/02	12/22/02	8	0	3
U-108	SY-102	8/22/02	1/19/03	9	0	18
U-109	SY-102	8/22/02	2/10/03	8	0	3
S-107	SY-102	8/22/02	2/10/03	37	0	15
S-101	SY-102	8/22/02	2/10/03	35	0	14
S-112	SY-102	8/22/02	2/10/03	19	0	8
SX-101	SY-102	8/22/02	2/10/03	10	0	14
244-CR	AP-103	8/29/02	8/29/02	15	0	0
C-103	244-CR	8/29/02	9/8/02	9	0	6
TAL88	AP-102	9/1/02	9/1/02	2	0	0
SPN87	SY-102	9/1/02	9/1/02	3	0	0
34L87	AP-102	9/1/02	9/1/02	0	0	0
EVAPF	AP-102	9/1/02	9/1/02	10	0	0
WATER	SY-102	9/2/02	9/2/02	1	0	0
WATER	AP-102	9/2/02	9/2/02	0	0	0
WATER	AP-102	9/2/02	9/2/02	0	0	0
244-CR	AP-103	9/8/02	9/8/02	15	0	0
C-103	244-CR	9/8/02	9/24/02	9	0	6
244-CR	AP-103	9/24/02	9/24/02	15	0	0
C-103	244-CR	9/24/02	11/18/02	8	0	5
244-BX	AP-102	9/27/02	9/27/02	15	0	0
BY-105	244-BX	9/27/02	12/12/02	4	0	3
BY-106	244-BX	9/27/02	12/12/02	5	0	3

APPENDIX G.

SINGLE-SHELL TANK RETRIEVAL SEQUENCE FOR CASE 1

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G1.0 Single-Shell Retrieval Sequence for Case 1

Table G-1. Single-Shell Retrieval Sequence for Case 1.

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)
241-S-112	10/1/2004	198	4/17/2005	1,347,300	4,837	1,352,137
241-S-102	1/3/2006	111	4/24/2006	836,100	8,401	844,501
241-S-105	1/1/2007	310	11/7/2007	1,326,005	2,549	1,328,554
241-S-106	1/2/2007	319	11/17/2007	1,140,419	4,929	1,145,348
241-S-107	1/3/2007	262	9/22/2007	927,934	35,456	963,390
241-S-101	1/4/2007	292	10/23/2007	1,539,169	49,389	1,588,558
241-C-102	1/5/2007	201	7/25/2007	1,383,321	51,539	1,434,860
241-C-112	9/30/2007	95	1/3/2008	509,741	19,965	529,705
241-U-108	10/1/2007	263	6/20/2008	1,097,780	28,124	1,125,903
241-BY-111	10/2/2007	282	7/10/2008	1,430,043	45,215	1,475,258
241-U-107	10/3/2007	244	6/3/2008	730,479	3,813	734,292
241-C-104	1/16/2008	185	7/19/2008	717,700	49,536	767,236
241-S-110	9/30/2008	730	9/30/2010	1,093,815	19,665	1,113,480
241-S-108	10/1/2008	361	9/27/2009	1,257,000	2,483	1,259,482
241-C-103	10/2/2008	75	12/16/2008	564,078	21,087	585,165
241-A-106	10/3/2008	149	3/1/2009	438,513	13,567	452,080
241-C-105	12/15/2008	118	4/12/2009	682,792	25,316	708,108
241-AX-103	2/27/2009	145	7/22/2009	276,066	3,073	279,138
241-A-102	4/13/2009	111	8/2/2009	91,981	2,536	94,516
241-BX-104	9/30/2009	91	12/30/2009	684,931	26,008	710,939
241-SX-105	10/1/2009	426	12/1/2010	1,249,122	11,733	1,260,855
241-SX-103	10/2/2009	730	10/2/2011	1,352,019	8,275	1,360,294
241-TX-118	10/3/2009	229	5/20/2010	823,912	8,487	832,399
241-B-101	10/4/2009	99	1/11/2010	358,036	3,323	361,358
241-AX-102	10/5/2009	110	1/23/2010	64,625	1,131	65,756
241-U-106	10/6/2009	145	2/28/2010	480,476	2,776	483,252
241-C-101	10/7/2009	87	1/2/2010	324,837	11,519	336,356
241-U-105	9/30/2010	232	5/20/2011	908,877	11,167	920,044
241-T-101	10/1/2010	93	1/2/2011	779,023	30,343	809,367
241-S-104	10/2/2010	208	4/28/2011	1,661,838	55,609	1,717,448
241-TX-113	10/3/2010	352	9/20/2011	2,460,712	18,676	2,479,388
241-BY-105	10/4/2010	303	8/3/2011	1,348,385	37,255	1,385,641
241-A-101	11/15/2010	543	5/11/2012	817,208	2,593	819,801
241-BY-109	11/16/2010	265	8/8/2011	764,956	16,591	781,547
241-A-103	11/17/2010	266	8/10/2011	913,484	8,360	921,843
241-U-102	11/18/2010	218	6/24/2011	672,677	11,774	684,451
241-SX-104	11/19/2010	685	10/4/2012	1,103,527	10,906	1,114,433
241-SX-101	11/20/2010	310	9/26/2011	1,094,033	12,624	1,106,656
241-BX-103	9/30/2011	75	12/14/2011	307,266	11,963	319,228

Table G-1. Single-Shell Retrieval Sequence for Case 1.

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)
241-T-111	10/1/2011	257	6/14/2012	710,982	27,062	738,043
241-TX-101	10/2/2011	105	1/15/2012	523,656	18,006	541,661
241-S-103	10/3/2011	175	3/26/2012	608,960	3,304	612,264
241-C-107	10/31/2011	158	4/6/2012	557,247	31,108	588,356
241-AX-101	12/6/2011	446	2/24/2013	745,545	8,489	754,034
241-BX-105	12/7/2011	70	2/15/2012	242,660	8,965	251,625
241-U-110	12/8/2011	148	5/4/2012	1,545,445	55,884	1,601,329
241-TX-112	12/9/2011	373	12/16/2012	1,854,437	18,720	1,873,157
241-U-103	12/10/2011	265	8/31/2012	938,573	5,795	944,368
241-BY-103	12/11/2011	255	8/22/2012	1,124,083	20,801	1,144,884
241-SX-111	12/12/2011	155	5/15/2012	797,640	28,048	825,688
241-SX-109	12/13/2011	217	7/17/2012	1,163,411	36,273	1,199,684
241-BY-104	9/30/2012	257	6/14/2013	1,087,451	11,799	1,099,249
241-SX-106	10/1/2012	321	8/18/2013	982,912	16,796	999,708
241-BX-101	10/2/2012	75	12/16/2012	285,088	10,859	295,947
241-B-111	12/8/2012	157	5/14/2013	301,004	11,567	312,571
241-SX-102	12/9/2012	358	12/2/2013	1,175,354	8,113	1,183,466
241-TX-109	12/10/2012	248	8/15/2013	426,023	9,742	435,765
241-C-111	12/11/2012	296	10/3/2013	393,399	14,186	407,585
241-TY-103	12/12/2012	146	5/7/2013	471,132	18,946	490,078
241-BX-102	12/13/2012	91	3/14/2013	473,620	17,814	491,434
241-TX-105	12/14/2012	359	12/8/2013	1,743,346	18,117	1,761,463
241-T-104	12/15/2012	237	8/9/2013	520,587	18,241	538,829
241-SX-107	12/16/2012	140	5/5/2013	653,964	22,516	676,480
241-TX-115	12/17/2012	371	12/23/2013	1,624,529	16,820	1,641,350
241-T-105	12/18/2012	93	3/21/2013	281,172	10,045	291,217
241-B-110	12/19/2012	162	5/30/2013	356,524	14,859	371,383
241-BY-101	9/30/2013	252	6/9/2014	959,318	23,845	983,163
241-SX-110	10/1/2013	164	3/14/2014	404,152	14,231	418,383
241-SX-112	11/30/2013	143	4/22/2014	702,157	24,695	726,852
241-TX-104	12/1/2013	102	3/13/2014	119,139	4,020	123,159
241-TX-114	12/2/2013	328	10/26/2014	1,517,257	15,213	1,532,470
241-BY-106	12/3/2013	378	12/16/2014	1,701,925	26,681	1,728,606
241-BY-112	12/4/2013	210	7/2/2014	1,116,222	21,620	1,137,842
241-SX-114	12/5/2013	183	6/6/2014	783,591	24,581	808,172
241-SX-108	12/6/2013	141	4/26/2014	322,122	10,695	332,817
241-TX-116	12/7/2013	376	12/18/2014	1,789,412	49,094	1,838,506
241-T-107	12/8/2013	190	6/16/2014	460,268	15,440	475,707
241-T-110	12/9/2013	225	7/22/2014	297,230	11,912	309,142
241-BY-102	12/10/2013	302	10/8/2014	896,073	20,901	916,974
241-C-109	12/11/2013	75	2/24/2014	320,329	12,219	332,548

Table G-1. Single-Shell Retrieval Sequence for Case 1.

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)
241-TX-110	12/14/2013	403	1/21/2015	1,257,099	14,130	1,271,230
241-BY-110	12/15/2013	259	8/31/2014	1,233,060	17,122	1,250,182
241-TX-117	3/13/2014	371	3/19/2015	1,689,860	20,362	1,710,223
241-BX-112	4/13/2014	123	8/14/2014	353,364	13,280	366,643
241-TY-101	4/14/2014	126	8/18/2014	969,542	35,632	1,005,174
241-BX-106	6/10/2014	68	8/17/2014	183,107	6,995	190,101
241-BX-107	6/21/2014	213	1/20/2015	899,501	35,587	935,089
241-TX-106	9/30/2014	282	7/9/2015	1,017,017	4,589	1,021,606
241-S-109	10/1/2014	290	7/18/2015	1,480,789	5,558	1,486,347
241-BX-110	10/2/2014	146	2/25/2015	573,042	17,072	590,115
241-TX-111	10/3/2014	242	6/2/2015	983,646	11,808	995,455
241-U-111	10/4/2014	207	4/29/2015	718,920	9,806	728,726
241-U-109	10/5/2014	264	6/26/2015	787,885	11,608	799,493
241-B-104	10/6/2014	225	5/19/2015	477,157	12,403	489,561
241-BY-108	10/7/2014	176	4/1/2015	468,162	13,118	481,281
241-BY-107	10/8/2014	200	4/26/2015	968,156	18,664	986,819
241-BX-109	12/14/2014	138	5/1/2015	244,820	10,836	255,655
241-B-109	1/21/2015	110	5/11/2015	522,489	18,630	541,119
241-S-111	2/23/2015	352	2/10/2016	956,102	42,224	998,325
241-TX-102	2/24/2015	173	8/16/2015	619,588	6,591	626,179
241-TY-105	2/25/2015	178	8/22/2015	468,438	19,768	488,206
241-C-110	2/26/2015	129	7/5/2015	351,641	13,233	364,873
241-B-103	2/27/2015	75	5/13/2015	153,503	3,946	157,450
241-T-112	3/19/2015	74	6/1/2015	115,438	4,415	119,853
241-TY-104	3/27/2015	93	6/28/2015	146,104	5,551	151,655
241-BX-111	4/20/2015	122	8/20/2015	443,579	6,998	450,576
241-B-106	4/27/2015	100	8/5/2015	138,190	5,308	143,498
241-B-204	5/1/2015	28	5/29/2015	74,542	2,765	77,307
241-B-203	5/9/2015	29	6/7/2015	88,799	3,236	92,035
241-B-107	5/11/2015	123	9/11/2015	485,352	19,617	504,969
241-T-102	5/31/2015	58	7/28/2015	297,724	11,147	308,871
241-B-105	6/1/2015	190	12/8/2015	381,550	4,426	385,976
241-TX-108	6/2/2015	143	10/23/2015	374,179	4,073	378,252
241-U-112	6/3/2015	69	8/11/2015	287,550	10,115	297,665
241-T-203	9/30/2015	21	10/21/2015	60,491	2,327	62,817
241-TX-103	10/8/2015	142	2/27/2016	448,466	4,496	452,962
241-U-104	10/9/2015	106	1/23/2016	479,526	15,689	495,214
241-B-108	10/10/2015	90	1/8/2016	257,823	9,426	267,249
241-B-102	10/11/2015	64	12/14/2015	108,592	2,770	111,363
241-T-204	10/12/2015	23	11/4/2015	59,096	2,281	61,377
241-T-108	10/13/2015	70	12/22/2015	139,919	4,967	144,886

Table G-1. Single-Shell Retrieval Sequence for Case 1.

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)
241-B-112	10/14/2015	65	12/18/2015	45,787	1,841	47,628
241-TX-107	10/15/2015	90	1/13/2016	92,220	1,914	94,133
241-T-109	10/16/2015	76	12/31/2015	159,158	1,643	160,801
241-TY-102	10/22/2015	99	1/29/2016	208,120	561	208,681
241-C-108	10/23/2015	77	1/8/2016	236,345	7,996	244,340
241-SX-113	10/24/2015	98	1/30/2016	176,245	6,497	182,742
241-A-105	10/25/2015	344	10/3/2016	220,618	7,917	228,535
241-SX-115	10/31/2015	62	1/1/2016	42,838	1,385	44,223
241-U-101	11/1/2015	61	1/1/2016	143,065	5,014	148,079
241-T-103	12/8/2015	62	2/8/2016	131,222	5,009	136,232
241-A-104	1/8/2016	101	4/18/2016	237,184	8,713	245,896
241-BX-108	1/14/2016	63	3/17/2016	49,742	2,020	51,762
241-AX-104	1/15/2016	36	2/20/2016	89,758	3,359	93,117
241-TY-106	1/16/2016	70	3/26/2016	129,253	4,918	134,171
241-T-106	9/30/2016	58	11/27/2016	122,992	4,611	127,603
241-B-201	10/1/2016	18	10/19/2016	116,485	4,384	120,869
241-B-202	10/2/2016	18	10/20/2016	30,105	1,185	31,290
241-C-202	10/3/2016	12	10/15/2016	8,004	299	8,303
241-T-201	10/4/2016	18	10/22/2016	111,767	4,186	115,953
241-T-202	10/5/2016	15	10/20/2016	34,599	1,340	35,939
241-U-201	10/6/2016	7	10/13/2016	21,120	777	21,897
241-U-202	10/7/2016	7	10/14/2016	21,121	777	21,898
241-U-203	10/8/2016	13	10/21/2016	10,600	384	10,984
241-U-204	10/9/2016	13	10/22/2016	15,600	577	16,177
241-C-201	10/10/2016	6	10/16/2016	16,296	662	16,958
241-C-203	10/11/2016	7	10/18/2016	29,941	1,169	31,109
241-C-204	10/12/2016	7	10/19/2016	13,272	513	13,785

G2.0 Risk Reduction Curves for Case 1

Figure G-1. Case 1 Airborne Risk Reduction Over Time.

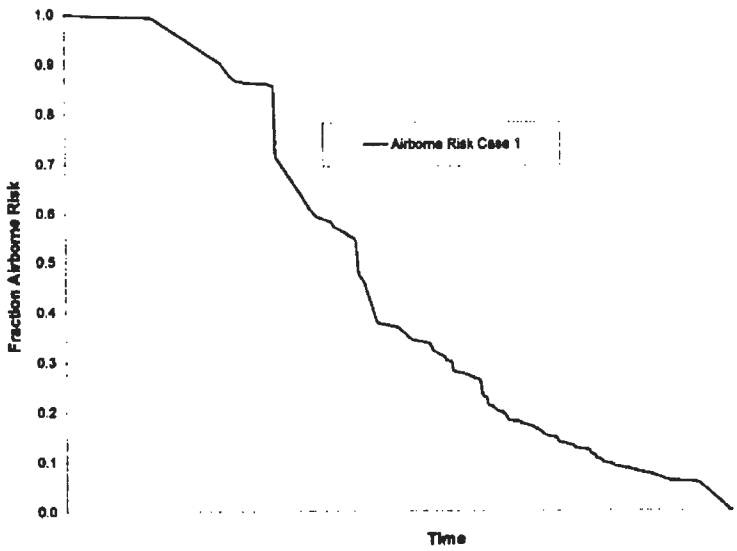


Figure G-2. Case 1 Groundwater Risk Reduction Over Time

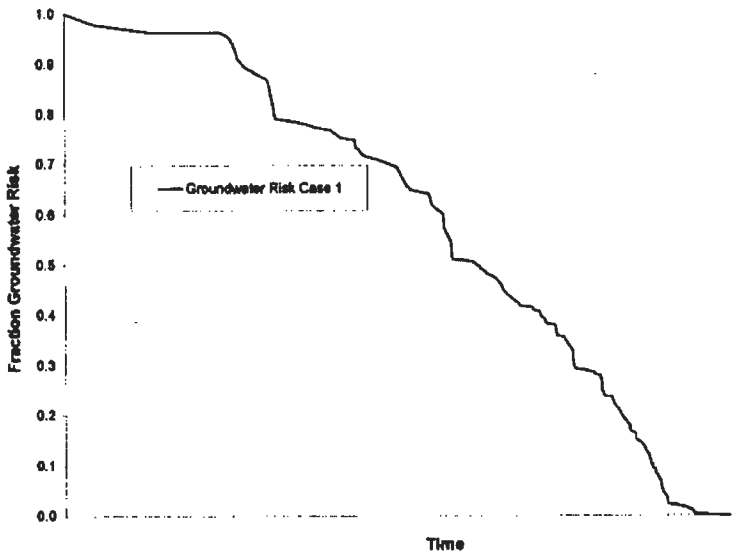
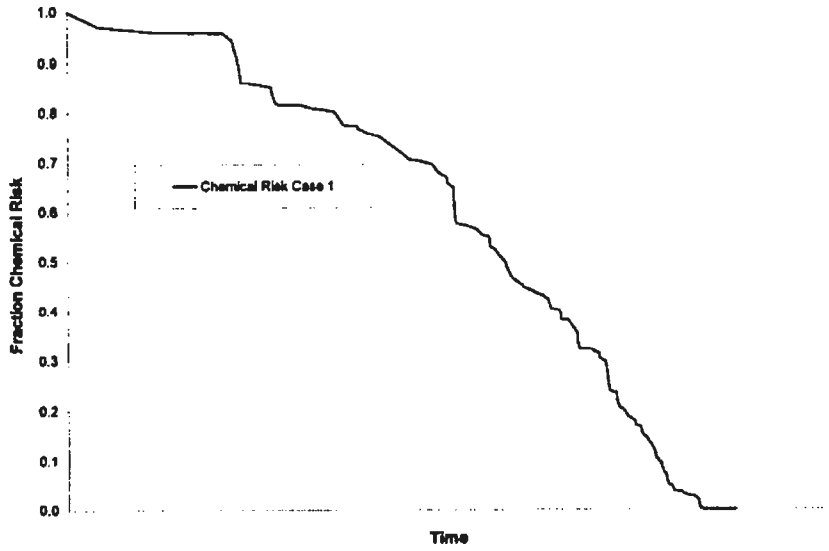


Figure G-3. Chemical Risk Reduction Over Time



APPENDIX H.

SINGLE-SHELL TANK RETRIEVAL SEQUENCE FOR CASE 3

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H1.0 Single-Shell Retrieval Sequence for Case 3

Table H-1. Single-Shell Retrieval Sequence for Case 3.

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)
241-S-112	10/1/2004	198	4/17/2005	1,347,300	4,837	1,352,137
241-S-102	1/3/2006	111	4/24/2006	836,100	8,401	844,501
241-C-202	9/30/2006	5	10/5/2006	8,004	299	8,303
241-C-204	9/30/2006	7	10/7/2006	13,272	513	13,785
241-C-201	10/5/2006	6	10/11/2006	16,296	662	16,958
241-C-203	10/7/2006	7	10/14/2006	29,941	1,169	31,109
241-AX-102	10/11/2006	110	1/29/2007	64,625	1,131	65,756
241-U-201	9/30/2007	13	10/13/2007	21,120	777	21,897
241-U-204	9/30/2007	6	10/6/2007	15,600	577	16,177
241-U-203	9/30/2007	6	10/6/2007	10,600	384	10,984
241-AX-104	9/30/2007	36	11/5/2007	89,759	3,359	93,118
241-C-104	1/16/2008	185	7/19/2008	717,700	49,536	767,236
241-U-202	9/30/2008	7	10/7/2008	21,121	777	21,898
241-T-204	9/30/2008	23	10/23/2008	59,096	2,281	61,377
241-T-202	9/30/2008	15	10/15/2008	34,599	1,340	35,939
241-B-202	9/30/2008	18	10/18/2008	30,105	1,185	31,290
241-BX-108	9/30/2008	63	12/2/2008	49,742	2,020	51,762
241-B-112	9/30/2008	65	12/4/2008	45,787	1,841	47,628
241-SX-115	9/30/2008	62	12/1/2008	42,838	1,385	44,224
241-T-203	9/30/2009	21	10/21/2009	60,491	2,327	62,817
241-B-204	9/30/2009	28	10/28/2009	74,542	2,765	77,307
241-B-203	9/30/2009	28	10/28/2009	88,799	3,236	92,035
241-TX-107	9/30/2009	89	12/28/2009	92,220	1,914	94,133
241-T-201	10/21/2009	18	11/8/2009	111,767	4,186	115,953
241-T-112	10/21/2009	74	1/3/2010	115,438	4,415	119,853
241-B-102	10/21/2009	64	12/24/2009	108,592	2,770	111,363
241-A-102	10/21/2009	111	2/9/2010	91,981	2,536	94,516
241-B-201	9/30/2010	18	10/18/2010	116,485	4,384	120,869
241-TY-106	9/30/2010	70	12/9/2010	129,253	4,918	134,171
241-TY-104	9/30/2010	93	1/1/2011	146,104	5,551	151,655
241-TX-104	9/30/2010	99	1/7/2011	119,139	4,020	123,159
241-U-101	9/30/2010	61	11/30/2010	143,065	5,014	148,079
241-T-103	9/30/2010	62	12/1/2010	131,222	5,009	136,232
241-T-106	9/30/2010	58	11/27/2010	122,992	4,611	127,603
241-T-108	9/30/2010	69	12/8/2010	139,919	4,967	144,886
241-B-106	9/30/2010	100	1/8/2011	138,190	5,308	143,498
241-B-103	10/18/2010	74	12/31/2010	153,503	3,946	157,450
241-SX-113	10/18/2010	98	1/24/2011	176,245	6,497	182,742
241-TY-102	9/30/2011	99	1/7/2012	208,120	561	208,681

Table H-1. Single-Shell Retrieval Sequence for Case 3.

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)
241-T-109	9/30/2011	73	12/12/2011	159,158	1,643	160,801
241-C-108	9/30/2011	77	12/16/2011	236,345	7,996	244,340
241-BX-106	9/30/2011	68	12/7/2011	183,107	6,995	190,101
241-BX-105	9/30/2011	70	12/9/2011	242,660	8,965	251,625
241-A-105	9/30/2011	84	12/23/2011	220,619	7,917	228,536
241-C-107	10/31/2011	158	4/6/2012	557,247	31,108	588,356
241-U-112	12/7/2011	69	2/14/2012	287,550	10,115	297,665
241-T-102	12/7/2011	58	2/3/2012	297,724	11,147	308,871
241-T-105	12/7/2011	92	3/8/2012	281,172	10,045	291,217
241-BX-101	12/7/2011	69	2/14/2012	285,088	10,859	295,947
241-BX-109	12/7/2011	137	4/22/2012	244,820	10,836	255,655
241-B-108	12/7/2011	90	3/6/2012	257,823	9,426	267,249
241-T-110	9/30/2012	224	5/12/2013	297,230	11,912	309,142
241-BX-103	9/30/2012	75	12/14/2012	307,266	11,963	319,228
241-B-111	9/30/2012	157	3/6/2013	301,004	11,567	312,571
241-AX-103	9/30/2012	139	2/16/2013	276,066	3,073	279,138
241-A-104	9/30/2012	101	1/9/2013	237,184	8,713	245,897
241-TX-109	12/10/2012	247	8/14/2013	426,023	9,742	435,765
241-TX-103	12/10/2012	140	4/29/2013	448,466	4,496	452,962
241-TX-108	12/10/2012	129	4/18/2013	374,179	4,073	378,252
241-T-107	12/10/2012	127	4/16/2013	460,268	15,440	475,707
241-BX-112	12/10/2012	123	4/12/2013	353,364	13,280	366,643
241-B-101	12/10/2012	99	3/19/2013	358,036	3,323	361,358
241-B-105	12/10/2012	190	6/18/2013	381,550	4,426	385,976
241-B-110	12/10/2012	162	5/21/2013	356,524	14,859	371,383
241-SX-108	12/10/2012	131	4/20/2013	322,122	10,695	332,817
241-SX-110	12/10/2012	125	4/14/2013	404,152	14,231	418,383
241-U-106	9/30/2013	146	2/23/2014	480,476	2,776	483,252
241-TY-103	2/10/2014	142	7/2/2014	471,132	18,946	490,078
241-TY-105	2/10/2014	175	8/4/2014	468,438	19,768	488,206
241-TX-101	2/10/2014	232	9/30/2014	523,656	18,006	541,661
241-TX-102	2/10/2014	168	7/28/2014	619,588	6,591	626,179
241-S-103	2/10/2014	175	8/4/2014	608,960	3,304	612,264
241-BY-108	2/10/2014	175	8/4/2014	468,162	13,118	481,281
241-U-104	2/10/2014	103	5/24/2014	479,526	15,689	495,214
241-T-104	2/10/2014	236	10/4/2014	520,587	18,241	538,829
241-C-101	2/10/2014	87	5/8/2014	324,837	11,519	336,356
241-C-109	2/10/2014	75	4/26/2014	320,329	12,219	332,548
241-BX-111	2/10/2014	123	6/13/2014	443,579	6,998	450,576
241-BX-102	2/10/2014	96	5/17/2014	473,620	17,814	491,434
241-B-104	2/10/2014	223	9/21/2014	477,157	12,403	489,561

Table H-1. Single-Shell Retrieval Sequence for Case 3.

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)
241-B-107	2/10/2014	128	6/18/2014	485,352	19,617	504,969
241-B-109	2/10/2014	114	6/4/2014	522,489	18,630	541,119
241-SX-107	2/23/2014	135	7/8/2014	653,964	22,516	676,480
241-C-110	4/26/2014	129	9/2/2014	351,641	13,233	364,873
241-C-111	5/8/2014	76	7/23/2014	393,399	14,186	407,585
241-BX-110	5/17/2014	143	10/7/2014	573,042	17,072	590,115
241-U-102	5/24/2014	217	12/27/2014	672,677	11,774	684,451
241-U-107	9/30/2014	365	9/30/2015	730,479	3,813	734,291
241-TX-118	10/4/2014	229	5/21/2015	823,912	8,487	832,399
241-S-107	10/4/2014	243	6/4/2015	927,934	35,456	963,390
241-BY-102	10/4/2014	197	4/19/2015	896,073	20,901	916,974
241-BY-109	10/4/2014	265	6/26/2015	764,956	16,591	781,547
241-T-101	10/4/2014	93	1/5/2015	779,023	30,343	809,367
241-T-111	10/4/2014	257	6/18/2015	710,982	27,062	738,043
241-C-112	10/4/2014	95	1/7/2015	509,741	19,965	529,705
241-BX-104	10/4/2014	92	1/4/2015	684,931	26,008	710,939
241-BX-107	10/4/2014	210	5/2/2015	899,501	35,587	935,089
241-SX-111	10/4/2014	155	3/8/2015	797,640	28,048	825,688
241-SX-114	10/4/2014	182	4/4/2015	783,591	24,581	808,172
241-SX-112	10/4/2014	142	2/23/2015	702,157	24,695	726,852
241-A-106	10/4/2014	145	2/26/2015	438,513	13,567	452,080
241-BY-101	10/7/2014	248	6/12/2015	959,318	23,845	983,163
241-U-111	12/27/2014	206	7/21/2015	718,920	9,806	728,726
241-BY-107	1/4/2015	192	7/15/2015	968,156	18,664	986,819
241-TX-111	1/5/2015	240	9/2/2015	983,646	11,808	995,455
241-C-103	1/7/2015	78	3/26/2015	564,078	21,087	585,165
241-S-111	2/23/2015	348	2/6/2016	956,102	42,224	998,325
241-C-105	2/26/2015	110	6/16/2015	682,792	25,316	708,108
241-SX-106	3/8/2015	322	1/24/2016	982,912	16,796	999,707
241-AX-101	3/26/2015	443	6/11/2016	745,545	8,489	754,034
241-TY-101	4/4/2015	122	8/4/2015	969,542	35,632	1,005,174
241-TX-106	4/19/2015	280	1/24/2016	1,017,017	4,589	1,021,606
241-BY-104	5/2/2015	260	1/17/2016	1,087,451	11,799	1,099,249
241-SX-101	5/21/2015	317	4/2/2016	1,094,033	12,624	1,106,656
241-U-109	9/30/2015	263	6/19/2016	787,885	11,608	799,493
241-TX-110	12/15/2015	290	9/30/2016	1,257,099	14,130	1,271,230
241-BY-103	12/15/2015	256	8/27/2016	1,124,083	20,801	1,144,884
241-BY-105	12/15/2015	304	10/14/2016	1,348,385	37,255	1,385,641
241-BY-110	12/15/2015	257	8/28/2016	1,233,060	17,122	1,250,182
241-BY-111	12/15/2015	285	9/25/2016	1,430,043	45,215	1,475,258
241-BY-112	12/15/2015	205	7/7/2016	1,116,222	21,620	1,137,842

Table H-1. Single-Shell Retrieval Sequence for Case 3.

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)
241-U-105	12/15/2015	234	8/5/2016	908,877	11,167	920,044
241-U-103	12/15/2015	457	3/16/2017	938,573	5,795	944,368
241-A-101	12/15/2015	537	6/4/2017	817,208	2,593	819,801
241-TX-114	1/17/2016	320	12/2/2016	1,517,257	15,213	1,532,470
241-TX-115	1/24/2016	377	2/4/2017	1,624,529	16,820	1,641,350
241-S-110	1/24/2016	262	10/12/2016	1,093,815	19,665	1,113,480
241-SX-104	2/6/2016	394	3/6/2017	1,103,527	10,906	1,114,433
241-S-106	4/2/2016	295	1/22/2017	1,140,419	4,929	1,145,348
241-A-103	6/11/2016	263	3/1/2017	913,484	8,360	921,843
241-U-108	6/19/2016	311	4/26/2017	1,097,780	28,124	1,125,903
241-TX-117	7/7/2016	366	7/8/2017	1,689,860	20,362	1,710,223
241-SX-102	8/5/2016	364	8/4/2017	1,175,353	8,113	1,183,466
241-BY-106	8/27/2016	369	8/31/2017	1,701,925	26,681	1,728,606
241-TX-105	8/28/2016	359	8/22/2017	1,743,346	18,117	1,761,463
241-TX-116	9/30/2016	375	10/10/2017	1,789,412	49,094	1,838,506
241-TX-112	10/12/2016	381	10/28/2017	1,854,437	18,720	1,873,157
241-SX-109	10/12/2016	217	5/17/2017	1,163,411	36,273	1,199,684
241-TX-113	12/2/2016	358	11/25/2017	2,460,712	18,676	2,479,388
241-SX-105	1/22/2017	430	3/28/2018	1,249,121	11,733	1,260,854
241-C-102	3/1/2017	205	9/22/2017	1,383,321	51,539	1,434,860
241-S-108	3/6/2017	378	3/19/2018	1,256,999	2,483	1,259,482
241-S-105	3/16/2017	302	1/12/2018	1,326,004	2,549	1,328,554
241-SX-103	4/26/2017	408	6/8/2018	1,352,019	8,275	1,360,294
241-S-109	5/17/2017	313	3/26/2018	1,480,789	5,558	1,486,347
241-S-101	8/4/2017	288	5/19/2018	1,539,169	49,389	1,588,558
241-U-110	1/12/2018	135	5/27/2018	1,545,445	55,884	1,601,329
241-S-104	3/19/2018	214	10/19/2018	1,661,838	55,609	1,717,448

H2.0 Risk Reduction Curves for Case 3

Figure H-1. Case 3 Airborne Risk Reduction Versus Volume Retrieved.

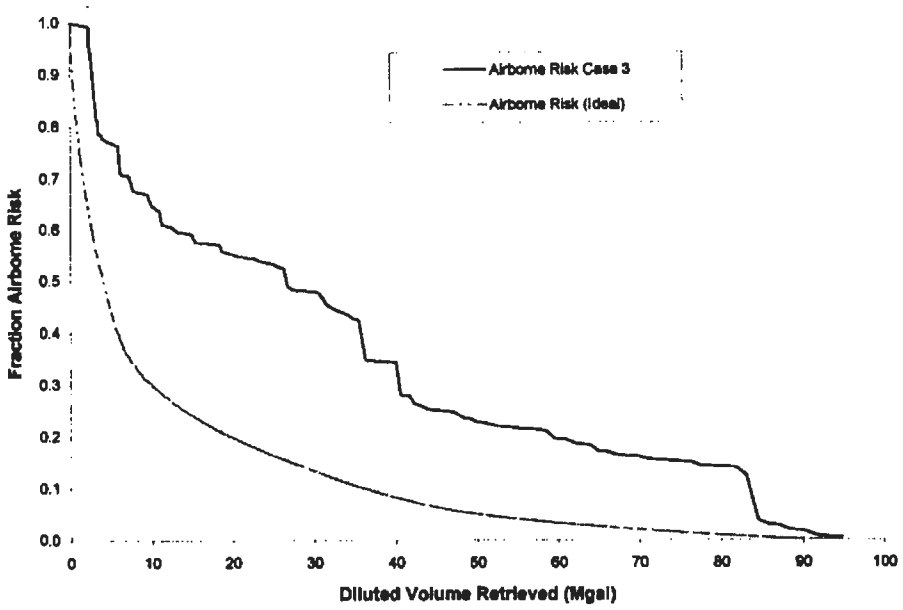


Figure H-2. Case 3 Groundwater Risk Reduction Versus Volume Retrieved.

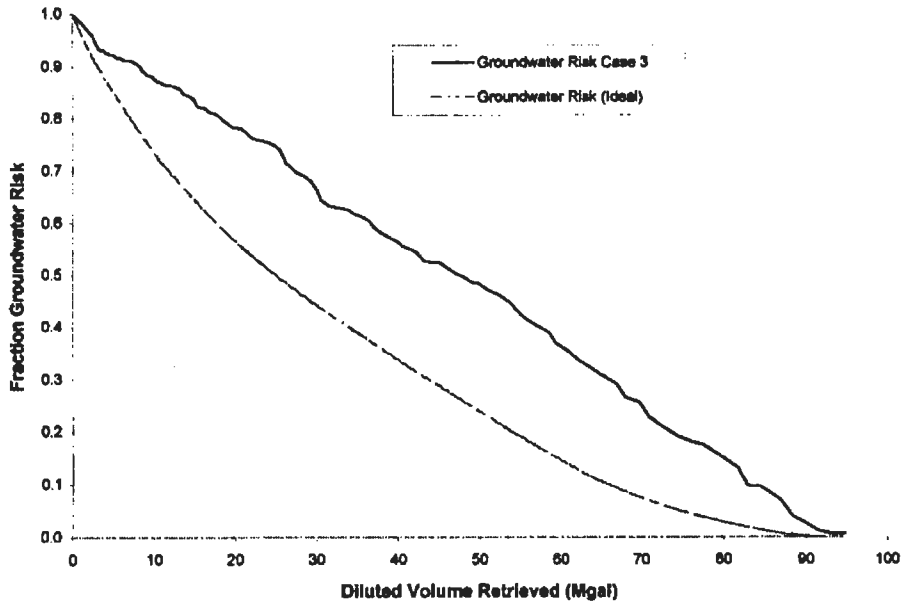


Figure H-3. Case 3 Chemical Risk Reduction Versus Volume Retrieved.

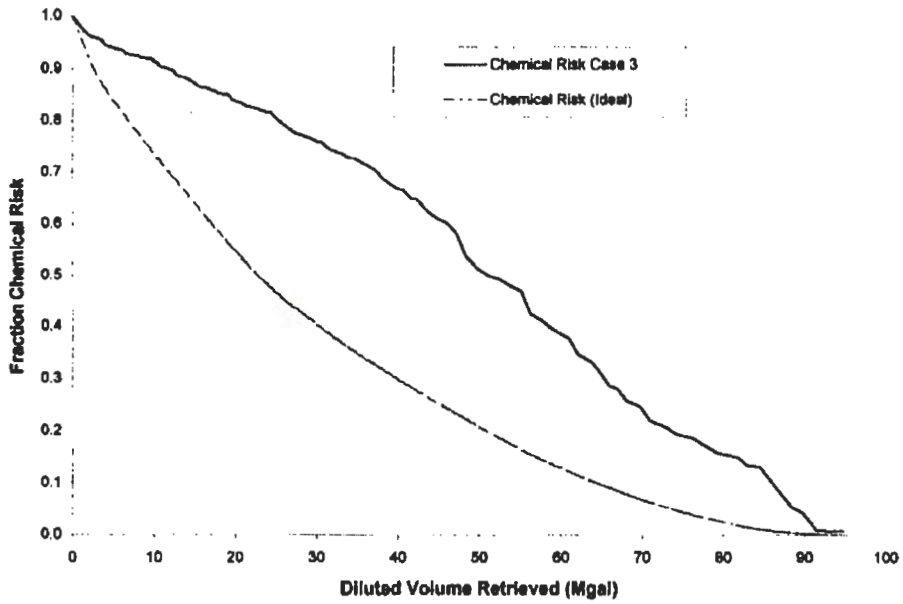


Figure H-4. Case 3 Airborne Risk Reduction Over Time.

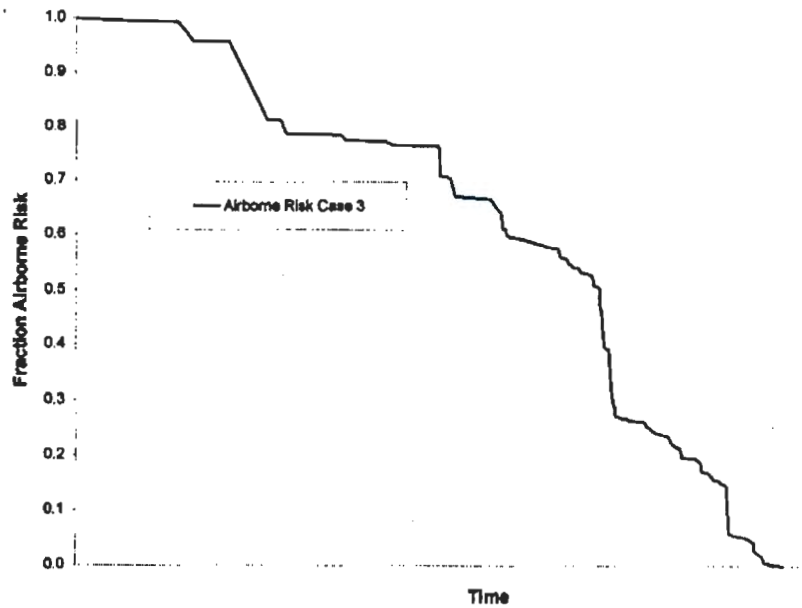


Figure H-5. Case 3 Groundwater Risk Reduction Over Time.

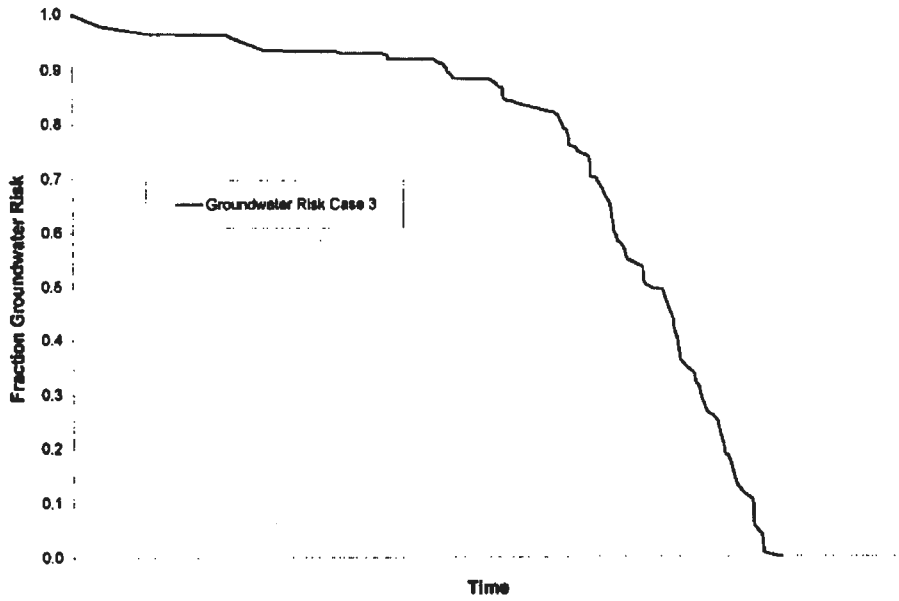
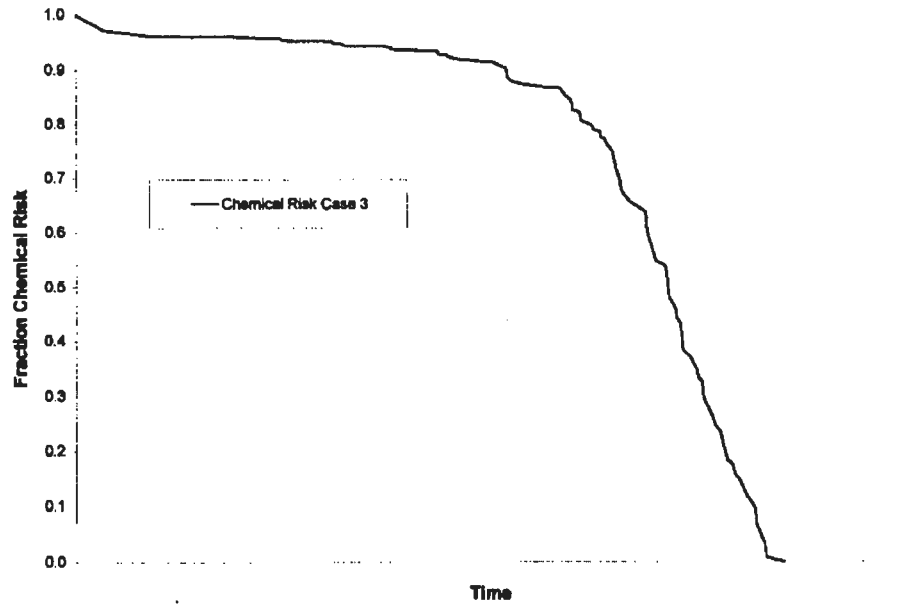


Figure H-6. Case 3 Chemical Risk Reduction Over Time.



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