ENGINEERING CHANGE NOTICE

1. ECN 669257

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ☐ Cancel/Void ☐	J.A. Seidl and J.N. Strode, Inventory & Flowsheet Engineering, R3-73, 373-1280	☐ Yes ☒ No	09/20/02
	6. Project Title/No./Work Order No. HPAB0491 SST Retrieval Sequence and DST Space Evaluation 116890/AJ60	7. Bldg./Sys./Fac. No. N/A	8. Approval Designator N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) RPP-8554, Rev. 0	10. Related ECN No(s). N/A	11. Related PO No. N/A

12a. Modification Work	12b. Work Package No.	12c. Modification Work Completed	12d. Restored to Original Condition (Temp. or Standby ECNs only)
☐ Yes (fill out Blk. 12b) ☒ No (NA Blks. 12b, 12c, 12d)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

Complete Revision

13b. Design Baseline Document? ☐ Yes ☒ No

14a. Justification (mark one)	14b. Justification Details
Criteria Change ☒ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-Found ☐ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐	Yearly update, incorporating comments from users.

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16. Design Verification Required	17. Cost Impact		18. Schedule Impact (days)
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19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐
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Environmental Permit	☐	Inventory Adjustment Request	☐		☐

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N/A		

21. Approvals

	Signature	Date		Signature	Date
Design Authority			Design Agent		
Cog. Eng.	J.N. Strode/J.A. Seidl	9/20/02	PE		
Cog. Mgr.	N.W. Kirch	9/20/02	QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other			Other		
T.W. Crawford		9/23/02			
R.A. Dodd		9/23/02			
D.J. Washenfelder		9/23/02	DEPARTMENT OF ENERGY		
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Single-Shell Tank Retrieval Sequence and Double-Shell Tank Space Evaluation

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U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: ECN-669257 UC: 2070
Org Code: 7G300 Charge Code: 12214-04849
B&R Code: EW 3120074 Total Pages: 213 jda 9/23

Key Words: Double-shell tank, single-shell tank, retrieval, risk, space evaluation.

Abstract: This document describes the baseline single-shell tank (SST) waste retrieval sequence for the River Protection Project updated for Fiscal Year 2002. The double-shell tank (DST) space evaluation presents projected DST needs for the Hanford Site and the need to build additional DSTs. This document satisfies 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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SEP 23 2002
DATE:
STA: 15
HANFORD RELEASE
ID: 20

Janis Aardal 9-23-02
Release Approval Date Release Stamp

Approved For Public Release

RECORD OF REVISION

(1) Document Number: RPP-8554

Page 1

(2) Title: Single-Shell Tank Retrieval Sequence and Double-Shell Tank Space Evaluation

Change Control Record

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Initially released 09/20/01 on EDT-628412.	J.A. Seidl	N.W. Kirch
		J.N. Strode	
1 RS	Incorporate per ECN-669257.	J.A. Seidl GS K, for SAS	N.W. Kirch NW Kirch 9/23/02
		J.N. Strode J.N. Strode	

A-7320-005 (10/97)

RPP-8554
Revision 1

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

Approved for public release

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

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September 2002

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Office of River Protection under Contract DE-AC27-99RL14047

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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) 2002, and the basis for evaluating future double-shell tank (DST) space needs and waste transfers through completion of the RPP mission. It satisfies 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.*

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, plus a subset of Case 3, called 3b. (Table 1-1 summarizes assumptions and results for each case, with more detailed assumptions located in Appendix A.) All cases employ a risk-based logic, developed for Rev 0 of this report and described in Appendix B, for selecting the SST retrieval sequence. The first few tanks already have a fixed retrieval schedule. For the others, a ground water risk list is generated, with all the remaining SSTs ordered by ground water risk ranking. An airborne risk list is also generated, with the same SSTs ordered by airborne contamination risk ranking. During the course of the retrieval, to determine what tank to retrieve next, the model selects in each list the available, highest risk, tank, taking into account the infrastructure in place. Among those two tanks, the model then selects the tank that best balances the feed of High Level Waste (HLW) and Low Activity Waste (LAW) melters, to keep the Waste Treatment Plant (WTP) operating steadily.

Once selected, SST retrievals are timed to occur as space within the DSTs will allow. In addition, Case 3b assumes new DSTs are built, as needed to complete SST retrieval by 9/30/2018. The time required to retrieve an SST is estimated based on the actual techniques assumed to be used for retrieval. This is a change from Rev 0 of this report, which used only past practice sluicing as the basis for retrieval time estimates.

Changes to the SST retrieval priority order from Rev 0 of this document are due to changes in estimated tank waste inventories. In addition, changes in Case 3 (and 3b) reflect a modification of the SST risk prioritization (see description of Case 3 below).

Case 1 [Reference Case] reflects the current tank farm technical baseline. This case is an update of Case 2 from Rev 0 of this report, and is the same case as described in Rev 4 of the Tank Farm Contractor Operation and Utilization Plan (TFCO&UP), HNF-SD-WM-SP-012. This case assumes tank space savings options of 0.85 Mgal are implemented and no new DSTs are built. Waste retrieval facilities and SST tank farm upgrades are assumed available according to the current baseline schedule. For the time before 3/1/2018, this case uses essentially the same treatment rates as those used in TFCO&UP Rev 3a (27 MT/d for LAW glass, and 1 MT/d for HLW glass).

After 3/1/2018, the treatment rates are increased to accommodate complete processing by 12/31/2028 (157.5 MT/d for LAW, 10.3 MT/d for HLW). The increased rates from last year's version (respectively 102 MT/d and 10.2 MT/d) are due to a change in the estimated sulfate loading allowed in LAW glass, resulting in production of a higher volume of glass, hence requiring higher capacity to complete processing by 2028. Case 1 does not meet the 2018 SST Retrieval milestone M-45-05; retrieval is accomplished by 2026. It does meet the 2028 End of Waste Processing milestone, at the expense of an aggressive WTP capacity ramp-up. The FY 2002 SST retrieval sequence shows a slight improvement in risk reduction performance over previous sequence submittals (Figures 4-1 through 4-3).

Case 2 [Updated RPP System Plan/Ecology Case 1b] assumes the WTP operates at higher treatment rates than Case 1 from hot commissioning to 3/1/2018 (see pA-9), as proposed by the WTP contractor. It assumes a moderate increase in capacity after 3/1/2018, from 32 to 64 MT/d for LAW, 2 to 4 MT/d for HLW. This case assumes tank space savings of 3 Mgal are implemented. SST retrieval is accomplished by 2037. Waste processing is completed in 2044. The Case 2 retrieval sequence airborne risk reduction is not as good as in Case 1, particularly for the first 38 Mgal of diluted waste retrieved. The groundwater risk reduction is slightly better than in Case 1 after the first 30 Mgal are retrieved (Figures G-1 and G-2).

Cases 3 [MAI/Closure Case] employs supplemental technologies to meet the required 2028 treatment end date without the LAW vitrification ramp up that occurs in Case 1. It assumes a LAW treatment plant capacity of 6.3 MT/d from 10/1/2007 to 1/30/2010, and then 19.0 MT/d until 12/31/2028. It assumes a HLW treatment plant capacity of 0.77 MT/d from 11/08/2007 to 12/31/2009, and then 4.8 MT/d until 12/31/2028. As with Case 1, Case 3 ends processing in 2028. It assumes tank space saving options of 3 Mgal are implemented, to accelerate SST retrieval. For Case 3, a specific SST retrieval sequence was developed to incorporate the goal of tank farm closures, while preserving a risk-based sequence. Two ranking lists were prepared based on the risk posed by each tank farm, instead of the risk by each individual tank for Cases 1 and 2, based on either airborne or groundwater risk per unit volume of waste. Otherwise, the sequence logic is similar to the one used for Cases 1 and 2. Early retrieval is specified in this case for more tanks than in Cases 1 and 2. For Case 3, all SSTs are retrieved by 2023, for a complete processing by 2028. The airborne risk reduction for Case 3 is not as good as in Case 1 or in Case 2, until 60 Mgal of diluted waste is retrieved (Figure H-1). The groundwater risk reduction is similar to Case 1 (Figure H-2).

A modified set of results was evaluated for Case 3 (Case 3b) to show how many new DST are required to complete SST retrieval by 2018 instead of 2023. Case 3b is the only case to comply with *Hanford Federal Facility Agreement and Consent Order* Milestone M-45-05, which calls for retrieving all waste from remaining single shell tanks by September 30, 2018. In this case, 17 additional DSTs are required to meet the *Hanford Federal Facility Agreement and Consent Order* Milestone M-45-05 (SST retrieval by 9/30/18). The first two new DSTs could be required as early as FY 2012.

Cases 1 and 3 show that the 2028 end of waste processing milestone (M-62-00) can be met, if an aggressive WTP capacity ramp up, or additional, supplemental, waste processing facilities are provided.

The Hanford Federal Facility Agreement and Consent Order (HFFACO) milestones (S-102, C-104, S-112) and proposed milestones (S-105, S-106, S-103, C-106) are met for individual tank retrieval actions in all cases.

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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
ILAW	Immobilized low activity waste
Kgal	kilogallon (1,000 gallons)
LAW	Low-activity waste
MAI	Mission Acceleration Initiative
Mgal	million gallons
MT	metric ton
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

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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) 2002, 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 2002.

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. 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 thereafter.

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 2002. 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 (Reference Case) completes waste treatment in 2028, and includes tank space options to save 0.85 million gallons of space. SST retrieval occurs in a risk-based sequence, within existing DST capacity, at a rate that supports treatment processing. Case 1 represents the current tank farm technical baseline.

Case 2 (Updated RPP System Plan/Ecology Case 1b) includes risk based SST retrieval within existing DST capacity, and includes tank space options to save 3 million gallons. Case 2 waste processing rates are lower than in Case 1 for the time period after 2018. Waste treatment is completed in 2044. Case 2 is based on the *River Protection Project System Plan* (DOE 2002b).

Case 3 (MAI/Closure Case) uses additional treatment options (beyond vitrification in the Waste Treatment Plant) to complete processing in 2028. This case includes tank space options to save 3 million gallons. Under Case 3, supplemental processes are used to provide additional treatment capacity instead of increasing the WTP vitrification capacity. This SST retrieval sequence ranks tanks by risk per unit volume of waste, grouped by tank farm. Case 3b is a subset of Case 3 that is constrained to finish waste retrieval by 2018; new DSTs are built as required to achieve this milestone. Case 3 represents a Target Baseline, which is being prepared to implement the concepts developed in the *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a).

Table 1-1, is a comparison of the main assumptions and results for each projection case. Space saving options beyond the 850 Kgal of space saved by decreasing operational space are not currently funded. Funding from DOE would have to be allocated before more options could be implemented.

Table 1-1. Summary of DST Space Use Projections (Assumptions and Results).

	Case 1	Case 2	Case 3 (Case 3b)
Brief Description	**Reference Case** Risk-based SST Retrieval within Existing DST Capacity Waste feed delivery and treatment match CHG current baseline.	**Updated RPP System Plan (Ecology Case 1b)** Risk-based SST Retrieval within Existing DST Capacity Waste feed delivery and treatment match proposed WTP treatment rates.	**MAI/Closure (Target Baseline)** Risk-based SST Retrieval within Existing DST Capacity Waste feed delivery and treatment match Mission Acceleration Initiative to complete processing in 2028.
DST Space Saving Options Incorporated	Decreasing dedicated operational space will save 0.85 Mgal.	Decreasing dedicated operational space will save 0.85 Mgal; raising tank fill limits will save up to 1.4 Mgal; further concentration of waste will save up to 0.73 Mgal. Total space savings incorporated ~3 Mgal.	Decreasing dedicated operational space will save 0.85 Mgal; raising tank fill limits will save up to 1.4 Mgal; further concentration of waste will save up to 0.73 Mgal. Total space savings incorporated ~3 Mgal.
LAW Vitrification Ramp Up	From - To MTG/day 1/01/08-1/31/11 2.24 2/01/11-2/28/18 27.0 3/01/18-12/31/28 157.5	From - To MTG/day 10/30/07-3/21/08 45.0 3/22/08-2/28/18 32.0 3/01/18-end 64	From - To MTG/day 10/01/07-1/30/10 ~6.3 1/31/10-12/31/28 19.0
Complete Waste Treatment	By 12/31/2028	TBD by projection	By 12/31/2028
LAW Waste Treatment Model for Sulfate	Recycle Sulfate	Recycle Sulfate	Add steam reforming
ILAW Na_2O Loading	Based on the Gimpel Rule	Based on the Gimpel Rule	18 wt% Na_2O
Alternative TRU Treatment Start	N/A	N/A	12/31/2007
Initiate HLW Hot Commissioning	12/31/2007	7/12/2007	7/12/2007
HLW Treatment Rate	From - To MTG/d 1/1/08-1/31/11 0.16 2/1/11-2/28/18 1.0 3/1/18-12/31/28 10.3	From - To MTG/d 11/8/07-3/21/08 3.0 3/22/08-2/28/18 2.0 3/1/18-end 4	From - To MTG/d 11/8/07-1/30/10 0.77 1/31/10-12/31/28 4.08
SST Retrieval Complete Retrieval Wastes Evaporated	TBD by projection (result: ~2026) Through S-102 only	TBD by projection (result: ~2037) Through S-102 only	TBD by projection (result: ~2023) *Case 3b: < 9/30/18* Through S-102 only
Maximum Number of Simultaneous Retrievals	7	7	7
Number of Additional DSTs Required Beyond the Existing 28 Tanks.	None	None	None (Case 3b completes SST retrieval in 2018 and requires 17 new DSTs)

All cases use a risk-based SST sequence, combined with infrastructure and balanced WTP feed constraints. Cases 1 and 2 operate on a risk per tank total inventory basis. Case 3 uses a risk per unit volume of waste basis, grouped by tank farm. The SST retrieval risk-based sequences were designed using criteria prioritizing highest risk tanks or tank farms first. The retrieval sequences considered both airborne and groundwater pathways in evaluating risk rankings for each tank or tank farm. The criteria and logic for these sequences are discussed in Section 3.0. The modeling also incorporated the near-term retrieval activities provided under Tri-Party Agreement Milestone M-45-00A. The near-term retrieval and demonstrations included in the sequence

modeling are summarized in Table 1-2. A detailed description of the scenarios and defining assumptions can be found in Appendices A and B of this document and in HNF-SD-WM-SP-012 (2002), *Tank Farm Contractor Operation and Utilization Plan, Rev. 4.*

Table 1-2. Single-Shell Tank Near Term Retrieval 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)].
Past-practice sluicing	Tank 241-C-106	Tank proposed for new retrieval/closure milestone.
Saltcake dissolution	Tank 241-S-105	Tank proposed for new retrieval/closure milestone.
Past-practice sluicing	Tank 241-S-106	Tank proposed for new retrieval/closure milestone.
Past-practice sluicing	Tank 241-S-103	Tank proposed for new retrieval/closure milestone.

2.0 METHODOLOGY FOR EVALUATING DOUBLE-SHELL TANK SPACE REQUIREMENTS

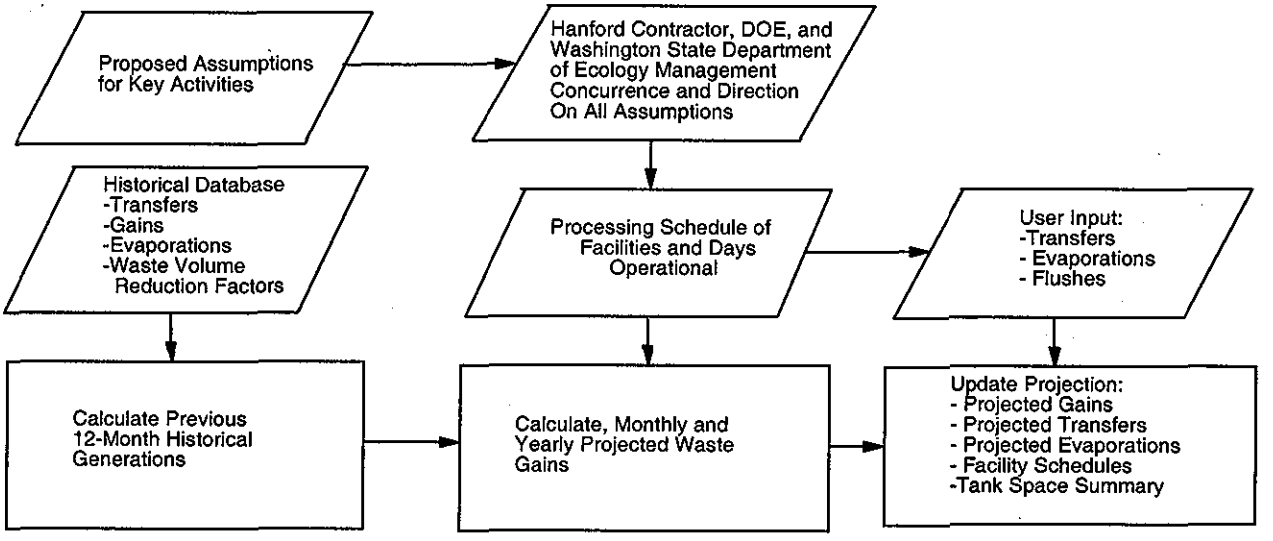
Completion of the RPP mission is dependent on the availability and efficient use of DST space. The DST space evaluation process provides the projected DST space use, based on specific assumptions for the generation of wastes, the composition of wastes, and the operation of tank farms and waste processing 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 (Milestone M-45-02). 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 in all DST space evaluation cases. An earlier SST strategy to retrieve low volume tanks first was evaluated in the previous revision of this document (RPP-8554, Rev. 0).

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). Accordingly, Appendix F lists all the gains, losses, and transfers through the end of September 2003. The projected transfers listed in Appendix F are similar for all of the case evaluations. Because Cases 2 and 3 allow space saving options that are larger than Case 1, some projected transactions for these cases may occur earlier.

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. Vitrification of HLW and LAW in the WTP are the only immobilization processes considered in Cases 1 and 2.

Case 3 introduces immobilization facilities to supplement vitrification in the WTP. In this case, portions of the waste (beyond the initial quantity feed) undergo supplemental processes, including steam reforming of LAW in the WTP; ^{137}Cs and ^{99}Tc removal from LAW followed by an undefined- as-yet immobilization step; and washing followed by immobilization of some TRU solids in phosphate-ceramic grout.

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 feed retrieval and staging activities for each projection case 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.

The Case 3 logic is new in FY 2002. For this case, HTWOS includes modifications to include simple modeling capabilities for supplemental immobilization technologies, and to estimate the timing of tank closures.

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. As a result, the total of the emergency, WTP return, and contingency space is 2.28 Mgal.

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 2007. In FY 2007, Tank 241-AZ-101 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-102 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 the 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.* For FY 2002, a composite measure of tank relative risk for both airborne and groundwater contamination was used to develop the SST retrieval sequence. In addition, infrastructure issues and the need to provide balanced LAW and HLW feeds to the WTP were factored into the retrieval prioritization process. The Tri-Party Agreement-specified retrieval demonstrations were also a consideration in establishing the retrieval priorities. As a result, retrieval dates for tanks C-106, S-112, S-102, C-104, S-105, S-106, and S-103 are fixed for all cases, regardless of changes in their risk rankings.

The risk-based sequences for FY 2002 are shown in Table 3-2. The FY 2002 relative risk ranking employs the same logic as used in FY 2001. Changes to the retrieval order from the FY 2001 list are due to changes in estimated tank inventories and to inclusion of a number of tanks whose retrievals were previously deferred to the end of the retrieval priority due to infrastructure constraints or processing issues. No tanks are deferred to the end of the retrieval priority this year. The sequence for Case 3 is a variation of the risk-based listing as it includes ranking according to relative risk per unit waste volume by tank farm. The risk rankings are the same for Cases 1 and 2; however, the retrieval sequence may differ between these two cases. This is because the cases differ in waste treatment rates, causing differences in retrieval timing. If the timing differs, tank retrieval can be affected by the timing of upgrades and outages, which impact the ability to transfer waste.

3.1.1 Technical Approach

The risk-based scenario was developed using risk factors from the *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement* (FEIS), DOE/EIS-0189, Volume 3, Appendix D "Anticipated Risk" to approximate the human health and environmental impacts of exposure to certain chemicals and radionuclides. This document provides factors for all the analytes required for calculating airborne, groundwater, and chemical risks. The FEIS factors 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 with respect to risk in the groundwater, for the purpose of this document. The "relative risk" from a radionuclide is calculated as the product of the analyte activity in the tank and its associated risk factor: pathways within the environment (proximity of a tank or farm to the Columbia River, for example) were not taken into account. The relative overall tank risk is the sum of the individual radionuclide risks. The approach and constituents of concern used in this

document 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 SST retrieval sequence. These parameters are groundwater, airborne, and chemical risk. Within the FEIS four exposure 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 for groundwater and chemical risk ranking because it was determined to be the most likely end-use scenario for 200 Area plateau facilities. The Industrial scenario involves mainly indoor activities that include consumption of groundwater, although outdoor activities (e.g. soil contact) are included. The groundwater radionuclide and chemical unit risk factors used in ranking apply only to the water ingestion and absorption components of the scenario.

The airborne contamination risk factors are based on a fifth scenario – that of an intruder dose, which assumes that a person drills into the top of a tank. Two subsets of this scenario, driller and post-driller, are available for calculation. The post-driller subset was used because of the number of people involved and the time span concerned. The post-well drilling resident lives on land over which exhumed waste has been spread, grows vegetables on it, consumes some of the vegetables, ingests small amounts of contaminated soil each day, inhales suspended radionuclides, and has external exposure. In this scenario, the dominant pathway for the isotopes of concern is inhalation and external dose, which are components of airborne exposure (Rittman 1994).

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, 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 is 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 December 2001 (April 2002 for Tank S-112), best-basis inventory (BBI) (the primary source for inventory data) and supplemental information from HNF-EP-0182-170, *Waste Tank Summary Report for Month Ending May 31, 2002* (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 relative 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 Relative Groundwater Risk

The analytes used to calculate the groundwater relative risk comprise mobile, long-lived radionuclides, specifically ^{14}C, ^{79}Se, ^{99}Tc, ^{129}I, and ^{238}U. The relative groundwater risk from a particular radionuclide is calculated as the product of the analyte activity and its associated risk factor. The relative overall tank risk is the sum of the individual radionuclide risks. For Case 3 the activity per unit volume of waste by tank farm is used instead of the total activity per tank.

3.1.2.2 Relative Airborne Risk

Airborne relative risk is calculated similarly to the groundwater risk, i.e. the product of the analyte activity and its associated risk factor. 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. For Case 3 the activity per unit volume of waste is used instead of the total activity per tank.

3.1.2.3 Relative Chemical Risk

The analytes used to determine the relative 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. For Case 3 the chemical inventory per unit volume of waste is used instead of the total inventory per tank. The overall relative risk for a tank is calculated by summing the relative risks for each analyte. The chemical risk results are displayed for informational purposes and are not used for prioritizing tank retrievals. As in the case of groundwater risk, the chemical risk ranking is relative. Chemical risk factors are given in units of g/ml in groundwater, with the ranking determined by the product of the risk factor and the entire tank (or tank farm) inventory.

3.1.3 Performance Criteria and Assumptions

The FY 2002 SST retrieval sequence show a slight improvement on risk reduction performance over previous sequence submittals. The performance improvement was derived from the prioritization of early tank retrievals to meet Tri-Party Agreement milestones and proposed milestones as well as changes in the BBI inventory. Processing of all SST and DST waste by 2028 is required for Cases 1 and 3. Case 2 processing is complete in 2044. In the FY 2001 document, nearly empty tanks and high sulfate tanks were deferred for processing until late in the schedule. No tanks are deferred in this FY 2002 report.

3.1.4 Tank Selection Basis

To have a basis for selecting tanks, certain parameters are set as constraints or initial condition assumptions. First, seven near-term retrieval and technology demonstration tanks (241-S-112, S-102, S-103 S-105, S-106, C-104, C-106) were prioritized to be encountered on certain dates in the sequence, to comply with their specific, or proposed, Tri-Party Agreement milestones. The Tank C-107 schedule was similarly fixed, (date constrained), because it has a current design and construction schedule. See Section 3.1.5 for more details on the selection of these seven tanks. For Case 3, near-term retrieval dates were also specified for tanks C-201, C-202, C-203, and C-204.

For Cases 1 and 2 the remaining SSTs were ordered in two lists, used as input to the model, ranking each tank with respect to airborne and groundwater risks by decreasing risk order. This ranking was implemented as an input to the model, from which the model was able to choose which tank to retrieve next. During the course of the retrieval, to determine what tank to retrieve next, the model selects in each list the available, highest risk tank, taking into account the infrastructure in place. Among those two tanks, the model then selects the tank that best balances the feed of HLW and LAW melters, to keep the WTP operating steadily.

For Cases 3 and 3b, an SST retrieval sequence was developed to incorporate the goal of tank farm closures, while preserving a risk-based sequence. Two ranking lists were prepared based on the risk posed by each tank farm, based on either airborne or groundwater risk per unit volume of waste. The model subsequently chooses which tank to retrieve based on the priority of the tank farm, however other constraints such as the number of simultaneous retrievals allowed in a tank farm and the requirement that the WTP feeds are balanced, may drive the model to select a tank from a different tank farm. The logic employed to determine the final SST retrieval sequence for all cases is explained in Sections 3.1.5. and 3.1.6.

3.1.5 Logic to Select Early Retrieval Tanks

Seven early-retrieval tanks are fixed selections at the beginning of the sequence. Of the seven, three (S-112, S-102, and C-104) were chosen based on previous analyses (see RPP-8554, Rev 0, Section 3.1.6) and because they are subject to Tri-Party Agreement milestones. The remaining four tanks (C-106, S-105, S-106, and S-103) are part of newly proposed Tri-Party Agreement retrieval Milestones to address high-risk tanks (with significant volume) and tanks with low volumes and consequently lower risk (TPA Change Control Form M-45-02-02).

3.1.6 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. Waste may be retrieved simultaneously from up to seven tanks for Cases 1, 2, and 3. Limitations on simultaneous transfers from specific tank farms or quadrants are given in Table A-1.

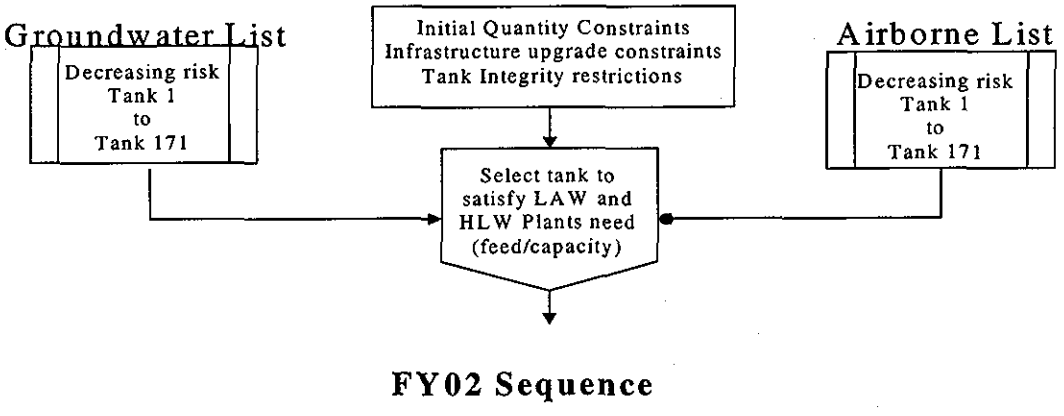
3. Waste from multiple SSTs will be mixed in the staging tanks to increase incidental blending.

In each list, the HTWOS model selects the first available tank (availability is determined by factors such as project date constraints and infrastructure requirements). The model then chooses one tanks between the two using one additional selection criterion. This selection criterion incorporates a balance between sludge retrieval (HLW tanks) and saltcake tanks (LAW 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. The feed balancing approach was initiated in the FY 2001 report (RPP-8554, Rev 0). The improvement achieved by implementing retrieval balancing was evaluated and described in Table 4-7 of the FY 2001 report.

Figure 3-1. Logic Used for Tank Selection



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.

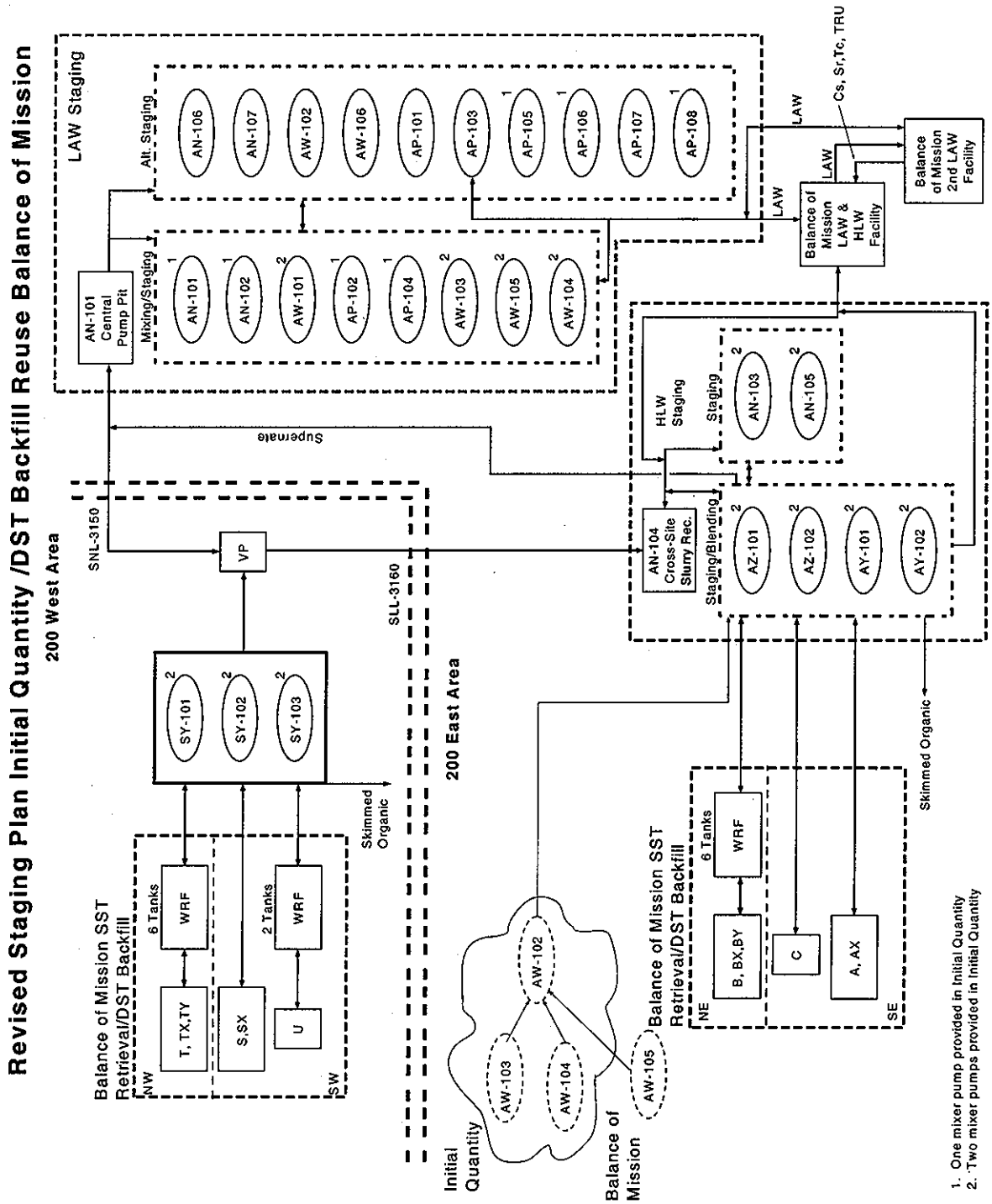
Table 3-1. Designated Receivers and Quadrants of Single-Shell Tank Farms.

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 has restrictions on waste receipts due to its designation as a flammable gas tank. Success of the sequence modeling for S Farm retrievals and transfer is dependent on removal of Tank 241-SY-103 from the Watch List (removal is complete (Roberson 2001), but transfer restrictions have not been eliminated) 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 for the Reference Case (Case 1).



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. Sections 3.2.2.1 through 3.2.2.5 are brief descriptions 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.

This year the HTWOS model applies specific assumptions for the length of retrieval for each SST according to the type of retrieval technology used. The technologies assumed to be employed are those described below.

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*).

The retrieval rate algorithms for past-practice sluicing are given in HNF-SD-WM-SP-012, 2002, *Tank Farm Contractor Operation and Utilization Plan*, Rev. 4,Table A-36.

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 have been 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 was planned during FY 2001 in Tank 241-U-107 in conjunction with planned saltwell pumping efforts under the Interim Stabilization Program. A

Topographical Mapping System was also to be demonstrated in Tank 241-U-107 to evaluate the effectiveness of the saltcake dissolution process. The U-107 test has been suspended indefinitely due to a delay caused by a partially plugged pipeline. The delay resulted in potential interference with the U-107 salt well pumping milestone if the test were to continue.

The Saltcake Dissolution technology retrieves SST waste at an average retrieval rate of 5 gpm of 5 molar Na solution (from a 10 gpm system operating at 50% TOE) with a 300 gallon flush of the system occurring every 7 days and lasting for 8 hours (Brendel 2001).

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). Field-scale testing of the AEAT power fluidics system was 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. In FY 2001, a dual nozzle pulsating mixer pump system was designed and fabricated that was sized to fit through a 12 inch diameter tank riser. Cold testing was performed on sand and water. Follow on tests are planned in FY 2002 to include nozzle modifications and address concerns about possible fouling by waste solids of the foot valve.

The Fluidics System technology retrieves SST waste at an average retrieval rate of 10 gpm of 5 molar Na solution (from a 15 gpm system operating at 66.7% TOE) with a 300 gallon flush of the system occurring every 7 days and lasting for 8 hours (Doeler 2001).

3.2.2.4 Confined-Sluicing System using Remote Crawler with Articulated Mast

Sludge waste mobilization and retrieval is accomplished by installation in the tank of a centrally located articulated mast and, through a separate riser, a small (sometimes collapsible) remote-operated tracked vehicle (crawler). In a confined-sluicing approach, fluid may be added to the waste in the immediate vicinity of the pump or vacuum removal device (which may be mounted on the Crawler or on the articulated mast.) The system is operated to remove 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 may be supernatant or water. The articulated mast was added to the system design to enhance system effectiveness and flexibility as a result of lessons learned at Oak Ridge National Laboratory during the retrieval of the Gunite

Tanks. The "articulated mast" is mentioned below in Section 3.2.2.5. This method currently is planned for use in Tank 241-C-104 (HNF-2944).

The Crawler System contains a slurry pump that operates at an average retrieval rate of 40 gpm of slurry containing 30 volume % solids (Crass 2000). Dilution water is added outside the tank to dilute the slurry to 10 wt% solids, making it suitable for transfer. When the volume of waste in the tank gets below 50,000 gallons, the transfer rate decreases. Three leak tests are performed before, in the middle of, and after retrieval operations. Each leak test takes 120 hours to perform and only two leak tests are counted as part of the minimum retrieval duration. The retrieval rate algorithms for the Crawler System are given in HNF-SD-WM-SP-012, 2002, *Tank Farm Contractor Operation and Utilization Plan*, Rev. 4,Table A-35.

3.2.2.5 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

Infrastructure is addressed in establishing the tank retrieval sequence. The HTWOS model takes into account the availability of infrastructure according to established and planned tank farm projects. For the time frame beyond these projects, the infrastructure is assumed to be available. That is because the model projections predict when retrievals will be needed, allowing projects to be planned to provide infrastructure by the need dates.

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 (Ecology/DOE 1999). 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. Once the SST sequence is established, HTWOS results show the times at which the tank retrievals are completed. The first three tank retrievals (S-112, S-102 and C-104) support Milestone M-45-00A in the Tri-Party Agreement, which addresses retrievals prior to 9/30/2006. The next five tanks (S-103, S-105, S-106, C-106, and C-107) were date constrained. The remaining SST waste will be retrieved and transferred into DSTs as space becomes available.

In 2018, an Enhanced WTP Operations phase is initiated. The design capacity of the existing HLW and LAW glass plants are assumed to increase, (for the Reference Case [Case 1]) and

additional higher capacity LAW and HLW glass plants will be added. On March 1, 2018, it is assumed that the LAW melters will have a total operating capacity of 157.5 MT/day, and the HLW melters will have a total operating capacity of 10.3 MT/day.

Under these constraints, SST waste retrieval will be completed in FY 2026. Processing of both LAW and HLW will be completed in 2028 for Case 1. 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.

Retrieval sequences and schedules for Cases 2, 3, and 3b are presented in Appendices G, H, and I.

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.

Infrastructure limitations are reflected in the HTWOS model, as it accounts for established and planned tank farm projects. Project assumptions are shown in Table A-1. Beyond these projects, infrastructure is assumed to be in place as needed. The projected need dates for transfers provide information that will allow additional projects to be timed accordingly.

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 of 5 *M* or an insoluble solids loading of 10 wt%, whichever requires the larger water addition (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 32,100,000 gal of SST waste will produce an estimated 91,000,000 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 for the Reference case (Case 1) (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 1 Sequence Data. (3 sheets)

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)	Groundwater Risk Ranking	Airborne Risk Ranking
241-S-112	6/1/2003	196	12/14/2003	2,794,557	5,038	2,799,595	21	29
241-C-106	11/1/2003	60	12/31/2003	88,121	1,779	89,899	127	66
241-S-102	12/1/2005	69	2/8/2006	687,341	7,091	694,431	40	70
241-C-104	5/30/2007	185	12/1/2007	712,250	54,950	767,200	2	2
241-S-105	3/31/2008	292	1/17/2009	1,142,195	2,077	1,144,272	25	38
241-S-106	6/30/2008	338	6/3/2009	1,363,351	5,495	1,368,846	22	97
241-S-103	9/30/2008	82	12/21/2008	581,265	3,284	584,549	34	64
241-C-107	9/8/2013	184	3/11/2014	445,632	28,363	473,995	65	5
241-SX-108	11/30/2013	26	12/26/2013	166,701	3,741	170,442	97	10
241-SX-104	12/29/2013	75	3/14/2014	1,081,336	11,343	1,092,679	29	12
241-S-107	3/17/2014	47	5/3/2014	973,610	32,064	1,005,674	50	8
241-S-108	5/6/2014	1417	3/23/2018	1,583,823	7,520	1,591,343	14	22
241-SX-105	5/7/2014	1248	10/6/2017	858,209	5,551	863,760	41	21
241-TX-118	6/24/2014	1437	5/31/2018	645,552	7,329	652,881	49	1
241-U-105	6/25/2014	1548	9/20/2018	904,107	10,133	914,240	3	11
241-B-101	6/26/2014	40	8/5/2014	246,851	6,769	253,620	96	13
241-TX-112	8/5/2014	1679	3/11/2019	1,773,351	18,153	1,791,504	5	15
241-C-103	10/6/2017	331	9/2/2018	1,317,344	49,586	1,366,930	80	3
241-SX-101	10/9/2017	273	7/9/2018	1,040,496	10,455	1,050,951	55	24
241-S-109	5/8/2018	305	3/9/2019	1,745,559	4,438	1,749,997	17	88
241-C-102	6/2/2018	428	8/4/2019	1,016,306	38,087	1,054,393	75	4
241-TX-105	6/20/2018	304	4/20/2019	1,602,992	17,044	1,620,035	4	17
241-BX-103	7/9/2018	29	8/7/2018	232,481	9,904	242,385	113	18
241-TX-115	8/7/2018	262	4/26/2019	1,542,762	16,052	1,558,814	6	19
241-C-105	9/5/2018	330	8/1/2019	1,574,119	58,497	1,632,616	53	7
241-TX-114	9/24/2018	258	6/9/2019	1,472,998	15,164	1,488,162	13	23
241-U-106	3/11/2019	64	5/14/2019	391,693	2,037	393,730	61	26
241-TX-110	3/14/2019	320	1/28/2020	1,254,127	14,400	1,268,526	16	25
241-SX-103	4/20/2019	171	10/8/2019	1,373,694	3,713	1,377,407	15	27
241-U-107	5/17/2019	1065	4/16/2022	837,857	9,840	847,698	23	28
241-A-106	8/4/2019	30	9/3/2019	362,832	12,553	375,385	76	9
241-AX-103	8/7/2019	40	9/16/2019	228,746	2,293	231,039	58	20
241-U-108	9/3/2019	468	12/14/2020	934,543	20,463	955,007	8	30
241-BX-102	9/3/2019	43	10/16/2019	663,255	25,116	688,371	131	33
241-S-101	9/8/2019	171	2/26/2020	1,288,121	42,993	1,331,114	42	32
241-TX-101	10/9/2019	242	6/7/2020	496,973	17,668	514,640	86	35
241-TX-111	10/17/2019	257	6/30/2020	958,275	11,590	969,864	28	36
241-S-104	1/6/2020	85	3/31/2020	1,397,953	47,196	1,445,150	62	34
241-C-101	6/7/2020	27	7/4/2020	611,584	22,831	634,415	69	41
241-S-110	6/14/2020	103	9/25/2020	1,113,742	16,593	1,130,335	20	37
241-TX-106	6/22/2020	287	4/5/2021	976,423	4,321	980,744	27	39
241-SX-109	6/22/2020	86	9/16/2020	1,091,032	35,067	1,126,100	66	40
241-A-102	6/30/2020	6	7/6/2020	57,353	2,066	59,419	70	42
241-BY-105	7/6/2020	228	2/19/2021	1,273,852	34,610	1,308,462	35	44
241-A-101	9/25/2020	143	2/15/2021	971,278	2,902	974,180	91	46
241-TX-117	10/8/2020	318	8/22/2021	1,252,098	16,962	1,269,061	37	43
241-SX-106	10/28/2020	139	3/16/2021	959,556	12,755	972,310	10	45
241-TX-116	12/20/2020	591	8/3/2022	1,582,217	33,598	1,615,815	32	47
241-BX-104	3/16/2021	119	7/13/2021	779,923	29,790	809,713	7	50
241-U-102	3/28/2021	477	7/18/2022	624,252	11,411	635,663	44	48
241-SX-102	4/22/2021	164	10/3/2021	1,133,742	4,607	1,138,350	45	49
241-C-112	7/13/2021	28	8/10/2021	357,572	15,095	372,667	24	51

Table 3-2. Single-Shell Tank Retrieval/Case 1 Sequence Data. (3 sheets)

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol (gal)	Retrieved solids vol (gal)	Total retrieved vol (gal)	Groundwater Risk Ranking	Airborne Risk Ranking
241-TX-107	8/27/2021	7	9/3/2021	80,699	1,089	81,788	102	52
241-SX-111	10/8/2021	37	11/14/2021	569,718	19,981	589,699	88	53
241-TX-102	11/14/2021	245	7/17/2022	583,714	5,707	589,420	48	59
241-AX-101	3/14/2022	159	8/20/2022	1,007,287	5,889	1,013,176	99	55
241-A-103	3/14/2022	54	5/7/2022	829,508	3,858	833,365	57	57
241-SX-107	4/24/2022	22	5/16/2022	572,714	20,365	593,080	94	54
241-AX-102	5/10/2022	5	5/15/2022	48,368	1,284	49,652	119	58
241-U-111	7/17/2022	277	4/20/2023	661,624	9,556	671,180	39	56
241-T-111	7/21/2022	95	10/24/2022	623,335	24,692	648,027	72	62
241-SX-114	7/26/2022	51	9/15/2022	596,044	20,054	616,098	82	60
241-C-111	8/3/2022	31	9/3/2022	322,063	11,654	333,717	89	65
241-SX-112	8/13/2022	26	9/8/2022	395,492	14,055	409,547	98	61
241-B-107	8/20/2022	29	9/18/2022	322,622	14,978	337,600	95	68
241-BX-101	9/8/2022	32	10/10/2022	267,042	10,712	277,754	123	72
241-B-111	9/19/2022	40	10/29/2022	273,364	11,528	284,891	68	74
241-TX-103	10/14/2022	62	12/15/2022	390,689	3,775	394,465	63	71
241-TX-108	10/14/2022	62	12/15/2022	343,768	3,732	347,500	67	73
241-BY-104	10/17/2022	232	6/6/2023	1,067,729	10,838	1,078,567	12	75
241-U-103	10/22/2022	385	11/11/2023	1,071,404	8,926	1,080,330	26	63
241-T-104	10/27/2022	70	1/5/2023	577,272	21,024	598,297	112	76
241-TX-109	11/1/2022	57	12/28/2022	384,697	9,210	393,907	79	77
241-B-110	1/13/2023	49	3/3/2023	330,716	14,894	345,610	109	78
241-BY-103	1/18/2023	300	11/14/2023	1,175,772	20,781	1,196,553	19	79
241-BY-111	1/23/2023	277	10/27/2023	985,366	24,613	1,009,979	38	82
241-SX-110	1/29/2023	25	2/23/2023	260,456	8,921	269,377	104	80
241-T-105	2/23/2023	35	3/30/2023	355,225	13,008	368,233	92	83
241-TY-103	3/3/2023	51	4/23/2023	415,172	17,625	432,797	46	84
241-TX-113	4/4/2023	322	2/20/2024	2,007,782	16,279	2,024,061	1	85
241-BY-112	6/8/2023	304	4/7/2024	1,229,979	22,607	1,252,586	33	86
241-T-107	6/10/2023	45	7/25/2023	519,707	19,533	539,240	31	87
241-U-110	6/15/2023	251	2/21/2024	881,887	32,280	914,167	54	67
241-BY-101	11/8/2023	307	9/10/2024	1,240,114	25,116	1,265,230	9	94
241-U-104	11/16/2023	79	2/3/2024	396,385	13,929	410,315	108	81
241-BY-106	11/17/2023	294	9/6/2024	1,312,106	12,843	1,324,950	11	105
241-BY-110	12/2/2023	130	4/10/2024	1,002,704	12,759	1,015,464	18	90
241-BY-108	2/12/2024	153	7/14/2024	507,104	13,665	520,769	30	110
241-TY-101	4/7/2024	36	5/13/2024	954,361	35,400	989,760	106	91
241-T-101	5/16/2024	21	6/6/2024	297,717	13,180	310,897	84	93
241-U-109	6/6/2024	110	9/24/2024	707,722	12,166	719,888	47	111
241-BY-107	6/23/2024	203	1/12/2025	837,623	12,385	850,009	36	115
241-BY-102	7/2/2024	270	3/29/2025	892,433	15,779	908,213	43	89
241-S-111	7/14/2024	68	9/20/2024	722,384	31,585	753,969	51	112
241-BX-112	9/20/2024	81	12/10/2024	330,637	13,018	343,655	107	92
241-TY-105	9/24/2024	46	11/9/2024	440,242	19,637	459,879	64	125
241-TX-104	11/10/2024	9	11/19/2024	107,109	5,750	112,859	100	99
241-C-109	11/19/2024	25	12/14/2024	298,515	11,941	310,456	83	101
241-BX-106	12/13/2024	32	1/14/2025	253,221	10,029	263,249	105	95
241-BX-107	12/17/2024	171	6/6/2025	875,652	35,729	911,380	71	96
241-BY-109	2/28/2025	164	8/11/2025	670,553	15,288	685,840	52	98
241-C-110	3/6/2025	32	4/7/2025	308,416	12,553	320,968	90	104
241-T-110	4/7/2025	51	5/28/2025	328,980	13,881	342,861	110	109
241-T-112	5/28/2025	25	6/22/2025	103,586	4,273	107,859	129	113
241-BX-105	5/30/2025	51	7/20/2025	291,522	11,407	302,929	77	102
241-BX-109	6/14/2025	45	7/29/2025	242,459	10,416	252,875	56	132
241-TY-104	6/22/2025	22	7/14/2025	143,081	6,177	149,257	85	116

Table 3-2. Single-Shell Tank Retrieval/Case 1 Sequence Data. (3 sheets)

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)	Groundwater Risk Ranking	Airborne Risk Ranking
241-T-102	7/14/2025	16	7/30/2025	234,938	9,150	244,088	103	121
241-BX-110	7/26/2025	82	10/16/2025	588,744	9,745	598,489	59	108
241-BX-111	7/29/2025	72	10/9/2025	505,531	7,784	513,315	60	123
241-TY-102	7/30/2025	31	8/30/2025	191,363	1,989	193,352	117	137
241-B-104	7/30/2025	59	9/27/2025	466,625	9,779	476,405	87	106
241-B-103	8/3/2025	18	8/21/2025	107,105	3,782	110,887	116	114
241-B-204	8/20/2025	2	8/22/2025	73,786	2,896	76,682	137	117
241-B-105	8/24/2025	141	1/12/2026	693,855	8,488	702,343	93	118
241-T-203	8/30/2025	2	9/1/2025	49,831	1,946	51,776	142	124
241-T-204	9/1/2025	2	9/3/2025	56,543	2,233	58,775	138	130
241-SX-113	9/6/2025	16	9/22/2025	186,079	7,145	193,224	118	134
241-C-108	9/22/2025	24	10/16/2025	230,117	8,628	238,745	126	136
241-B-203	10/8/2025	11	10/19/2025	84,908	3,187	88,095	136	120
241-U-112	10/9/2025	26	11/4/2025	263,125	9,929	273,054	122	138
241-T-108	10/16/2025	2	10/18/2025	29,954	1,374	31,328	132	139
241-B-109	10/21/2025	60	12/20/2025	346,057	14,382	360,438	73	122
241-T-109	11/4/2025	18	11/22/2025	114,287	1,466	115,753	130	140
241-B-106	12/19/2025	22	1/10/2026	134,161	5,461	139,622	81	127
241-B-112	12/23/2025	25	1/17/2026	48,252	2,295	50,547	115	144
241-A-105	12/24/2025	18	1/11/2026	206,513	7,907	214,420	74	6
241-AX-104	12/25/2025	8	1/2/2026	86,314	3,488	89,802	78	14
241-B-108	12/29/2025	35	2/2/2026	229,876	8,964	238,840	120	141
241-B-102	1/4/2026	9	1/13/2026	54,823	1,951	56,774	128	143
241-TY-106	1/10/2026	2	1/12/2026	134,757	5,415	140,172	111	142
241-U-101	1/14/2026	3	1/17/2026	133,801	5,002	138,803	124	135
241-T-103	1/16/2026	8	1/24/2026	148,500	5,948	154,448	121	69
241-T-106	1/16/2026	4	1/20/2026	101,718	4,266	105,984	125	129
241-BX-108	1/16/2026	4	1/20/2026	82,933	3,954	86,888	101	133
241-U-201	1/19/2026	2	1/21/2026	18,826	736	19,562	134	148
241-B-202	1/22/2026	1	1/23/2026	43,354	1,734	45,089	135	126
241-T-201	1/25/2026	2	1/27/2026	77,888	2,975	80,863	141	103
241-T-202	1/26/2026	1	1/27/2026	27,675	1,112	28,787	143	131
241-SX-115	1/26/2026	7	2/2/2026	9,064	608	9,672	133	31
241-U-204	1/30/2026	1	1/31/2026	27,179	1,029	28,209	140	145
241-U-202	2/14/2026	1	2/15/2026	15,868	620	16,488	146	147
241-U-203	2/27/2026	1	2/28/2026	13,022	511	13,533	149	149
241-B-201	4/10/2026	1	4/11/2026	96,446	3,700	100,147	139	100
241-C-203	4/25/2026	2	4/27/2026	16,637	682	17,319	144	128
241-A-104	4/25/2026	15	5/10/2026	231,625	8,784	240,408	114	16
241-C-204	4/30/2026	2	5/2/2026	10,471	439	10,910	145	146
241-C-202	5/5/2026	1	5/6/2026	8,253	347	8,600	147	119
241-C-201	5/10/2026	1	5/11/2026	8,162	349	8,512	148	0

1: The SST (Case 1) 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 1, SST waste is retrieved as DSTs become available and is not constrained by funding for SST retrieval infrastructure.

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Figure 3-3. Single-Shell Tank Retrieval/Case 1 Sequence and Schedule.

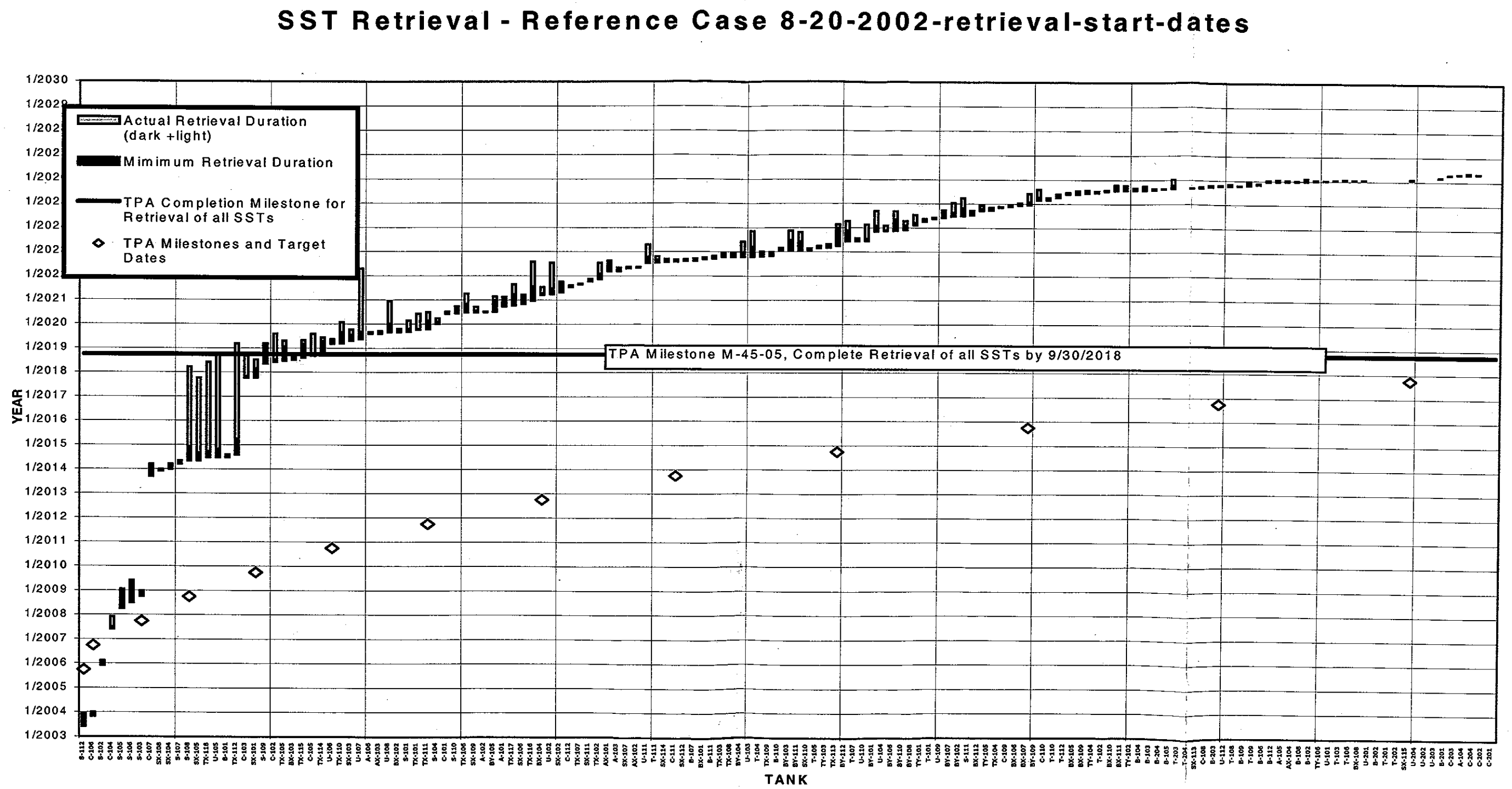
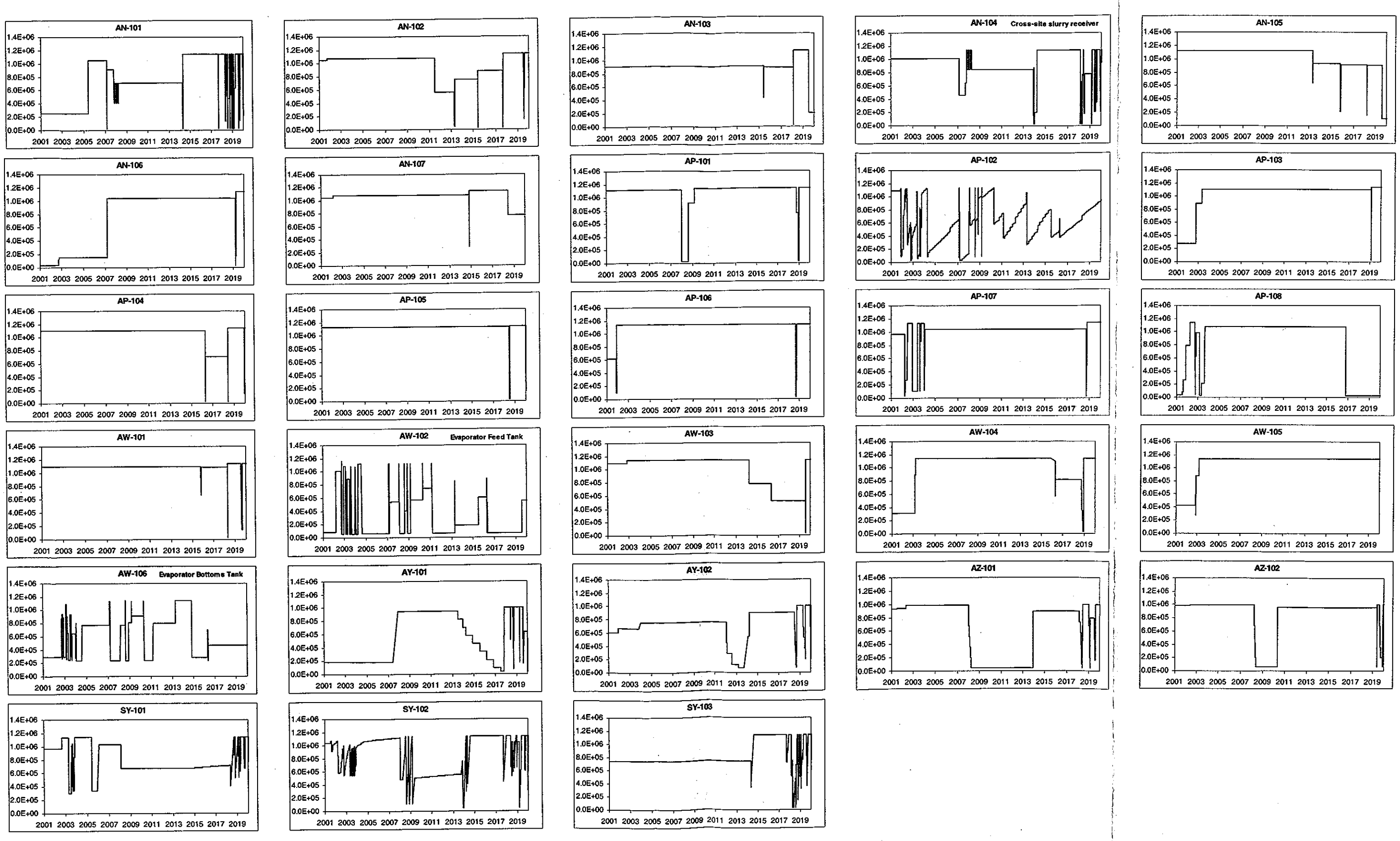


Figure 3-4. Case 1 Individual Double-Shell Tank Volume Plots (gallons).



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

The tank retrieval sequences for all cases have 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, 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. Entries in the table are the relative risk for each tank divided by the sum of relative risks for all tanks. Appendix C contains relative risk data.

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

Tank	Groundwater Risk %	Airborne Risk %	Chemical Risk %	Volume (Kgal)
241-C-104	2.489	10.899	0.274	263
241-C-106	0.032	0.274	0.011	48
241-S-102	1.074	0.231	0.987	492
241-S-103	1.200	0.291	1.112	237
241-S-105	1.471	0.587	2.294	456
241-S-106	1.584	0.109	3.102	455
241-S-112	1.586	0.109	2.658	523
TOTAL:	**9.435 %**	**13.098 %**	**10.438 %**	**2474**

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 for Case 1:

- 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 and time pertain only to Projection Case 1. Information for Case 2 risk reduction versus both volume retrieved and time is shown in Appendix G. Information for Cases 3 and 3b risk reduction versus both volume retrieved and

time is shown in Appendices H and I. 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 Tri-Party Agreement Milestone M-45-00A for long-term risk reduction.

When the current sequence is compared to the SST retrieval sequence from FY 2001, overall reduction in airborne risk is accelerated in the early retrievals, but achieves similarity to the FY 2001 risk reduction curve halfway through the mission. The groundwater risk reduction curve for FY 2002 shows similar risk reduction throughout the mission compared to those for FY 2001. The chemical risk reduction for FY 2002 was also similar to that for FY 2001. 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 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.

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

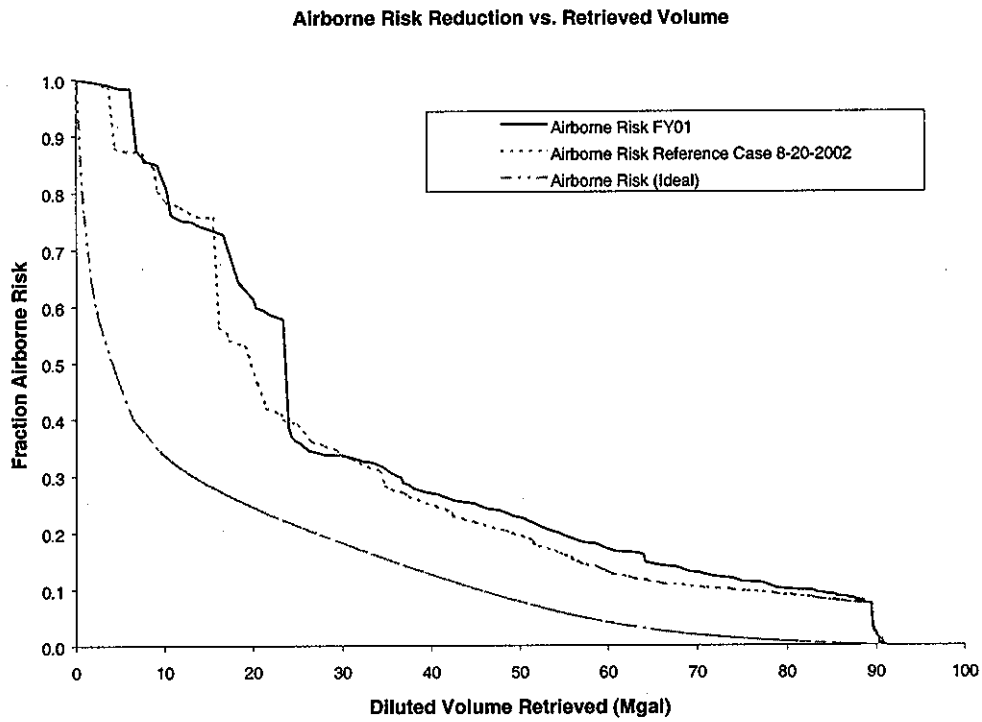


Figure 4-2. Case 1 Groundwater Risk Reduction Versus Volume Retrieved.

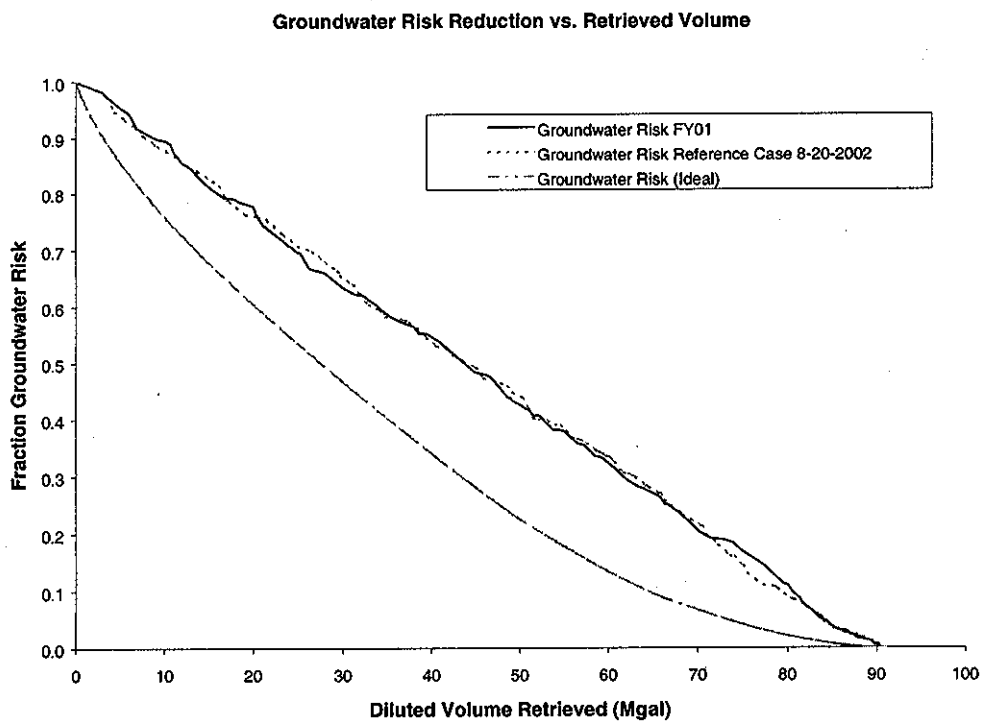


Figure 4-3. Case 1 Chemical Risk Reduction Versus Volume Retrieved.

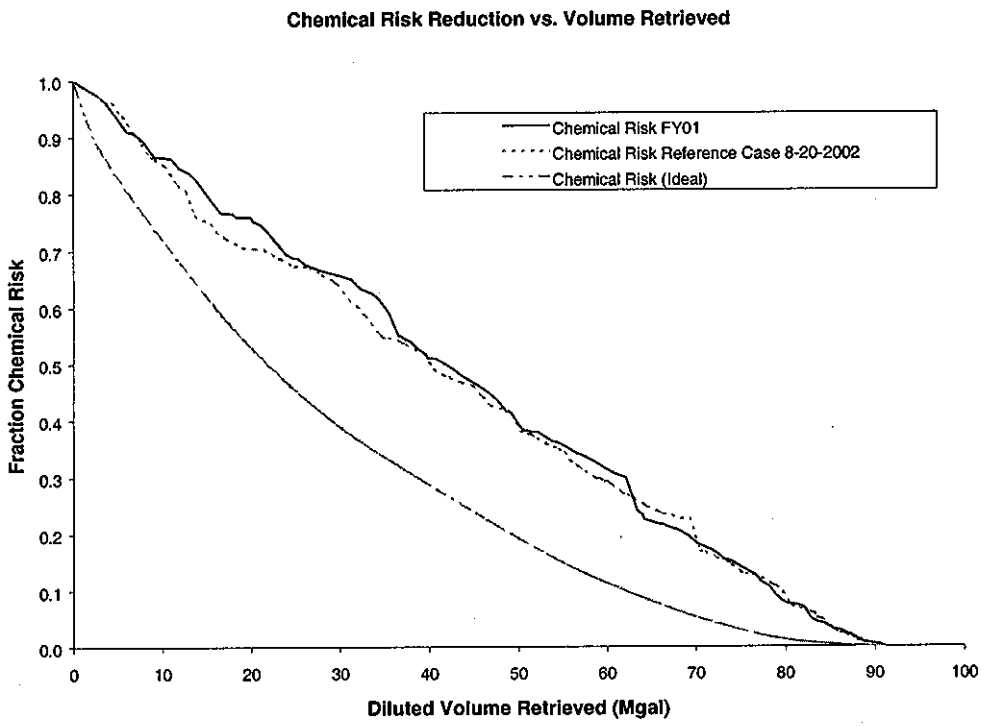


Figure 4-4. Case 1 Airborne Risk Reduction Over Time.

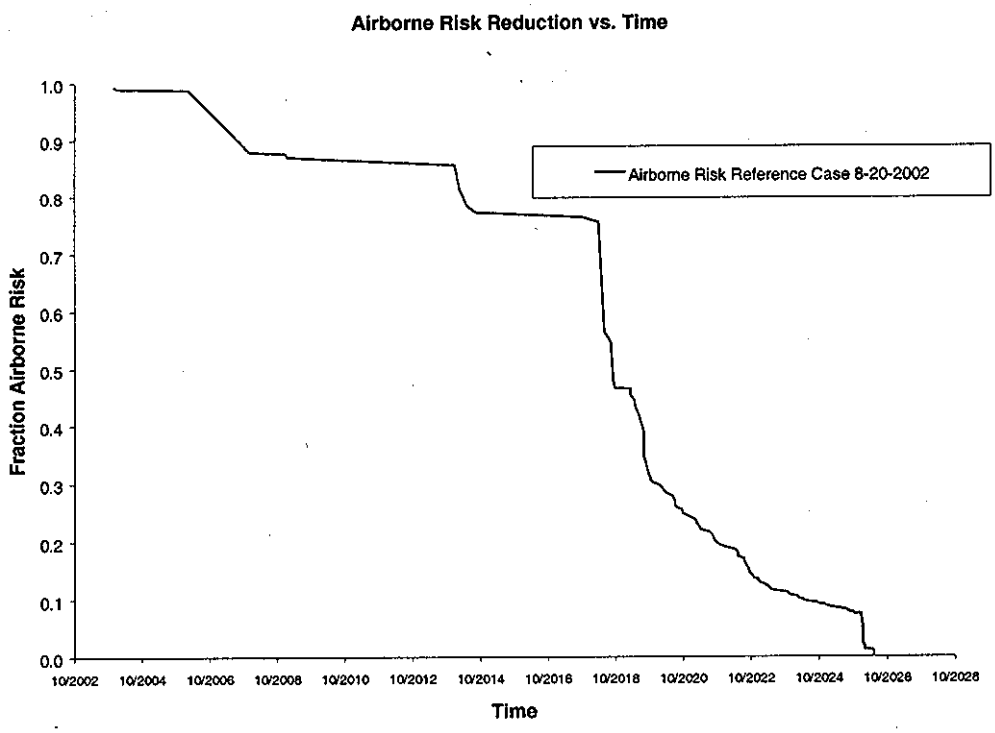


Figure 4-5. Case 1 Groundwater Risk Reduction Over Time.

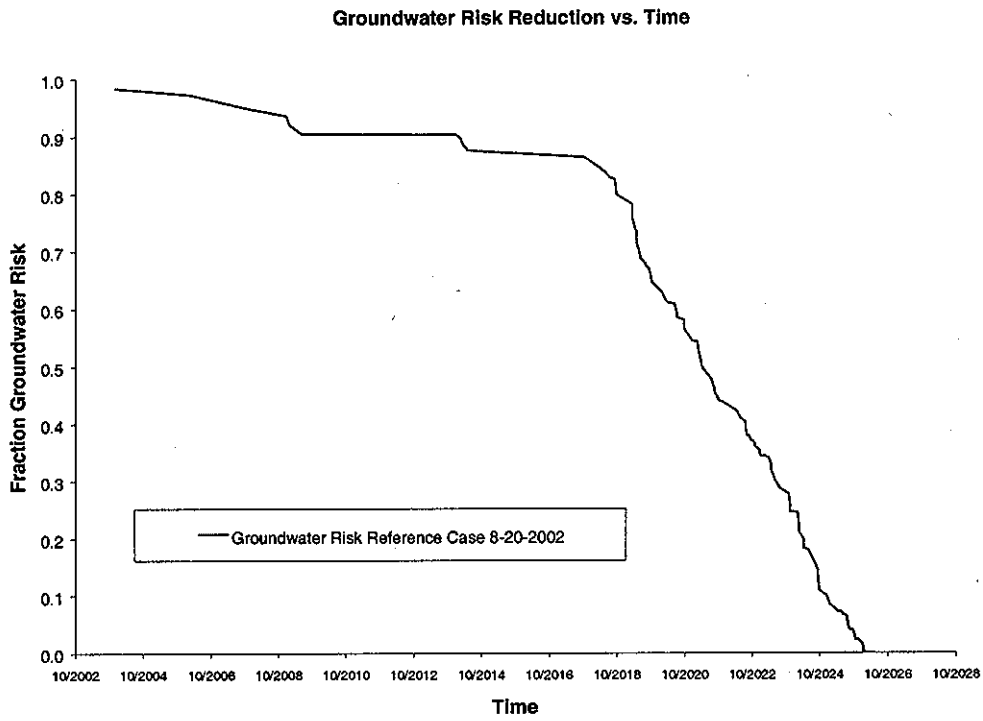
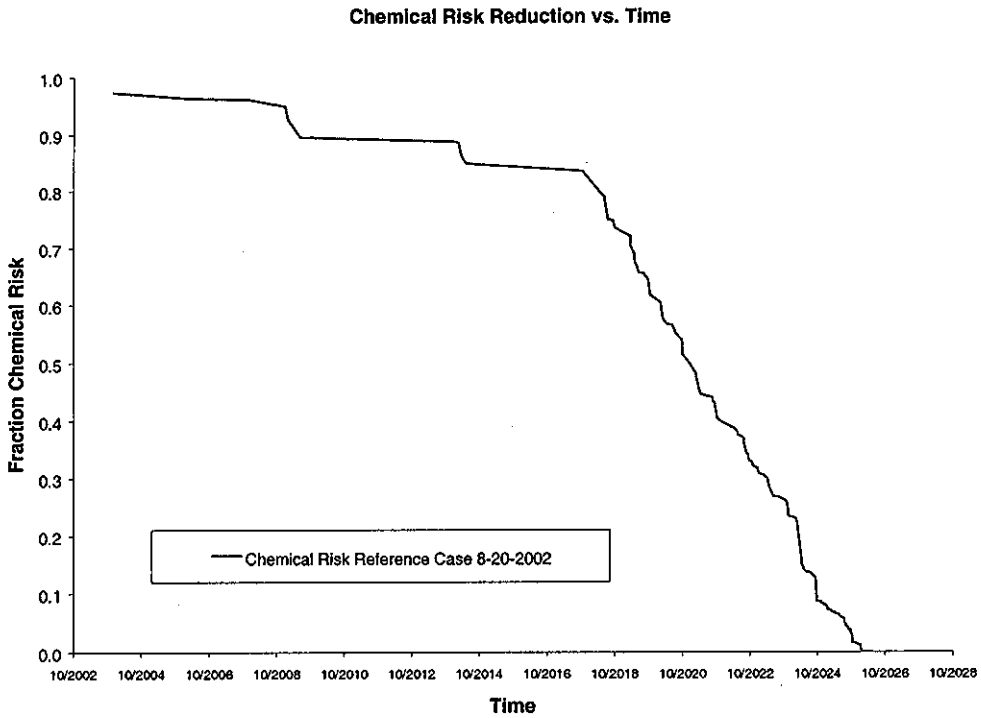


Figure 4-6. Case 1 Chemical Risk Reduction Over Time.



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5.0 DOUBLE-SHELL TANK SPACE EVALUATION

5.1 DOUBLE-SHELL TANK SPACE EVALUATION ASSUMPTIONS AND CONSTRAINTS

The 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. For FY 2002, Case 1 projection incorporates a risk-based SST retrieval sequence that completes waste vitrification in 2028 and maintains waste volumes within existing DST capacity. Case 2 and Case 3 incorporate SST waste retrieval scenarios that also do not require new DST capacity. Case 3b evaluates the need for new DSTs to retrieve SSTs by 2018. In this subset, 20.4 Mgal of new DST space is needed. The assumptions and results are summarized in Table 1-1 and in sections 5.1.1 through 5.1.3, below, with a more comprehensive list provided in Appendix A.

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. Volumes used for each sequence were calculated based on tank inventory and composition information representative of June 30, 2001 (April 2002 for Tank 241-S-112) with adjustments for historical transfers through May 31, 2002.

5.1.1 Projection Case 1 Assumptions and Results Summary

Projection Case 1:

- Represents the contractual baseline for the tank farm contractor
- Incorporates a risk-based retrieval sequence.
- Is not constrained to retrieve waste by 2018, but completes waste vitrification in 2028
- Maintains waste volumes within existing DST capacity.
- Uses WTP Initial Phase processing assumptions based on Bechtel National, Incorporated WTP contract information, and assume an aggressive WTP capacity ramp-up after 2018, to complete processing by 2028.
- Assumes a tank space savings of 0.85 Mgal achieved by decreasing dedicated operational space. It was assumed that the Inactive Miscellaneous Underground Storage Tank wastes could be retrieved to Tank AP-102. This allowed Tank AW-105 to be used to store concentrated wastes and created an additional 0.85 million gallons of storage space. The 0.85 Mgal had been a reserved space in Tank AW-105. Allowing the

eventual transfer of IMUST waste (in 2011) to AP-108 frees up the 0.85 Mgal in the near term, with cleanout of AW-105 expected in FY 2003.

- Completes SST waste retrieval in May 2026.

A detailed description of the development of the SST retrieval sequence is provided in Section 3.0. The SST retrieval sequence for Case 1 is provided in Section 4.0.

5.1.2 Projection Case 2 Assumptions and Results Summary

Projection Case 2:

- Represents the *River Protection Project System Plan* (DOE 2002b), updated for this study.
- Incorporates a risk-based retrieval sequence
- Is not constrained to retrieve waste by 2018, and is not constrained to complete waste processing by 2028 (Tri-Party Agreement Milestone M-45-05; M-45-05-T05 through M-45-05-T09 do not constrain the retrieval schedule)
- Maintains waste volumes within existing DST capacity, as in case 1
- Uses WTP Initial Phase processing assumptions based on operations as proposed in the *River Protection Project System Plan* (DOE 2002b) and updated for this study.
- Incorporates tank space options to save a total of 3 million gallons of space by FY 2006. The options used and their related space savings are shown below (Boyles, 2001):
    - Decreasing dedicated operational space to create an additional 0.85 million gallons of storage space. (Same assumption as described above for Case 1).
    - 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.
    - Some of the existing concentrated wastes stored in DSTs could be concentrated to a higher specific gravity. In Projection Case 2, concentrating some of these wastes to a specific gravity of about 1.4 was used to save an additional 0.73 million gallons.
- Under this scenario, SST waste retrieval is completed in October, 2037.
- The Enhanced WTP Operations processing schedule and Waste Treatment Plant processing rates result in completion of waste processing in 2044.

The retrieval sequence, the schedule and volume information for Case 2 SST waste retrieval is provided in Appendix G.

5.1.3 Projection Case 3 and Case 3b Assumptions and Results Summary

The Case 3 and case 3b Projections:

- Address implementation of concepts described in the *Performance Management Plan for the Accelerated Cleanup of the Hanford Site* (DOE 2002a)

- Incorporate a risk-based retrieval sequence by tank farm, ranking by risk per unit volume of waste, rather than by individual tank inventory. In addition, the SST retrieval sequence employs a tank farm at a time approach, selecting the highest risk farms first, instead of individual tanks.

- Address tank farm closure and closure program constraints

- Complete processing by 2028. Case 3b, not case 3, is also constrained to retrieve SSTs by 2018.

- Case 3 maintains waste volumes within existing DST capacity.
  Case 3b requires the construction of 17 new DSTs, because of the additional constraint to retrieve SSTs by 2018.

- Incorporate tank space options to save a total of 3 million gallons of space by FY 2006 (Same assumption as in Case 2).

- Do not increase the vitrification capacity of the WTP during the enhanced operations phase (post 2018). Rather, supplemental treatment technologies are employed to treat part of the waste feed stream, reducing the burden on vitrification. Supplemental technologies include steam reforming of LAW in the WTP, treatment of TRU from the tank farms, and Mission Acceleration Initiative (MAI) processing of low Cesium supernatant from SSTs.

- Case 3 completes SST retrieval in October 2023.
  Case 3b, which requires SST retrieval to complete in 2018, finishes retrieval in August 2018.

The retrieval sequences for Cases 3 and 3b are provided in Appendices H and I.

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 October 2000 through September 2001. 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 (Kgal/month).

Facility	Management Limit From HNF-SD-WM-ER-029, Rev. 20 (64 Kgal/mo)	Facility Target For FY 2002	Average Monthly Facility Generations (10/2000 - 09/2001)
Tank farms	10.0	10.0	3.7
WESF/B Plant	23.0	0.0	0.42
PUREX	15.0	0.42	0.0
T Plant	6.0	1.58	0.0
222-S Laboratory	5.0	0.83	0.0
300 Area	5.0	0.15	0.0
400 Area	0.0	0.0	0.0
TOTAL	64.0	12.98	4.12

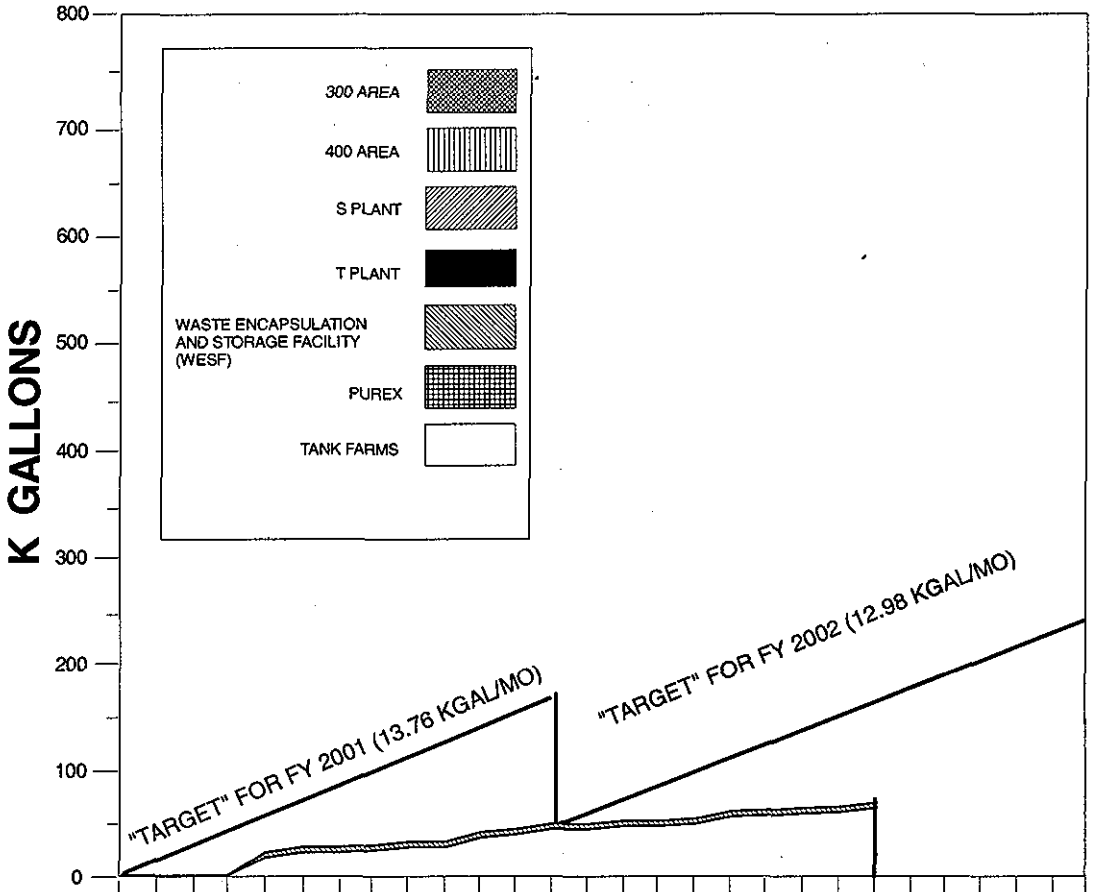
Notes:

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 2000 through September 2001.

The total average monthly facility generations are 4.12 Kgal in FY 2001, down from 6.3 Kgal in FY 2000. The total of the facility targets for FY2002 are also lower than in FY2001, by 0.78 Kgal/month. Targets were reduced for WESF, T Plant, and the 300 Area. The volumes of waste entering the DST tank space for October 2000 – September 2001 are compared graphically to the various targets or projected generations in Figures 5-1 through 5-4.

Figure 5-1. Monthly Facility Generations.



FY 2002 TARGET		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	1/02	2/02	3/02	4/02	5/02	6/02	7/02	8/02	9/02	10/02	11/02	12/02
300 AREA	0.2	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	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
T PLANT	1.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
WESF	0.0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
PUREX	0.4	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	0	0	1	16	5	0	2	3	0	9	3	5	0	3	0	2	7	1	2	1	4						
TOTAL	12.98	0	0	1	21	5	0	2	3	0	9	3	5	0	3	0	2	7	1	2	1	4						

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

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

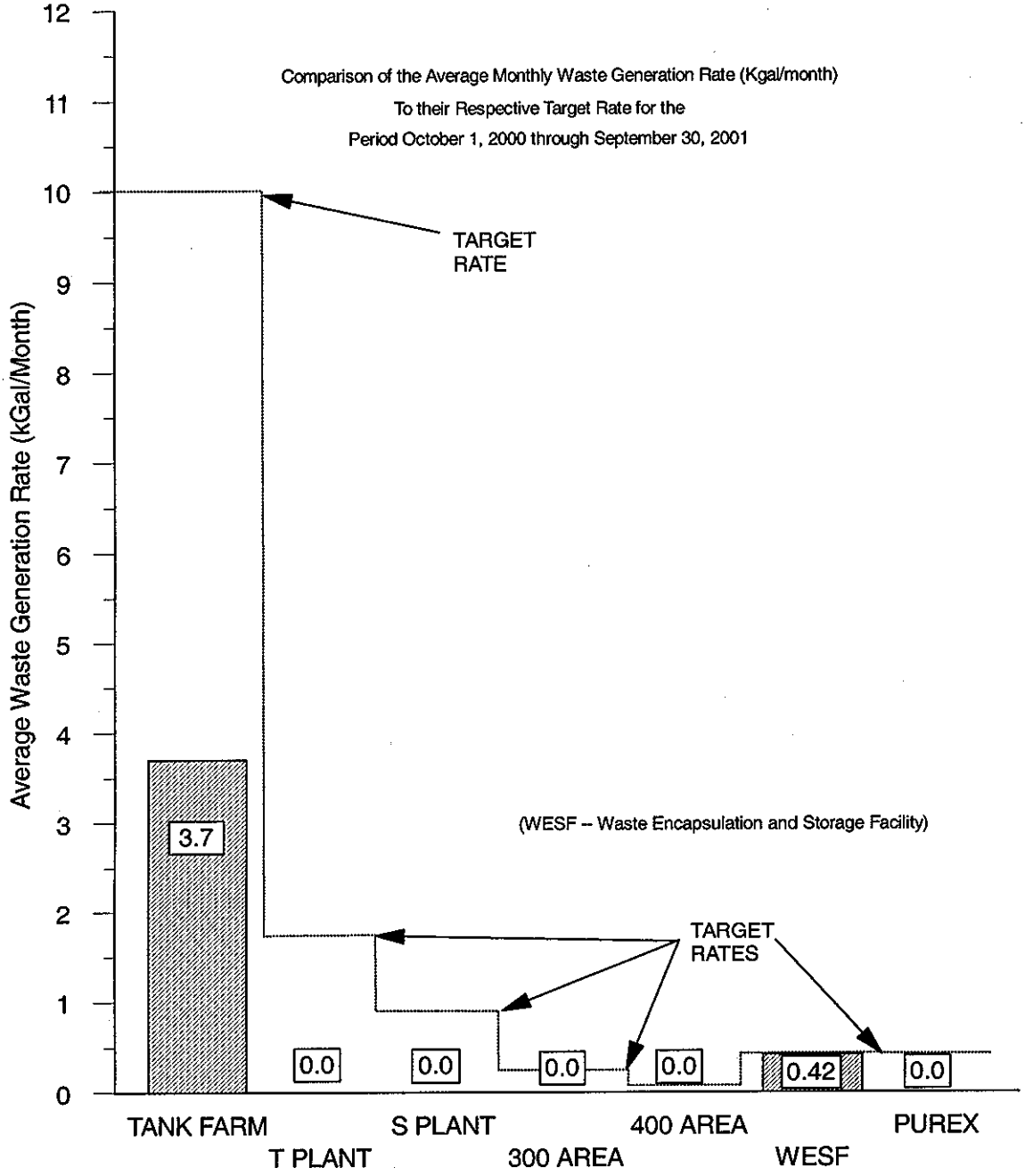
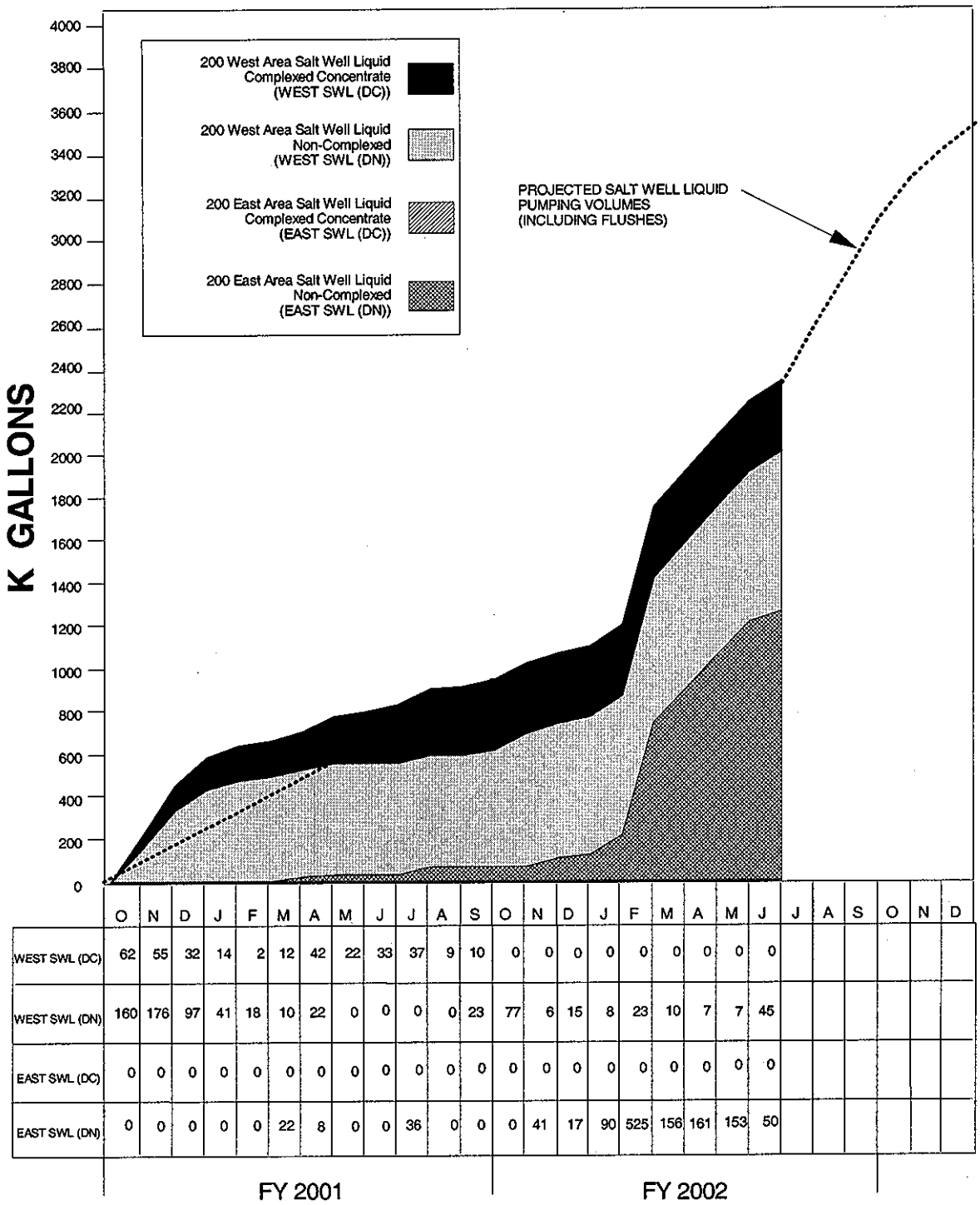
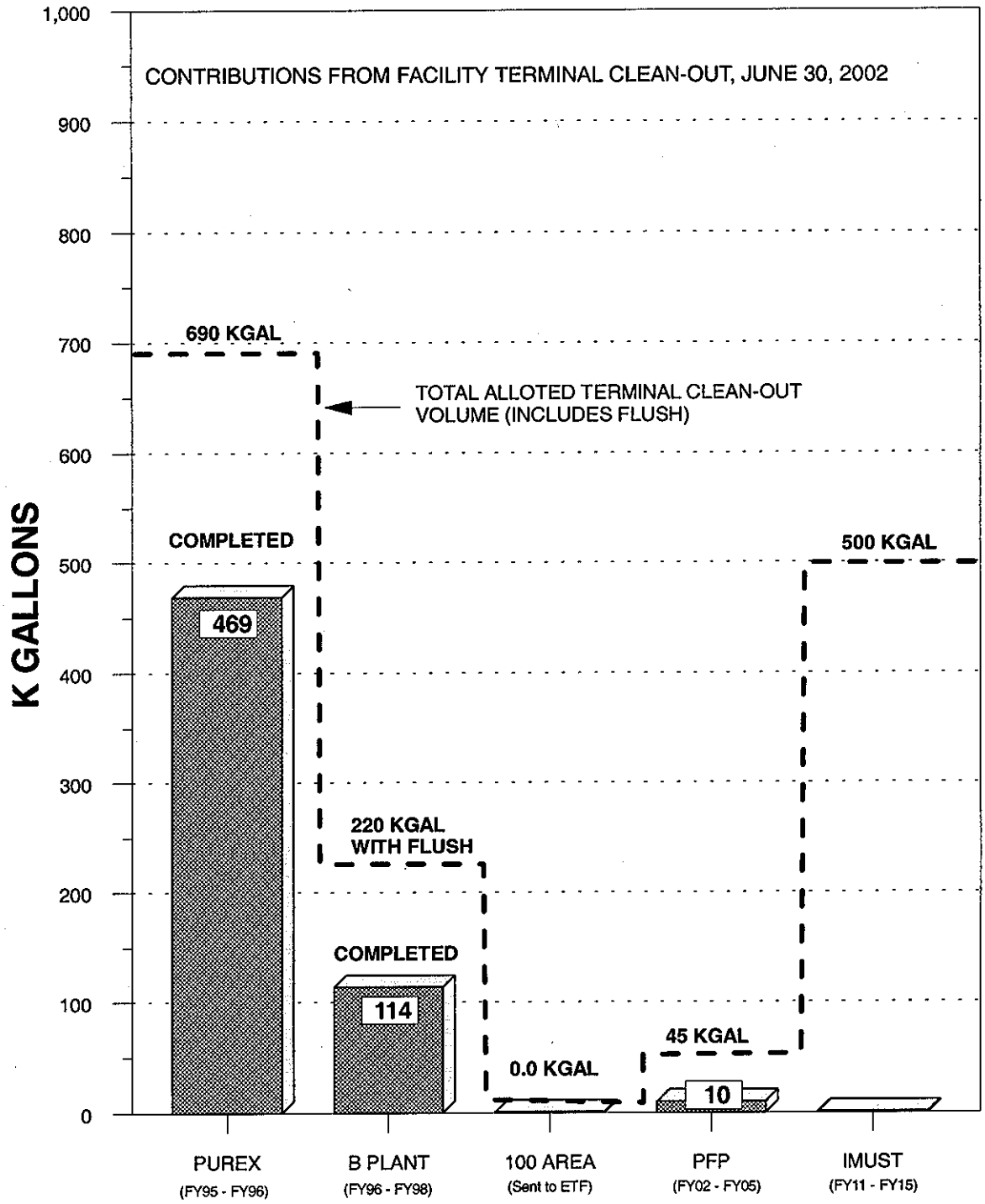


Figure 5-3. Monthly Contributions from Saltwell Liquid Pumping.



	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
WEST SWL (DC)	62	55	32	14	2	12	42	22	33	37	9	10	0	0	0	0	0	0	0	0	0						
WEST SWL (DN)	160	176	97	41	18	10	22	0	0	0	0	23	77	6	15	8	23	10	7	7	45						
EAST SWL (DC)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
EAST SWL (DN)	0	0	0	0	0	22	8	0	0	36	0	0	0	41	17	90	525	156	161	153	50						

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 selected 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. (The options listed are not independent. Implementing one option could affect the volume saved by other options.)

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	2, 3
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	2, 3
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 1-1. Detailed assumptions are provided in Appendix A. None of the cases requires construction of new DST storage capacity, except for Case 3b, which retrieves SSTs by 2018. In this subset 20.4 Mgal of new storage space are needed.

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 2003) 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 Case 1 projection.

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 (The model accommodates evaporator outages and associated tank farm upgrades). A reduction in evaporation capacity during years when space is tight or when waste receipts are high could result in a tank space shortage. After 2018,

the projection shows that the evaporator isn't needed. The WTP will have ten years of operating experience, will have treated a sufficient volume of waste to make space available, and the assumed total treatment rate allows retrieval to move on an aggressive schedule. Time is available between startup and 2018 to review the need for evaporator operations as treatment progresses.

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 2003.

5.4.1 Projection Case 1 Results

The SST retrieval sequence for FY 2002 and the body of this report are based on the Case 1 projection that incorporates a risk-based SST retrieval sequence to fit existing DST capacity. The Case 1 projection has extended retrieval durations or delayed the start of additional SST retrieval starts to prevent overfilling available space. The Case 1 projection incorporates 0.85 million gallons of tank space options by 2003 (from decreased dedicated operational space). Tank space needs for the Case 1 projection are shown in Figure 5-5 (no new DST capacity is required). Aging-Waste Tank space needs are shown in Figure 5-6. The retrieval sequence and risk reduction curves for Case 1 are shown in Section 4.0.

A spreadsheet summarizing the waste generations, evaporator waste volume reduction, and processing requirements for the Case 1 projection is included in Table 5-3. The near term tank use, evaporator, and cross-site transfer information for Case 1 are shown in Tables 5-4 through 5-7.

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

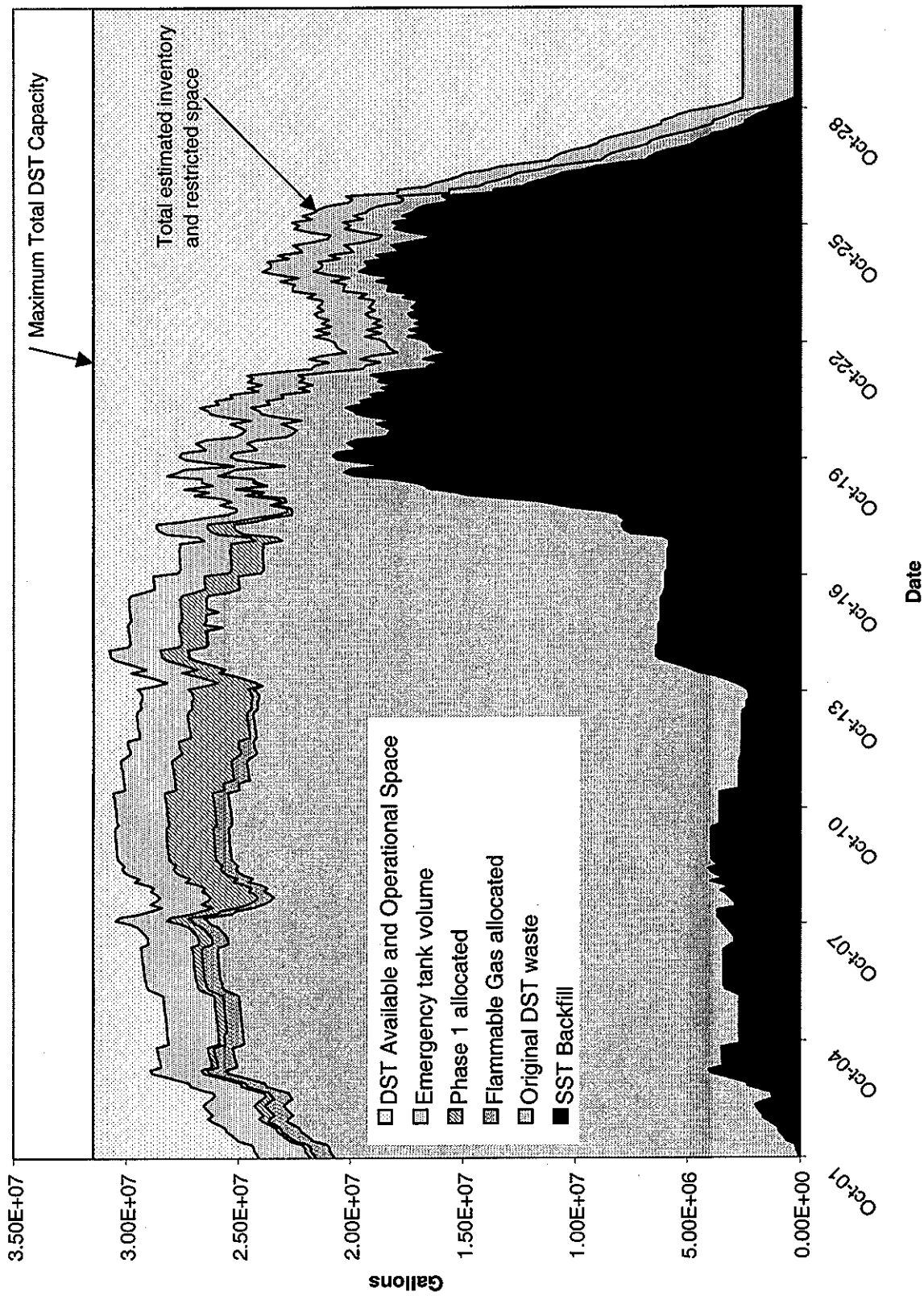
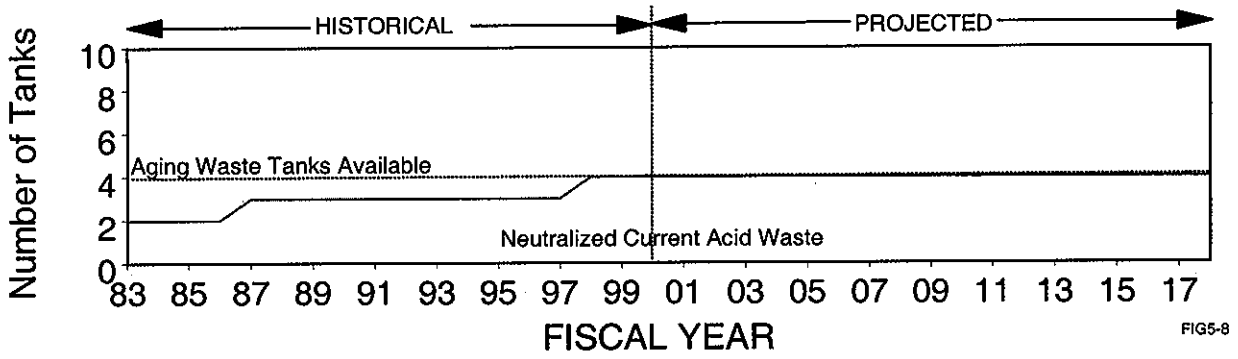


Figure 5-6. Aging Tank Requirements for Case 1.



5.4.1.1 Aging Waste Tank Space for Case 1

Because the Plutonium Uranium Extraction Plant has been decommissioned, only two of the four 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, with the remainder planned for retrieval into Tank 241-AY-102 in FY 2004. Tank 241-AY-101 will be used to retrieve the SST wastes from Tank 241-C-104 starting in FY 2007.

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 2002, 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 2007, 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 5-6. The uses of each individual aging waste tank for the Case 1 projection are shown in Figure 5-7

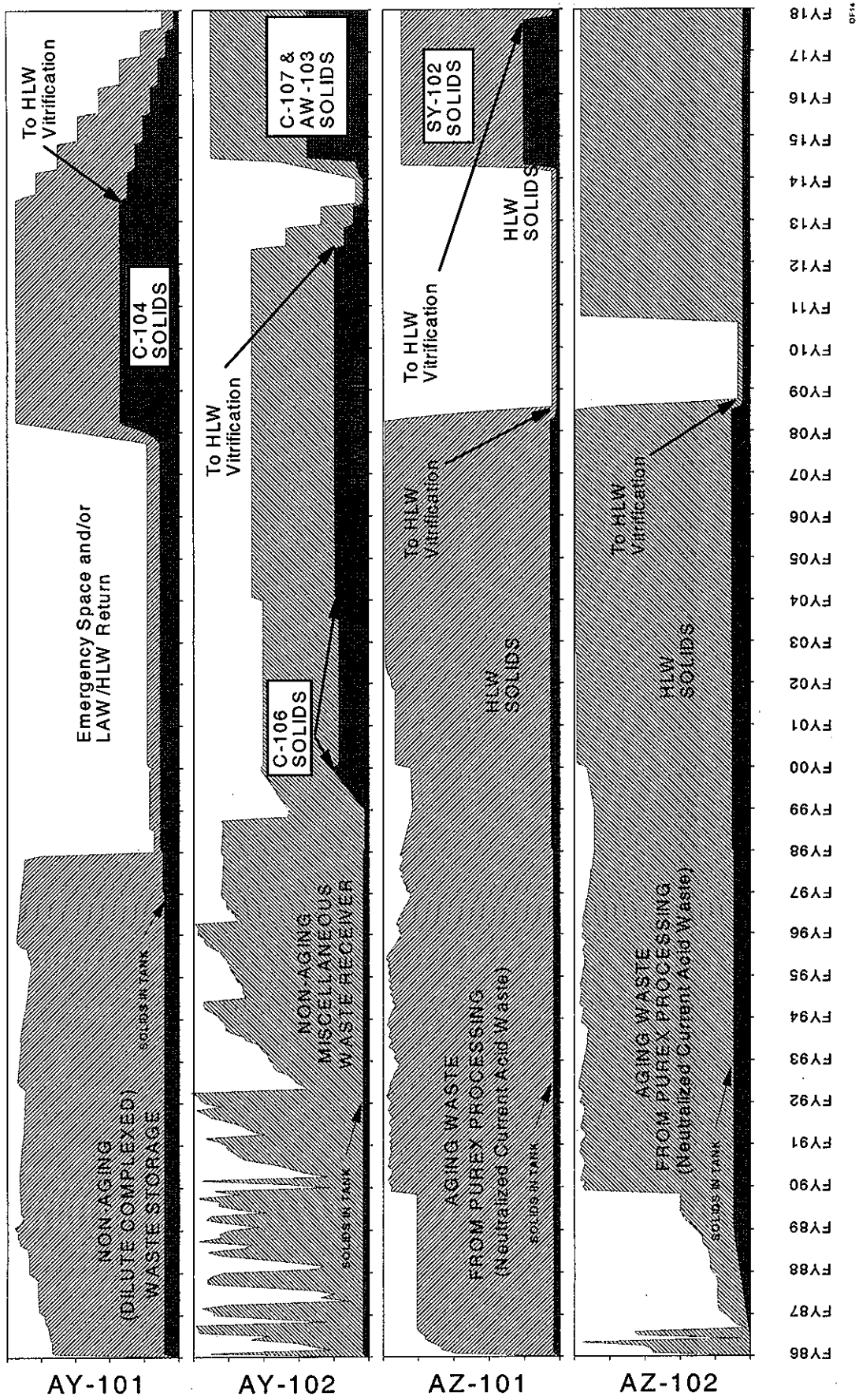


Figure 5-7. Aging Waste Tank Use for Case 1.

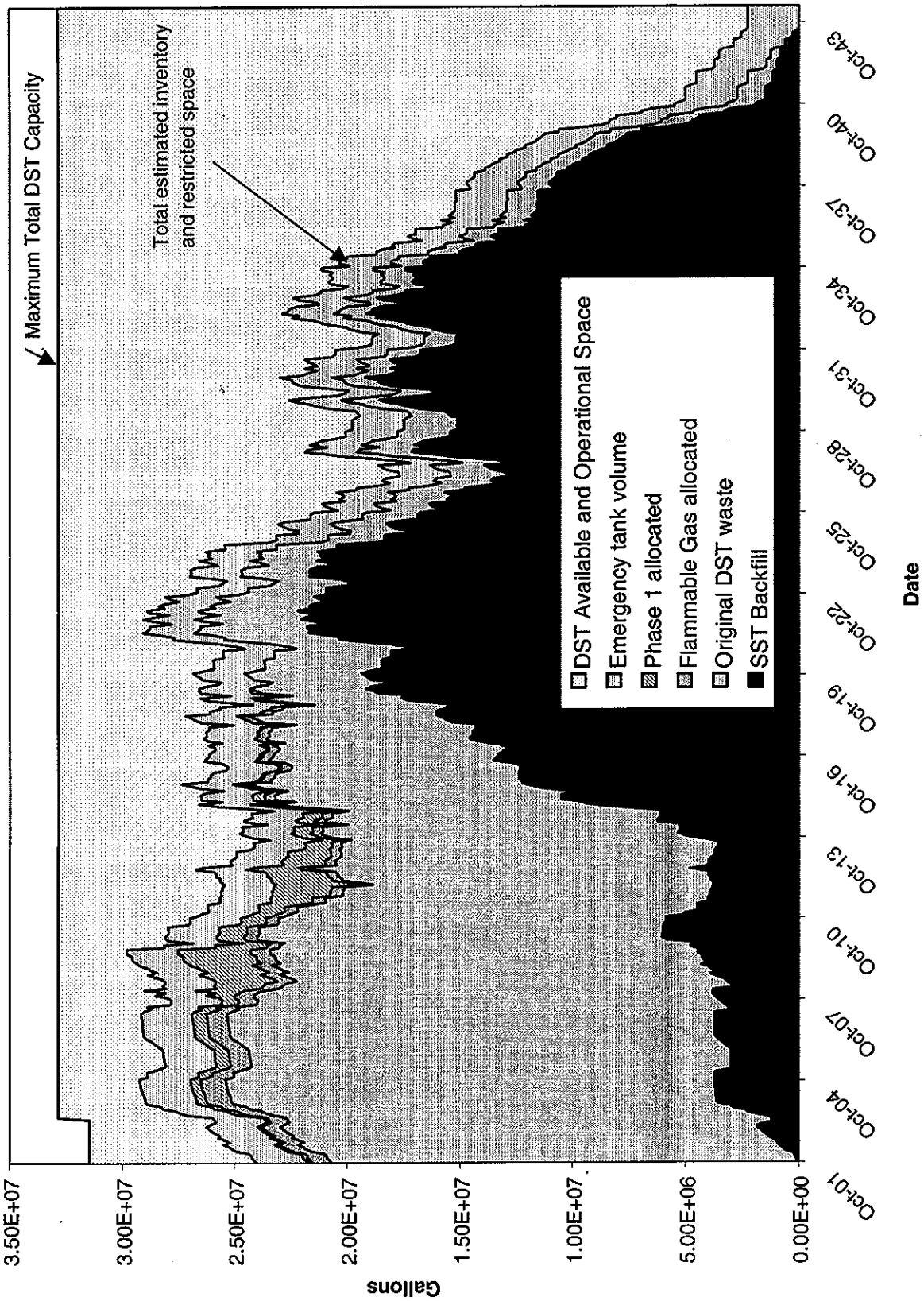
Table 5-3. Spreadsheet of Waste Additions and Reductions (Kgal) for Case 1.

FISCAL YEAR	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
STARTING INVENTORY	20455	20924	22751	24371	24764	24948	25881	26240	23985	25357	25351	24564	24226	24173	27188	26463	25007	23333
SPACE UTILIZATION																		
Spare Space	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140
Contingency Space	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Restricted Space	1416	1263	1323	1332	1333	1333	1979	1450	1450	1450	1965	2599	1480	1033	1237	1134	305	364
Priority/Operational Space	2323	1828	2357	2081	2699	1766	727	2222	1742	1990	1741	1445	2690	628	877	2223	2665	2098
Solids Return Tank	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140
NEW WASTE ADDITIONS																		
B Plant/WESF	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S Plant/WSCF	0	2	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
T Plant	0	5	17	15	11	8	5	3	3	3	3	3	3	3	3	3	3	3
300/400 Areas	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
Flushes	159	0	9	16	14	17	198	5	5	5	5	5	294	205	462	427	5	3
SWL Pumping	943	2084	977	144	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tank Farms	44	30	120	170	116	170	117	170	116	128	111	169	117	170	78	170	120	170
SST Retrieval	0	0	1877	1013	0	694	512	1397	1957	0	0	0	69	4134	0	0	262	8354
PFP	0	13	10	13	10	0	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
Retrieval Water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Everything Else	0	67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pretreatment Dilution	0	0	0	0	0	0	335	0	0	0	0	0	229	0	378	414	0	0
Wash Water	0	0	162	16	0	0	142	3	1	1	1	0	142	1	2	83	4	2
PUREX	0	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	100	100	100	100	100	0	0	0
NEW WASTE ADDITIONS TOTA	1151	2208	3189	1421	184	933	1332	1596	2100	156	238	296	973	4632	1042	1116	413	8551
TOTAL WASTE BEFORE EVAP	21606	23132	25940	25792	24948	25881	27213	27836	26085	25513	25589	24860	25199	28805	28230	27579	25420	31884
EVAPORATOR WVR	-682	-381	-1569	-1028	0	0	-973	-894	-728	-162	-509	0	-336	0	0	-652	0	0
CUM EVAPORATOR WVR	-1364	-1745	-3314	-4342	-4342	-4342	-5315	-6209	-6937	-7099	-7608	-7608	-7944	-7944	-7944	-8596	-8596	-8596
Low Activity Waste Outflow	0	0	0	0	0	0	0	-1083	0	0	-516	0	-517	-1372	-1522	-1798	-1904	-6963
High Level Waste Outflow	0	0	0	0	0	0	0	-1874	0	0	0	-634	-173	-245	-245	-122	-183	-2003
EVAP AND OUTFLOWS TOTAL	-682	-381	-1569	-1028	0	0	-973	-3851	-728	-162	-1025	-634	-1026	-1617	-1767	-2572	-2087	-8966
NET INVENTORY CHANGE	469	1827	1620	393	184	933	359	-2255	1372	-6	-787	-338	-53	3015	-725	-1456	-1674	-415
END OF YEAR INVENTORY	20924	22751	24371	24764	24948	25881	26240	23985	25357	25351	24564	24226	24173	27188	26463	25007	23333	22918
TOTAL CAPACITY	26943	28122	30331	30457	31260	31260	31226	29937	30829	31071	30550	30550	30623	31129	30857	30644	28583	27660
% of DST CAPACITY IN USE	86	89	96	97	99	99	99	95	98	99	97	97	97	99	98	97	91	88

5.4.2 Projection Case 2 Results

The projected tank space needs for the Case 2 projection are shown in Figure 5-8 The projected tank space needs for the Case 2 projection do not exceed existing DST capacity. This case completes retrieval in 2037, and waste processing is complete in 2044. The retrieval sequence and risk-reduction curves for Case 2 are shown in Appendix G.

Figure 5-8. Double-Shell Tank Space Requirements for the Case 2 Projection.



5.4.3 Projection Case 3 and Case 3b Results

The Case 3 projection incorporates an SST retrieval sequence that retrieves tank farms with the highest risk per unit volume of waste first. The Case 3 projection incorporates 3 million gallons of tank space-saving options by 2006 (the same as in Case 2.). SST retrieval for Case 3 completes in 2023. Waste processing is complete in 2028. The retrieval sequence and risk reduction curves for Case 3 are shown in Appendix H.

The objective of Case 3b was to discern the number of new tanks needed if all SST retrieval is to complete in 2018. Projected tank space needs for the Case 3b projection are shown in Figure 5-10. The projected tank space needs for the Case 3 projection exceed existing DST capacity by 2 tanks in FY 2012, by up to 5 tanks in FY 2013, and by up to a maximum of 17 additional tanks in FY 2018. The retrieval sequence and risk reduction curves for Case 3b are show in Appendix I. Options to reduce the tank space shortage for Case 3b 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.

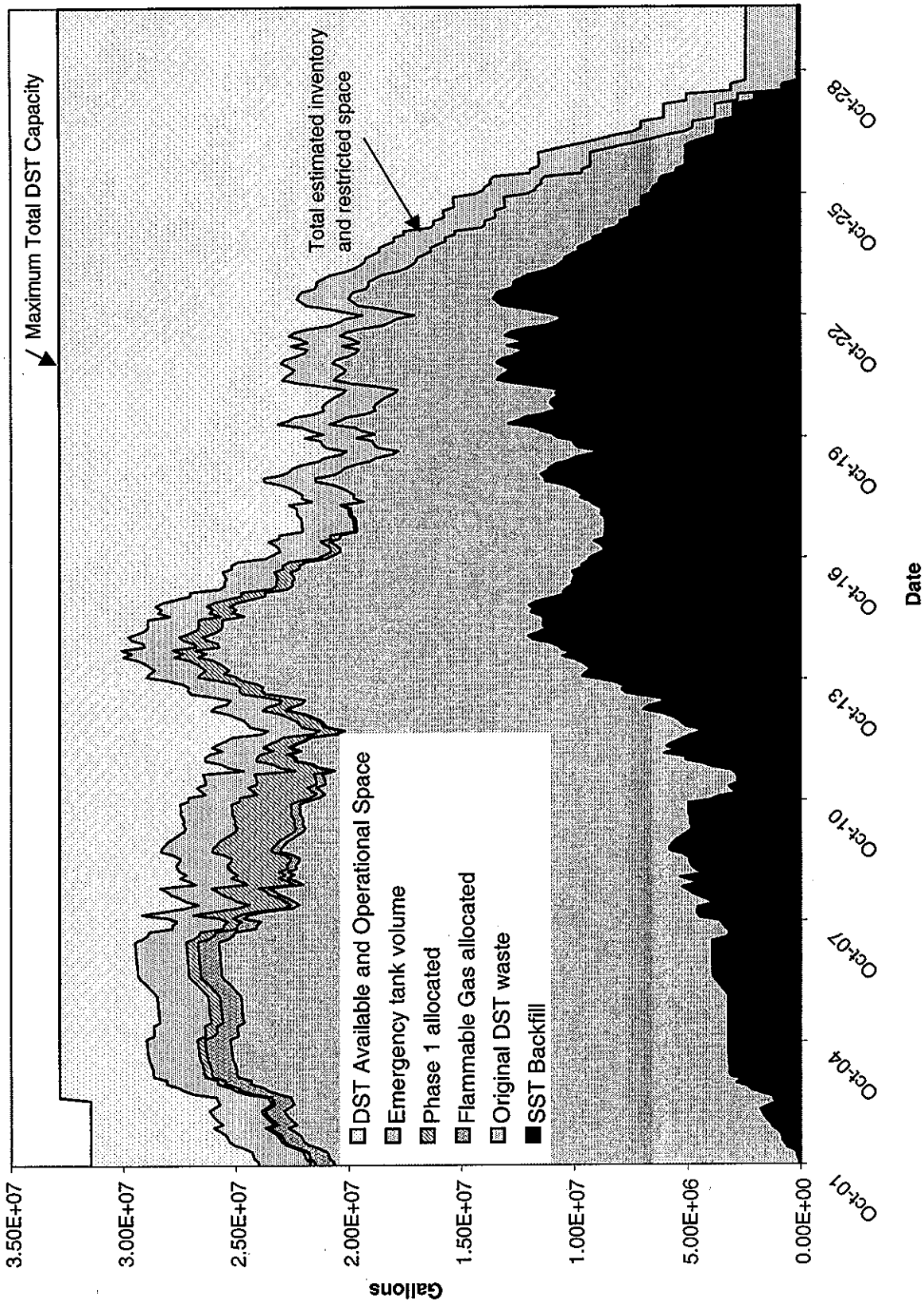
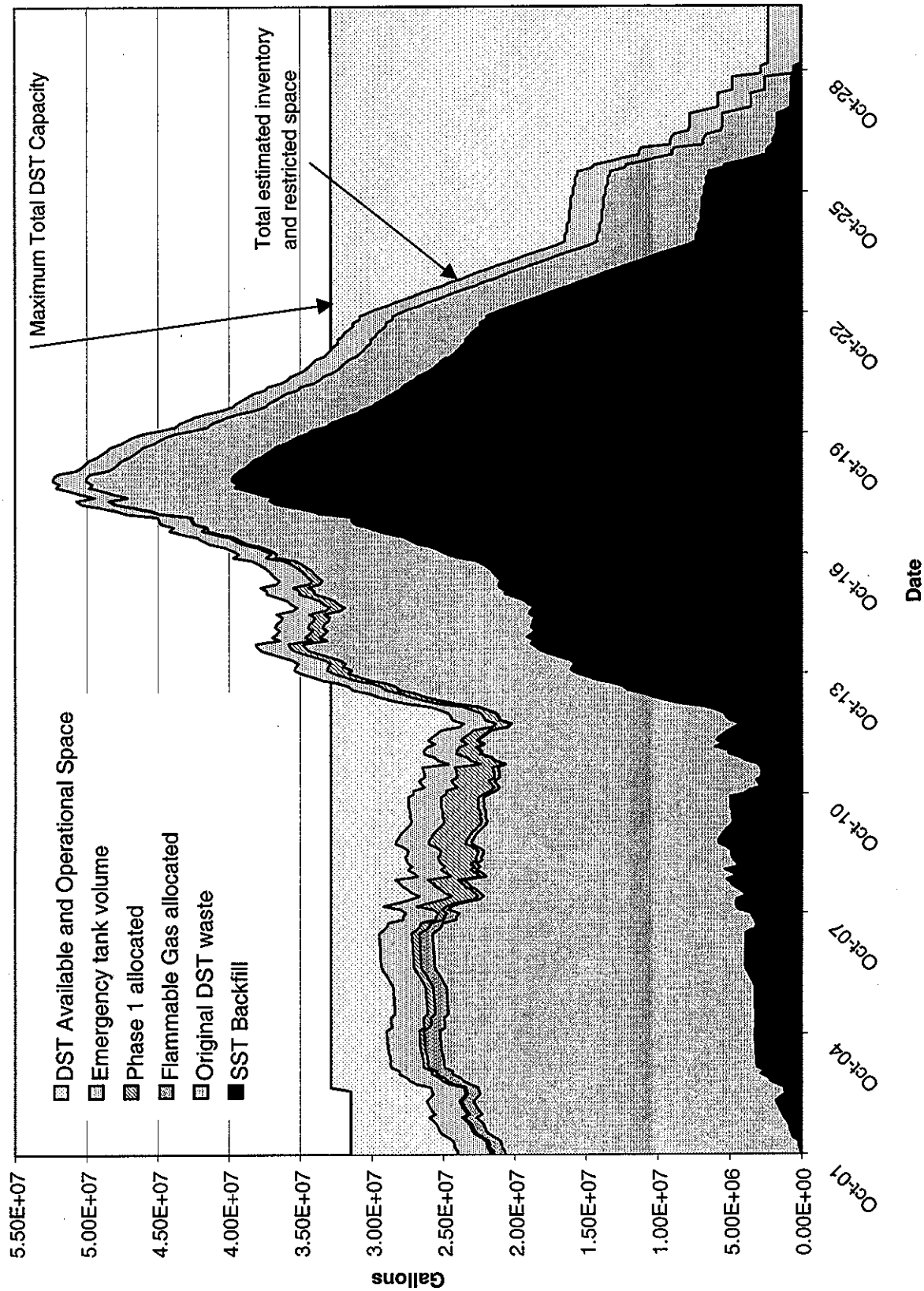


Figure 5-10. Double-Shell Tank Space Requirements for the Case 3b Projection.



5.4.4 Interpretation of Short-Range Projection Results for Case 1

This section provides an interpretation of detailed short-range projection results, applicable to projection Case 1, which is the contractual baseline case. 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. (The short-range projections do not apply to Cases 2 and 3 because of differences in tank space savings assumptions).

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 each 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 2000 to September 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-AP-102), while other tanks will store concentrated waste.

Figure 5-11 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 5-4.

Figure 5-11. Tank Levels During the Short-Range Projection for Case 1.

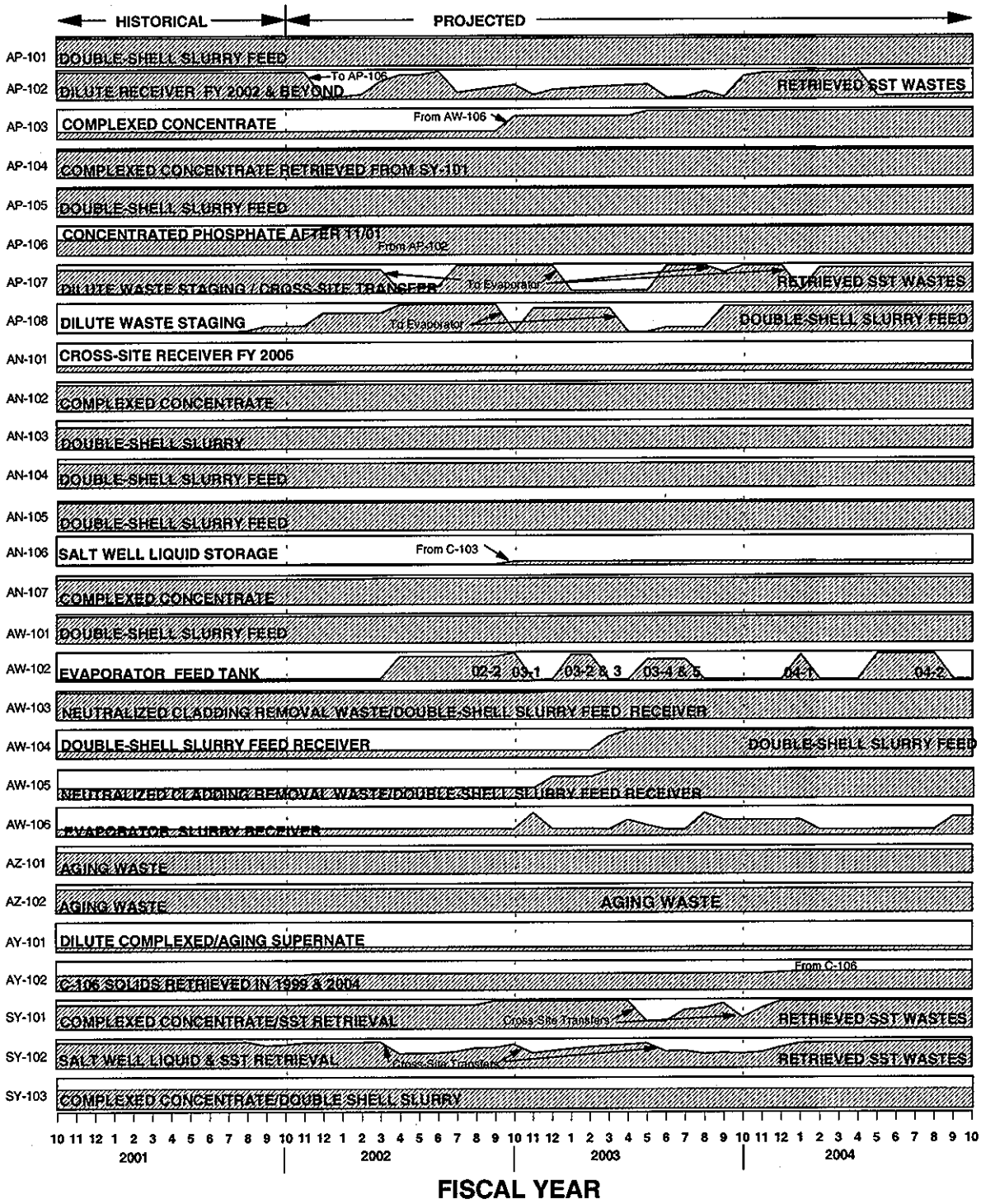


Table 5-4. Projected Tank Use on 09/2003. (2 Sheets)

Tank	Liquid (Kgal)	Solids (Kgal)	Total (Kgal)	Comment/Projected Use for Tank as of 09/2003
AY-101	74	108	182	Emergency space; used to retrieve C-104 waste from FY 2007 on
AY-102	477	192	669	Will receive additional solids from Tank 241-C-106 starting 11/2003; third HLW feed tank in all projection cases
AZ-101	948	52	1000	NCAW/SL; first HLW feed tank in all projection cases
AZ-102	887	105	992	NCAW/SL; second HLW feed tank in all projection cases
SY-101	156	299	455	CC/SL inventory; retrieval/dilution completed in FY 2000; transferred to AP-102 in FY 2002; will be used for SST retrieval starting 6/2003
SY-102	1004	73	1077	DN/PT inventory; 200 West Area saltwell liquid and dilute receiver; will be used for SST retrieval starting 6/2003
SY-103	400	342	742	CC/SL inventory
AW-101	739	388	1127	DSSF/SL inventory
AW-102	28	31	59	Evaporator feed tank
AW-103	830	313	1143	SF/PD solids; DSSF will be added to tank in FY 2002 and beyond
AW-104	921	223	1144	SF/SL; will be refilled w/ DSSF started in FY 2003
AW-105	889	255	1144	SF/PD solids; projected refill w/ DSSF
AW-106	427	221	648	Evaporator slurry receiver tank; tank level will vary as concentrated waste is added and removed
AN-101	253	0	253	To be used as an intermediate staging tank starting in FY 2005; waste cannot be transferred to AN farm until 6/2005
AN-102	938	139	1077	CC (TRU) inventory; fourth source tank of LAW waste processed (NCAW supernate are second and third sources)
AN-103	500	459	959	DSS inventory
AN-104	608	445	1053	DSSF inventory; second LAW tank to be processed
AN-105	635	492	1127	DSSF inventory;
AN-106	139	17	156	DN/SL; projected refill w/ DSSF in FY 2005; waste cannot be transferred to AN farm until 6/2005
AN-107	838	247	1085	CC (TRU)/SL inventory
AP-101	1113	0	1113	DSSF; first LAW waste to be processed
AP-102	928	0	928	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	1102	0	1102	CC/SL; received concentrated waste 02/1999 on
AP-104	1106	0	1106	CC; received cross-site waste from Tanks 241-SY-101 and SY-102 in FY 2000
AP-105	1042	89	1131	Filled with DSSF in June 2000
AP-106	1140	0	1140	Received CP from AP-102 in FY 2001
AP-107	1134	0	1134	DN/DC; used to receive cross-site waste from Tank 241-SY-102 and to stage dilute for evaporation; will receive DSSF in FY 2004
AP-108	1076	0	1076	Used to stage dilute for evaporation; will receive DSSF in FY 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.

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 5-6) 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 Phase processing (Tanks 241- AN-101, AN-102, AN-105, AP-104, and AP-101)
- The large volume of SST waste retrieved beginning in FY 2003
- 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 5-13, 5-14, 5-15, and 5-16 show the detailed operation of all the DST waste tanks for the Case 1 projection during the near term.

Figure 5-12. Case 1 Dilute Receiver Tanks and 242-A Evaporator Operations.

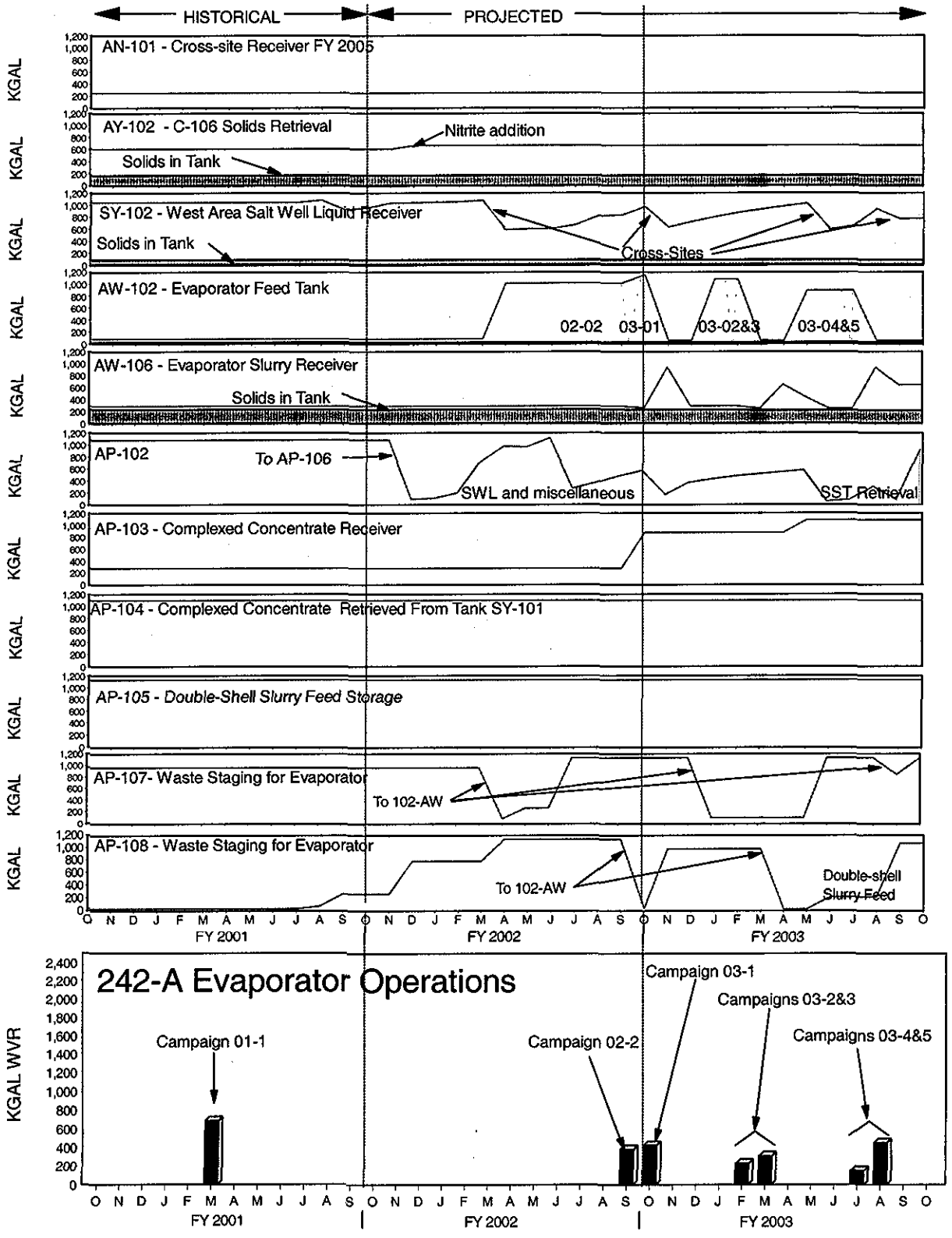


Figure 5-13. Case 1 West Area Waste Generations and SY Tank Levels.

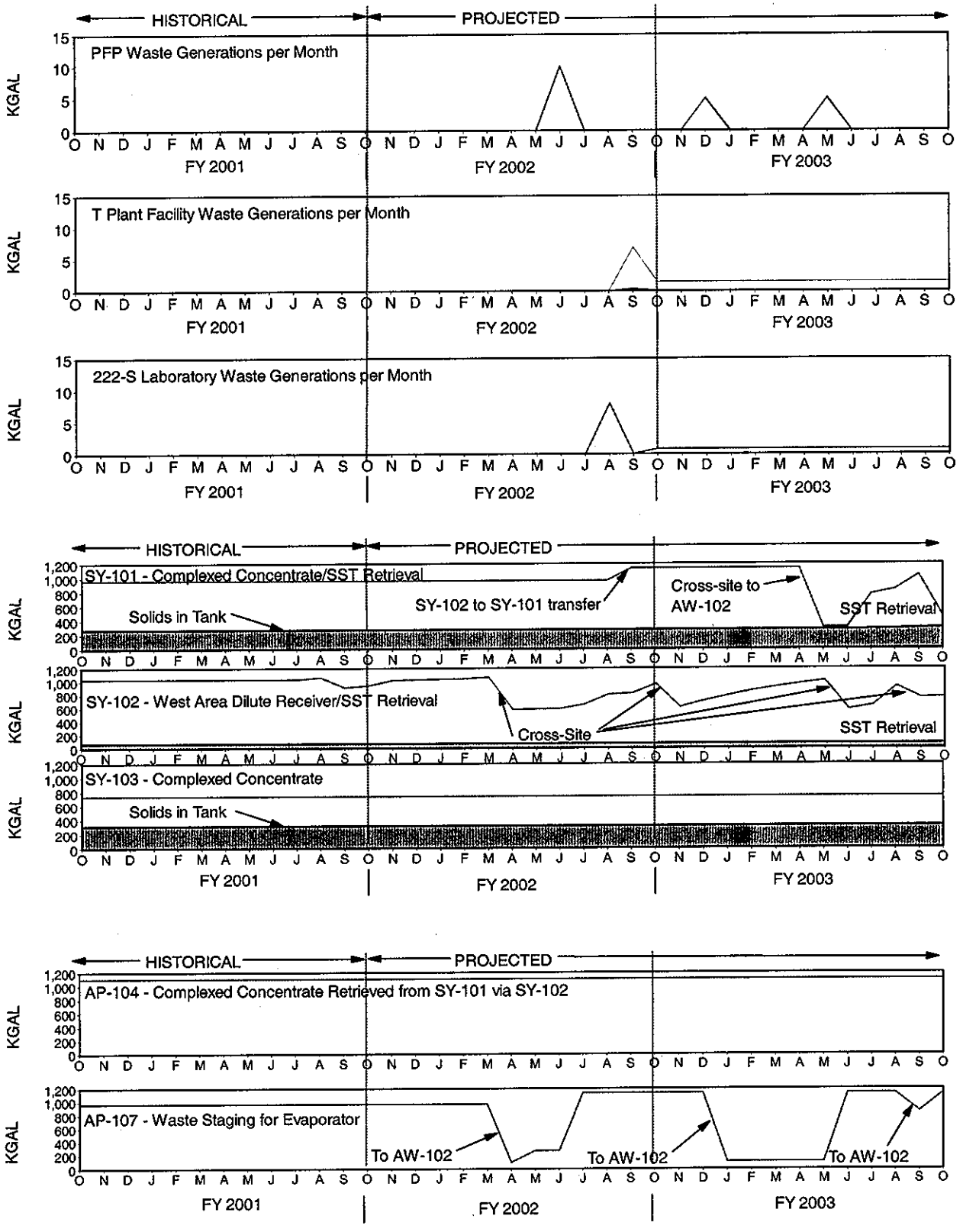


Figure 5-14. Case 1 AN Farm Tank Levels.

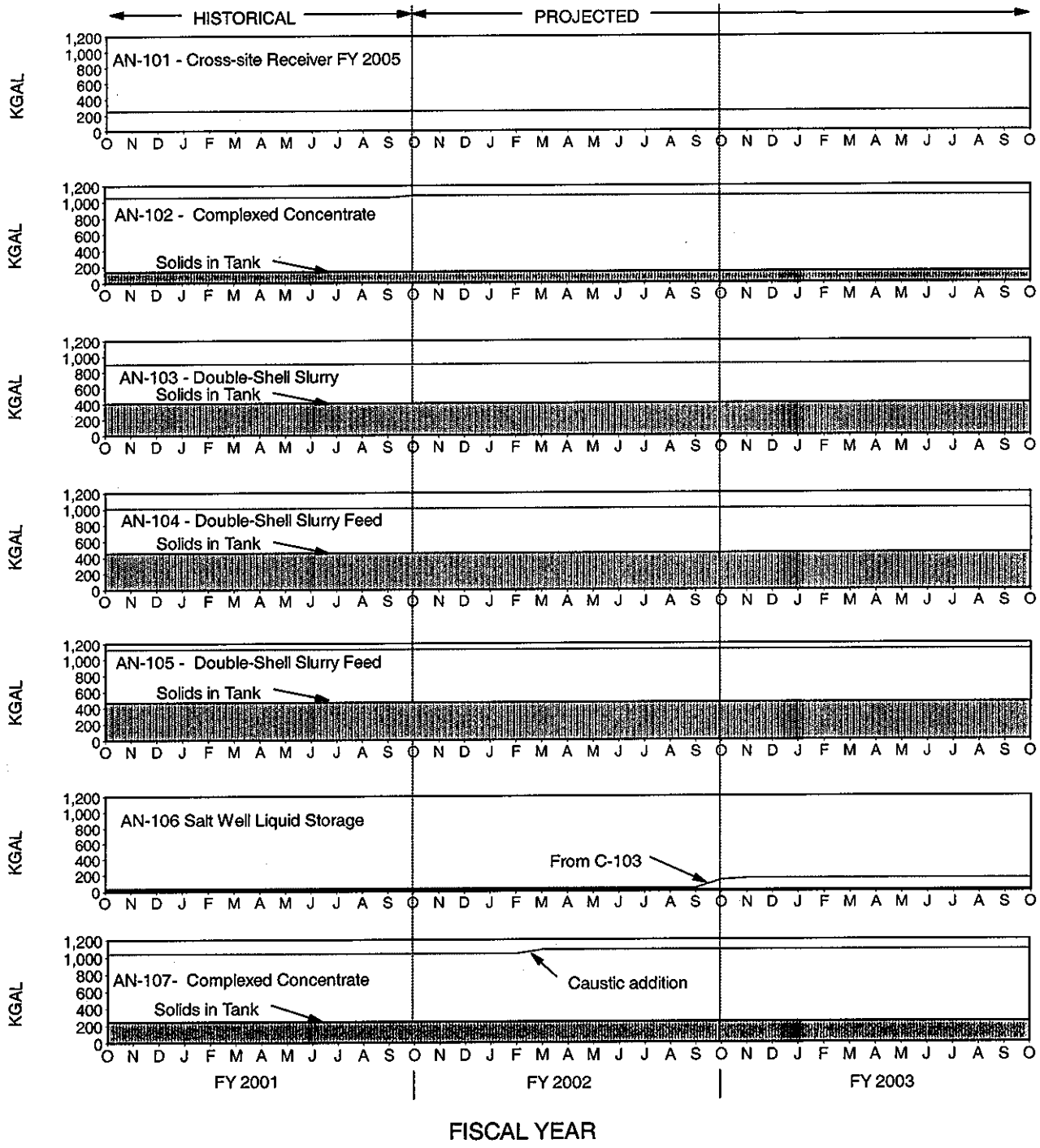


Figure 5-15. Case 1 AP Farm Tank Levels.

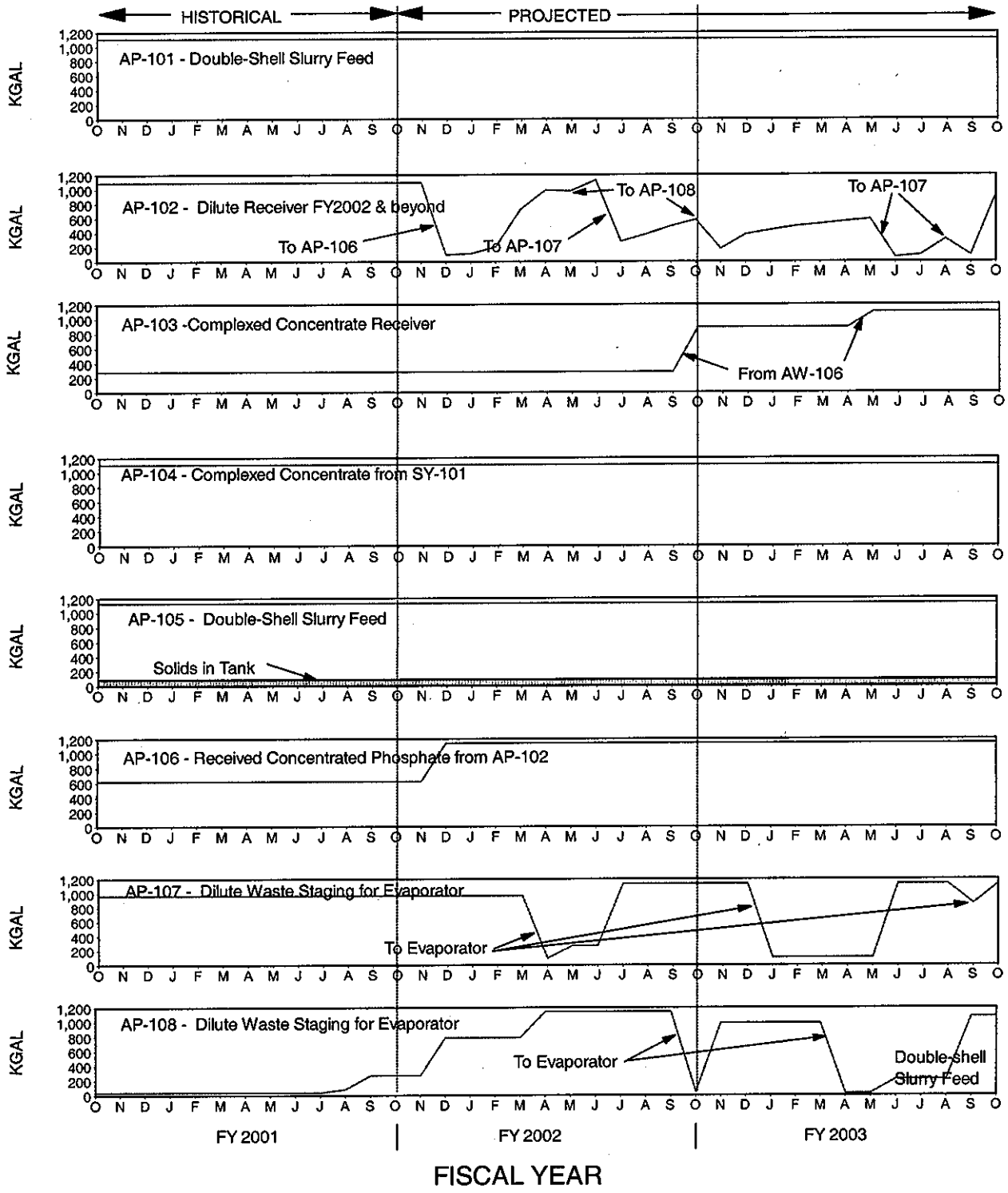
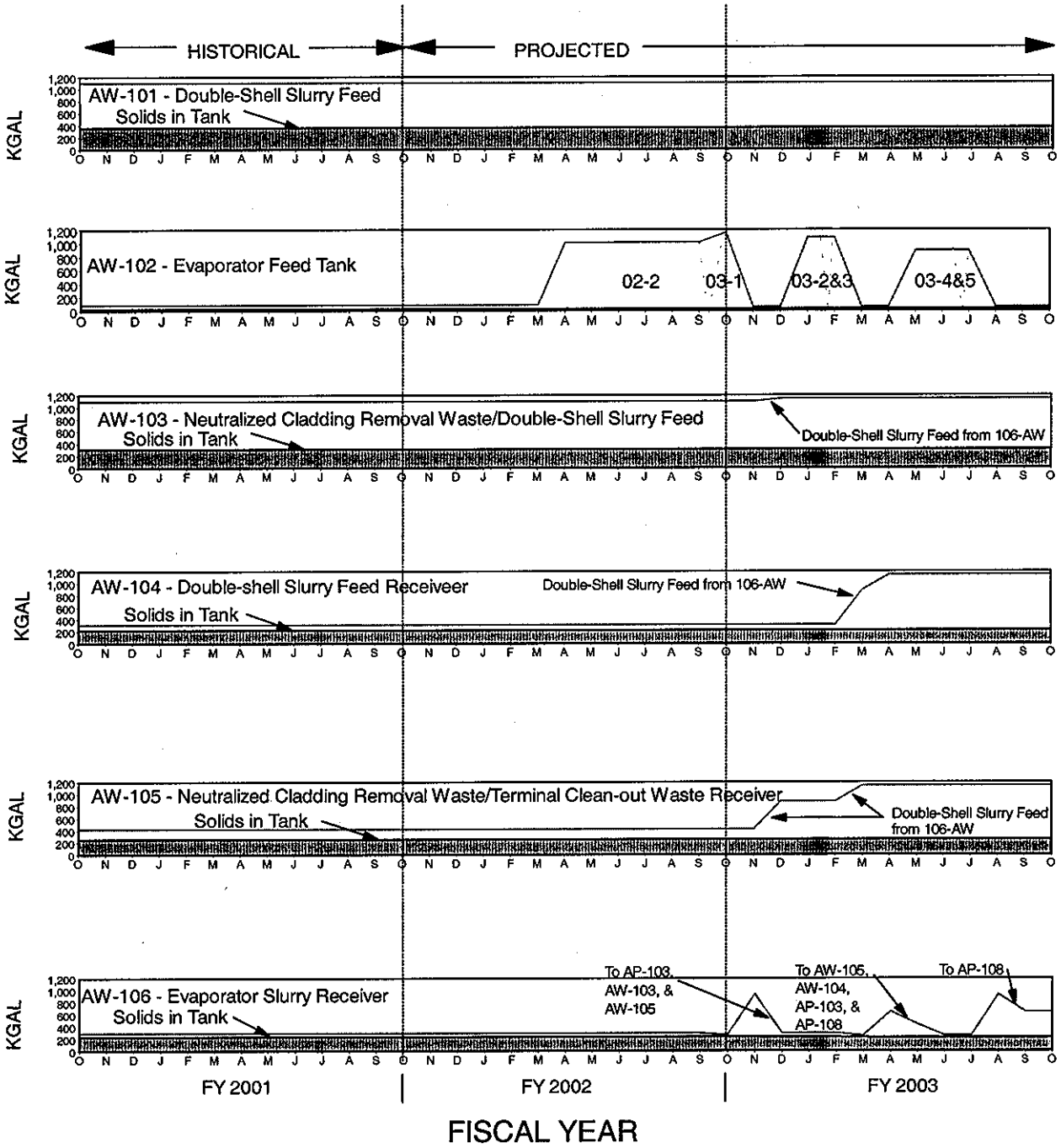


Figure 5-16. Case 1 AW Farm Tank Levels.



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 1 projection. 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 Flyckt 2002) to project future condensate production recorded in Table 5-5. The waste sources, campaign schedule, and concentrated waste receiver tanks used in the Case 1 projection are summarized in Table 5-6. Table 5-6 shows evaporator campaigns through the FY 2004. Cross-site transfers through FY 2004 are shown in Table 5-7

Table 5-5. Evaporator Waste Volume Reduction and Liquid Effluent Retention Facility Additions for the Case 1 Projection.

Fiscal Year	Evaporator Waste Volume Reduction (Kgal)	Condensate to Liquid Effluent Retention Facility (Kgal)
2002	380	440
2003	1570	1810
2004	1030	1180
2005	0	0
2006	0	0
2007	970	1120
2008	890	1020
2009	730	840
2010	160	180
2011	510	590
2012	0	0
2013	340	390
2014	0	0
2015	0	0
2016	650	750
2017	0	0
2018	0	0

Table 5-6. Evaporator Campaign Schedule for Case 1 Projection.

Campaign	Start Date	Staging Tank (Staging Date to AW-102)	Original Waste Source	Waste Feed Type	Feed Volume (Kgal)	Receiver Tank
02-1	3/2002	Cold Run				
02-2	9/2002	AP-107 (3/2002)	SY-102 to AP-107--- 9/2000 SY-102 to AP-107---11/2000	DN/DC DN/DC	~980	AP-103
03-1	10/2002	AP-108 (9/2002)	AP-102 to AP-108--- 3/2002	DN/DC	~1100	AW-103 (full) AW-105
03-2	2/2003	AP-107 (12/2002)	AP-102 to AP-107--- 6/2002	DN/DC	~1030	AW-105 (full) AW-104
03-3	3/2003	AP-108 (3/2003)	AP-102 to AP-108--- 10/2002	DN/DC	~1100	AW-104 (full) AP-103 (full) AP-108
03-4	7/2003	SY-101 (4/2003)	SY-101 to AW-102--- 4/2003 Direct transfer.	DN/DC	~870	AP-108
03-5	8/2003	AP-107 (8/2003)	SY-102 to AP-102--- 5/2003 AP-102 to AP-107--- 5/2003	DN/DC	~1030	AP-108 (full) AP-107 (~1/2004)
04-1	1/2004	AP-107 (1/2004)	SY-101 to AP-102--- 7/2003 AP-102 to AP-107--- 8/2003	DN (S-112 waste)	~1100	AP-107 (full)
04-2	8/2004	AP-102 (4/2004)	SY-101 to AP-102--- 9/2003	DN (S-112 waste)	~1060	Store in 106AW temporarily.

Issue: Tank space will be extremely tight after Evaporator Campaign 03-3. SWL pumping should be winding down but the accelerated retrieval of S-112 will be retrieving wastes that need to be evaporated. Intermediate staging space for evaporator feeds will require one or more of the following alternatives:

1. Delay sending concentrated waste from Tank AW-106 to AP farm and use AP tanks as temporary intermediate feed staging tanks for as long as possible.
2. Characterize wastes and stage for evaporation in 3 months.
3. Fill AP-102, stop all additions, characterize, and feed directly to AW-102 (stops use of AP-102 for up to 4 months). The other alternative is to characterize the waste in AP-102 and allow addition of a small volume of known wastes for approximately 3-4 months.

Use space in AN-106 (costly routing if space is needed before the new cross-site line tie-in is completed).

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

Table 5-7. Cross-Site Transfer Schedule for Case 1 Projection

Date for Cross-site	Receiver Tank	Volume (Kgal)	Comments
10/2002	SY-102 to AP-102	~500	DN/DC-salt well liquid and DN
4/2003	SY-101 to AW-102	~800	DC---SY-101 waste
5/2003	SY-102 to AP-102	~500	DN/DC-salt well liquid and DN
7/2003	SY-101 to AP-102	~700	DN (waste retrieved from S-112)
8/2003	SY-101 to AP-102	~700	DN (waste retrieved from S-112)
9/2003	SY-101 to AP-102	~400	DN (waste retrieved from S-112)

Additional Notes for Tables 5-6 and 5-7:

1. The transfers in 4/2003 and 5/2003 could be changed in order to simplify routing and procedures.
2. 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.
3. Some evaporator campaigns could be accelerated or delayed.

Notes:

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

See Figure 5-12 for dilute receiver tanks, evaporator waste volume reduction, and the 242-A Evaporator operating schedules for the Case 1 projection.

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 2002 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 conduct all retrieval activities within the existing DST capacity. For Case 1, no new tanks are needed.

5.5.2 Case 2 Projected Tank Needs

The Case 2 project will conduct all retrieval activities 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 conduct all retrieval activities within the existing DST capacity. For Case 3, no new tanks are needed.

The Case 3b subset, which retrieves SSTs by 2018, exceeds DST capacity. For this subset, an additional 17 new tanks are needed.

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 the Case 3b subset, which retrieves SSTs by 2018, the total cost using year 2002 dollars would be on the order of $1.275 billion to build the 17 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 Case 3b subset projection, the first two 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 three fiscal years.

Table 5-8. Number of New Double-Shell Tanks to be Constructed and Funding Required ($M) to Meet Space Needs for Case 3b.

	Update Number of Tanks and Cost for Case 3b 2018 Retrieval Subset	
Fiscal Year	**New Double-Shell Tanks**	**Funding Required ($M)**
2002		0
2003		0
2004		0
2005		0
2006		0
2007		0
2008		12
2009		56
2010		109
2011		131
2012	2	120
2013	3	158
2014	0	267
2015	1	275
2016	5	143
2017	6	5
2018		
TOTALS	17	$1,275

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6.0 CONCLUSIONS

6.1 SINGLE-SHELL TANK RETRIEVAL SEQUENCE

6.1.1 Single-Shell Tank Risk-Sequence Benefits

The FY 2002 retrieval sequence using airborne and groundwater risk factors continues the improved approach developed in FY2001 for Rev 0 of this document. The enhanced basis for risk measures is as follows.

- The FY 2000 sequence was determined solely on ^{99}Tc inventory, while the FY 2001 and FY 2002 sequences distinguish 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 good approximation of the ideal risk reduction curves (Figures 4-1 through 4-6).

6.1.2 Single-Shell Tank Assumption-Based Benefits for the Reference Case (Case 1)

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

- Retrieval of all SSTs is completed by 2026.

- Risk reduction in airborne is improved over the FY 2001 sequence. Risk reduction for groundwater radionuclide and chemical contamination is similar to the FY 2001 result.

- Processing of all SST and DST waste is completed by the end of 2028. To achieve this, in spite of the effect of the Gimpel rule on the number of glass canister to produce, the Waste Treatment Plant capacity was increased from 102/10.2 MT of glass/d in FY 2001 to 157.7/10.3 MT of glass/d in FY 2002.

- 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 further decreased the space available for SST retrieval. To complete retrieval of all SSTs by 2018, case 3b exceeds available space in FY 2012-2018, and requires up to 17 new DSTs.

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 5-8.

The projected tank space shortage in Case 3b may be avoided by a combination of the following options (see Table 5-2 for a more complete listing):

- Delay retrieval of SST wastes (would require changing the assumption that all SSTs are retrieved by 2018)
- Do not allow the return of wastes from the Waste Treatment Plant to DSTs to free up dedicated space.
- Allow addition of wastes to early feed-tank headspace
- Accelerate the treatment of waste
- Delay the SST interim stabilization effort
- Construct new DSTs.

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APPENDIX A

ASSUMPTIONS MATRIX AND SCENARIO DEFINITIONS FOR 2002 SINGLE-SHELL TANK RETRIEVAL SEQUENCE AND DOUBLE-SHELL TANK SPACE EVALUATION

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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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Differences in assumptions among the three cases have been highlighted.
Table A-1. Assumption Matrix for the 2002 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	**Case 1 Reference Case**	**Case 2 "Updated" RPP System Plan (Ecology Case 1b)**	**Case 3 MAI/Closure (Target Baseline)**
Brief Description	**Risk-based SST Retrieval within Existing DST Capacity** SST Retrieval Sequence FY 2002 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 feed delivery and treatment rates are consistent with those established for CHG's current baseline; processing completed in 2028. Tank space options save a total of 0.85 million gallons of space by FY 2003. The SST wastes retrieved from S-112 is evaporated. Salt well liquid pumping complete 2004 to meet Consent Decree milestones.	**Risk-based SST Retrieval within Existing DST Capacity** SST Retrieval Sequence FY 2002 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 feed delivery and treatment rates match proposed WTP treatment rates.** Tank space options save a total of 3 million gallons of space by FY 2006.The SST wastes retrieved from S-112 is evaporated. Salt well liquid pumping complete 2004 to meet Consent Decree milestones.	**Risk-based SST Retrieval within Existing DST Capacity** SST Retrieval Sequence FY 2002 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 feed delivery and treatment rates match Mission Acceleration Initiative which completes processing in 2028.** Tank space options save a total of 3 million gallons of space by FY 2006.The SST wastes retrieved from S-112 is evaporated. Salt well liquid pumping complete 2004 to meet Consent Decree milestones.
Major Technical Assumptions			
BBI data represents tank compositions and inventory as of	June 30, 2001 with adjustments for historical transfers through 5/31/2002.	June 30, 2001 with adjustments for historical transfers through 5/31/2002.	June 30, 2001 with adjustments for historical transfers through 5/31/2002.
Mission Summary Diagram -Schedule float -Transfer window	Handled external to the model Two months	Handled external to the model Two months	Handled external to the model Two months
Non Tank Farm Facility Generations			
Total Limit	21-61 Kgal/year	21-61 Kgal/year	21-61 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%
T Plant Yearly Rate (FY 2002)	19 Kgal/year	19 Kgal/year	19 Kgal/year

Table A-1. Assumption Matrix for the 2002 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	**Case 1 Reference Case**	**Case 2 "Updated" RPP System Plan (Ecology Case 1b)**	**Case 3 MAI/Closure (Target Baseline)**
Yearly Rate (FY 2003 on) Flush for misc. waste WVRF	3 to 17 Kgal/year 22% 99%	3 to 17 Kgal/year 22% 99%	3 to 17 Kgal/year 22% 99%
300 Area Yearly Rate Flush for misc. waste WVRF	2 to 29 Kgal/year 44% 94%	2 to 29 Kgal/year 44% 94%	2 to 29 Kgal/year 44% 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 Dates Total volume Flush WVRF	2002-2005 45 Kgal total 22% 81%	2002-2005 45 Kgal total 22% 81%	2002-2005 45 Kgal total 22% 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 WVRF	120 Kgal/year 99%	120 Kgal/year 99%	120 Kgal/year 99%
IMUST Wastes Total Volume (2011-15)	500 Kgal total	500 Kgal total	500 Kgal total
Chemical Addition, Kgal Tank AN-106 (FY 2002) Tank AN-107 (FY 2002) Tank AZ-102 (FY 2002)	AN-106--4.9 (8 M NaOH) + flush AN-107--112.5 (19 M NaOH) + flush AZ-102--7.6 (19 M NaOH) + flush	AN-106--4.9 (8 M NaOH) + flush AN-107--112.5 (19 M NaOH) + flush AZ-102--7.6 (19 M NaOH) + flush	AN-106--4.9 (8 M NaOH) + flush AN-107--112.5 (19 M NaOH) + flush AZ-102--7.6 (19 M NaOH) + flush
SST Interim Stabilization Volume remaining West Area Receiver Pumping Completion, FY Porosity saltcake/sludge Dilution/Flush for Pumping WVRF, non-complexed WVRF, complexed	~1.3 Mgal on 5/1/2002 Tank SY-102 2004 25%/15% 28-275% 47% 10%	~1.3 Mgal on 5/1/2002 Tank SY-102 2004 25%/15% 28-275% 47% 10%	~1.3 Mgal on 5/1/2002 Tank SY-102 2004 25%/15% 28-275% 47% 10%

Table A-1. Assumption Matrix for the 2002 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	Case 1 Reference Case	Case 2 "Updated" RPP System Plan (Ecology Case 1b)	Case 3 MAI/Closure (Target Baseline)
DST Space Management			
Evaporator			
242-A Shutdown	2018	2018	2018
New Evaporator Available	No new evaporator capacity available after 3/1/2018.	No new evaporator capacity available after 3/1/2018.	No new evaporator capacity available after 3/1/2018.
Next Outage Date	6 month Outage each year in 2003 - 2005	6 month Outage each year in 2003 - 2005	6 month Outage each year in 2003 - 2005
Training Vol. (bi-yearly)	50 Kgal	50 Kgal	50 Kgal
Average Evaporation Rate	500 Kgal/month	500 Kgal/month	500 Kgal/month
Max. Evaporation Limit (g/ml)	1.41 g/ml	1.41 g/ml	1.41 g/ml
Modeled Evaporation Limit	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	3 months minimum	3 months minimum	3 months minimum
Yearly evaporation of waste	Yes	Yes	Yes
SST Wastes Evaporated	S-112 only	S-112 only	S-112 only
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
Total Emergency Space/WTP Return and Contingency Space	2.28 Mgal Total	2.28 Mgal Total	2.28 Mgal Total
Emergency Space	1.14 Mgal	1.14 Mgal	1.14 Mgal
LAW or HLW Return Space	1.14 Mgal	1.14 Mgal	1.14 Mgal
Contingency space	None	None	None
Waste Segregation/DST Solids			
Total DST solids	~4.5 Mgal	~4.5 Mgal	~4.5 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 enhanced WTP operations	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)	Dedicated operational space will be decreased by up to 0.85 Mgal. Total space savings incorporated 0.85 Mgal.	Dedicated operational space will be decreased by up to 0.85 Mgal; raising tank fill limits will save up to 1.4 Mgal; further concentration of waste will save up to 0.73 Mgal. Total space savings incorporated ~3 Mgal.	Dedicated operational space will be decreased by up to 0.85 Mgal; raising tank fill limits will save up to 1.4 Mgal; further concentration of waste will save up to 0.73 Mgal. Total space savings incorporated ~3 Mgal.
Major Project Assumptions			
AW-B Pit work (W-314), start date - operational date	4/1/2001 - 8/2/2002	4/1/2001 - 8/2/2002	4/1/2001 - 8/2/2002
AW-A Pit work (W-314)	6/30/2001 - 9/15/2002	6/30/2001 - 9/15/2002	6/30/2001 - 9/15/2002

Table A-1. Assumption Matrix for the 2002 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	**Case 1** **Reference Case**	**Case 2** **"Updated" RPP System Plan (Ecology Case 1b)**	**Case 3** **MAI/Closure (Target Baseline)**
AN-101-01A and AN-104-04A Pit work (W-314)	6/1/2001 - 9/16/2003	6/1/2001 - 9/16/2003	6/1/2001 - 9/16/2003
241-A-A Pit work (W-314)	10/17/2003 - 10/13/2004	10/17/2003 - 10/13/2004	10/17/2003 - 10/13/2004
AN Farm Outage (W-314)	10/1/2001 - 3/12/2004	10/1/2001 - 3/12/2004	10/1/2001 - 3/12/2004
AP Farm Outage (W-314)	5/15/2003 - 3/1/2005	5/15/2003 - 3/1/2005	5/15/2003 - 3/1/2005
Cross-site line outage connects cross-site to AN farm (W-314)	10/1/2003 - 4/30/2004	10/1/2003 - 4/30/2004	10/1/2003 - 4/30/2004
Cross-site to AP farm (W-211)	10/1/2003-5/11/2005	10/1/2003-5/11/2005	10/1/2003-5/11/2005
AW Farm Outage (W-314)	12/2/2002 - 8/9/2004	12/2/2002 - 8/9/2004	12/2/2002 - 8/9/2004
SY Farm Outage (W-314)	11/1/2002 - 5/30/2004	11/1/2002 - 5/30/2004	11/1/2002 - 5/30/2004
244-S Outage (W-314) - 222-S direct routed to SY farm after 9/30/2004 - PFP can no longer use 244-S after 6/30/2005 (waste from 244-TX is now routed through 244-S)	4/10/2003 - 9/30/2004	4/10/2003 - 9/30/2004	4/10/2003 - 9/30/2004
AY Farm Electrical and Instrumentation Upgrades	12/23/2002 - 12/08/2003	12/23/2002 - 12/08/2003	12/23/2002 - 12/08/2003
AZ Farm Electrical and Instrumentation Upgrades	1/09/2003 - 10/10/2003	1/09/2003 - 10/10/2003	1/09/2003 - 10/10/2003
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	7/12/2007	7/12/2007
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.

Table A-1. Assumption Matrix for the 2002 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	**Case 1 Reference Case**	**Case 2 "Updated" RPP System Plan (Ecology Case 1b)**	**Case 3 MAI/Closure (Target Baseline)**
First LAW Delivery (60d prior to Initiate LAW Hot Commissioning date above)	Start date - Finish date 11/1/2007 - 12/31/2007	Start date - Finish date 5/12/2007 - 7/12/2007	Start date - Finish date 5/12/2007 - 7/12/2007
Backup Feed Strategy	Identify one tank as backup. No rolling backup required.	Identify one tank as backup. No rolling backup required.	N/A
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-102 to AN-104 after delivery of LAW Batch 6 (the dissolved solids batch in AN-104). • Transfer SY-101 to AP-108	• Transfer SY-102 to AN-104 after delivery of LAW Batch 6 (the dissolved solids batch in AN-104). • Transfer SY-101 to AP-108	• Transfer SY-102 to AN-104 after delivery of LAW Batch 6 (the dissolved solids batch in AN-104). • Transfer SY-101 to AP-108
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	27 MTG/d	32 MTG/d	19 MTG/d
LAW Melter Design Capacity	45 MTG/d	45 MTG/d	N/A
Steam Reforming Capacity	N/A	N/A	30 MTG/d
LAW Process TOE	Not specified or needed.	Not specified or needed.	Not specified or needed.
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 Vitrification Ramp Up	From - To MTG/day 1/01/08-1/31/11 2.24 2/01/11-2/28/18 27.0 3/01/18-12/31/28 157.5	From - To MTG/day 10/30/07-3/21/08 45.0 3/22/08-2/28/18 32.0 3/01/18-end 64	From - To MTG/day 10/1/07-1/30/10 ~6.3 1/31/10-12/31/28 19.0
Complete Waste Treatment	By 12/31/2028	TBD by projection	By 12/31/2028
LAW Waste Treatment Model for Sulfate	Recycle Sulfate	Recycle Sulfate	Add steam reforming
ILAW Na2O Loading	Based on the Gimpel rule (rev. 2) for calculating the concentration of SO_3 in glass.	Based on the Gimpel rule (rev. 2) for calculating the concentration of SO_3 in glass.	18 wt% Na_2O
LAW Feed Receipt Tank Usage	1.5 Mgal Total Capacity; be capable of receiving 1 Mgal	1.5 Mgal Total Capacity; be capable of receiving 1 Mgal	1.5 Mgal Total Capacity; be capable of receiving 1 Mgal

Table A-1. Assumption Matrix for the 2002 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	**Case 1 Reference Case**	**Case 2 "Updated" RPP System Plan (Ecology Case 1b)**	**Case 3 MAI/Closure (Target Baseline)**
	without interruption while feeding out of the remaining 0.5 Mgal	without interruption while feeding out of the remaining 0.5 Mgal	without interruption while feeding out of the remaining 0.5 Mgal
Initial Quantity HLW Feed Delivery			
Initiate HLW Hot Commissioning	12/31/2007	7/12/2007	7/12/2007
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 AW-104
First HLW Delivery	Start date - Finish date 11/1/2007 - 12/31/2007	Start date - Finish date 5/12/2007 - 7/12/2007	Start date - Finish date 5/12/2007 - 7/12/2007
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.	N/A
Initial Quantity HLW Treatment Plant			
Initiate HLW Vitrification Services (full capacity)	Included in ramp up.	Included in ramp up.	Included in ramp up.
HLW Process Annual Capacity	2.0 MTG/d	2.0 MTG/d	4.1 MTG/d
HLW Melter Design Capacity	3.0 MTG/d	3.0 MTG/d	6.0 MTG/d
HLW Process TOE (implied)	Not specified or needed.	Not specified or needed.	Not specified or needed.
HLW Treatment Ramp Up	From - To / MTG/d 1/1/08-1/31/11 0.16 2/1/11-2/28/18 1.0 3/1/18-12/31/28 10.3	From - To / MTG/d 11/8/07-3/21/08 3.0 3/22/08-2/28/18 2.0 3/1/18-end 4.0	From - To / MTG/d 11/8/07-1/30/10 0.77 1/31/10-12/31/28 4.08
Method for Estimating HLW Waste Oxide Loading	Glass Properties Model	Glass Properties Model	Glass Properties Model
HLW Feed Receipt Tank Usage	Sufficient space to receive 160,000 gallons (600 m^3) of HLW feed without interruption.	Sufficient space to receive 160,000 gallons (600 m^3) of HLW feed without interruption.	Sufficient space to receive 160,000 gallons (600 m^3) of HLW feed without interruption.
Performance Management Plan			
Alternative TRU Treatment			
Alternative TRU start	N/A	N/A	3/1/2008
Alternative TRU rate	N/A	N/A	1,000 MT solids/year
Alternative TRU feed sources	N/A	N/A	AW-103, AW-105, SY-102, All T-200 & B-200 series SSTs T-111, T-110

Table A-1. Assumption Matrix for the 2002 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	Case 1 Reference Case	Case 2 "Updated" RPP System Plan (Ecology Case 1b)	Case 3 MAI/Closure (Target Baseline)
Mission Acceleration Initiative Facilities			
MAI ramp-up Processing Rate Processing rate in gpm of 5 M Na (10 gpm is full capacity).	N/A	N/A	From - To Process Rate 8/31/08-8/31/10 3 gpm 9/1/10-12/31/28 6 gpm
MAI feed sources	N/A	N/A	Low Cs supernate from SSTs
SST Retrieval			
Number of SSTs Retrieved	149	149	149
Retrievable Sludge Volume	11.1 Mgal	11.1 Mgal	11.1 Mgal
Retrievable Saltcake Volume	20.9 Mgal	20.9 Mgal	20.9 Mgal
Early Retrieval Sequence and Minimum Retrieval Durations in days (d)	**C-106:** Start: 11/1/2003, 60 d. **S-112:** Start: 6/1/2003, 196 d **S-102:** Start: 12/1/2005, 69 d **C-104:** Start: 5/30/2007, 185d **S-105:** Start: 3/31/2008, ~287d **S-106:** Start: 6/30/2008, ~311d **S-103:** Start: 9/30/2008, ~ 82d Continues risk based sequence.	**C-106:** Start: 11/1/2003, 60 d. **S-112:** Start: 6/1/2003, 196 d **S-102:** Start: 12/1/2005, 69 d **C-104:** Start: 5/30/2007, 185d **S-105:** Start: 3/31/2008, ~287d **S-106:** Start: 6/30/2008, ~311d **S-103:** Start: 9/30/2008, ~ 82d Continues risk based sequence.	**C-106:** Start: 11/1/2003, 60 d. **S-112:** Start: 6/1/2003, 196 d **S-102:** Start: 12/1/2005, 69 d **C-104:** Start: 5/30/2007, 185d **S-105:** Start: 3/31/2008, ~287d **S-106:** Start: 6/30/2008, ~311d **S-103:** Start: 9/30/2008, ~ 82d Continues risk based sequence.
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 12/31/2002. 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 12/31/2002. Retrieval completed to support waste processing and as DST space allows.	**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 12/31/2002. Retrieval completed to support completion of waste processing by end of 2028.
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.	Risk based sequencing based on total tank farm risk versus total tank farm volume, grouped by tank farm. Use the requirement to keep the processing plants operating to balance between the groundwater risk measure and the airborne risk measure.
WRF Availability Dates	B WRF: 6/23/14 T WRF: 6/23/14 U WRF: 6/23/14	B WRF: 10/1/07 T WRF: 10/1/07 U WRF: 10/1/07 (Note: Project need dates for the WRFs will be determined from the projected retrieval schedule.)	B WRF: 10/1/07 T WRF: 10/1/07 U WRF: 10/1/07 (Note: Project need dates for the WRFs will be determined from the projected retrieval schedule.)
Availability Dates for Tank Farms Upgrades	A Farm: 9/25/13 AX Farm: 9/25/13 B Farm: 6/23/14 BX Farm: 6/23/14 BY Farm: 9/24/15	A Farm: 10/1/04 AX Farm: 10/1/04 B Farm: 10/1/07 BX Farm: 10/1/07 BY Farm: 10/1/07	A Farm: 10/1/03 AX Farm: 10/1/03 B Farm: 10/1/07 BX Farm: 10/1/07 BY Farm: 10/1/07

Table A-1. Assumption Matrix for the 2002 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	**Case 1 Reference Case**	**Case 2 "Updated" RPP System Plan (Ecology Case 1b)**	**Case 3 MAI/Closure (Target Baseline)**
	C Farm (100): 5/31/06 C Farm (200): 5/31/06 S Farm: 10/26/09 SX Farm: 11/30/15 T Farm: 6/23/14 TX Farm: 6/23/14 TY Farm: 6/23/14 U Farm: 6/23/14	C Farm (100): 10/1/04 C Farm (200): 10/1/18 S Farm: 6/1/03 SX Farm: 10/1/18 T Farm: 10/1/07 TX Farm: 10/1/07 TY Farm: 10/1/07 U Farm: 10/1/07	C Farm (100): 10/1/03 C Farm (200): 10/1/03 S Farm: 10/1/03 SX Farm: 10/1/03 T Farm: 10/1/07 TX Farm: 10/1/07 TY Farm: 10/1/07 U Farm: 10/1/07
The maximum number of simultaneous retrievals is determined by the most limiting condition(s) resulting from application of the following constraints:	Retrieval and transfer systems can support a maximum of 6 simultaneous retrievals for the B, BX, BY, T, TX and TY farms. Retrieval and transfer systems can support a maximum of 2 simultaneous retrievals in each tank farm for the A, AX, C, S, SX, and U farms. Retrieval and transfer systems can support a maximum of 6 simultaneous retrievals in each quadrant: SE - A, AX, and C farms NE - B, BX, and BY farms SW - S, SX, and SY farms NW - T, TX, and TY farms Retrieval and transfer systems can support a maximum of 7 simultaneous retrievals in all the tank farms.	Retrieval and transfer systems can support a maximum of 6 simultaneous retrievals for the B, BX, BY, T, TX and TY farms. Retrieval and transfer systems can support a maximum of 2 simultaneous retrievals in each tank farm for the A, AX, C, S, SX, and U farms. Retrieval and transfer systems can support a maximum of 6 simultaneous retrievals in each quadrant: SE - A, AX, and C farms NE - B, BX, and BY farms SW - S, SX, and SY farms NW - T, TX, and TY farms Retrieval and transfer systems can support a maximum of 7 simultaneous retrievals in all the tank farms.	Retrieval and transfer systems can support a maximum of 6 simultaneous retrievals for the B, BX, BY, T, TX and TY farms. Retrieval and transfer systems can support a maximum of 2 simultaneous retrievals in each tank farm for the A, AX, C, S, SX, and U farms. Retrieval and transfer systems can support a maximum of 6 simultaneous retrievals in each quadrant: SE - A, AX, and C farms NE - B, BX, and BY farms SW - S, SX, and SY farms NW - T, TX, and TY farms Retrieval and transfer systems can support a maximum of 7 simultaneous retrievals in all the tank farms.
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.
Cs and Sr Capsule Processing			
Cs and Sr Capsule Processing Start Date	March 2018	March 2018	N/A – Capsules sent to dry storage (DOE/ORP-2000-06)
Duration to Process Cs and Sr Capsules	5 years (the first five years of enhanced WTP operations)	5 years (the first five years of enhanced WTP operations)	N/A
Storage and Disposal			
ILAW Package Assumptions	Each package holds 2.275 m^3 (601 gallon) of ILAW	Each package holds 2.275 m^3 (601 gallon) of ILAW	Each package holds 2.275 m^3 (601 gallon) of ILAW

Table A-1. Assumption Matrix for the 2002 Single-Shell Retrieval Sequence and Double–Shell Tanks Space Evaluation. (All years are fiscal years)

Projection Case	**Case 1 Reference Case**	**Case 2 "Updated" RPP System Plan (Ecology Case 1b)**	**Case 3 MAI/Closure (Target Baseline)**
ILAW Glass Density	2.6 MT/m3	2.6 MT/m3	2.6 MT/m3
ILAW Package Net Mass	5.92 MT	5.92 MT	5.92 MT
ILAW Facility Availability Dates (Project W-520)	12/28/2007	Determined by model	Determined by model
ILAW Product Shipment Starts When WTP Storage is X% Full	50	50	N/A
Design Capacity for Interim ILAW Storage, Packages	450	450	N/A
IHLW Canister Assumptions	Each canister holds 1.1356 m^3 (300 gallon) of IHLW	Each canister holds 1.1356 m^3 (300 gallon) of IHLW	Each canister holds 1.1356 m^3 (300 gallon) of IHLW
IHLW Glass Density	2.6 MT/m^3	2.6 MT/m^3	2.6 MT/m^3
IHLW Canister Net Mass	2.95 MT	2.95 MT	2.95 MT
IHLW Facility Availability Dates (Project W-464)	12/31/2007	Determined by model	Determined by model
IHLW Product Shipment Starts When WTP Storage is X% Full	50	50	N/A
Design Capacity for Interim IHLW Storage, Canisters	45	45	N/A

Notes:
BBI = Best Basis Inventory
Enhanced WTP Operations--period following Initial Phase 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
MAI = Mission Acceleration Initiative
MTG/d = metric tonne glass/day
NCAW = neutralized current acid waste
NCRW = neutralized cladding removal waste
PUREX = Plutonium-Uranium Extraction Plant
SR = Steam Reforming
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 Reference Case 1.

Case Name/Identifier	TFC O&UP Rev. 4 / OWVP_Case1_8-20-2002

Objective: Run the HTWOS model to update the CHG technical baseline. This case will be based on Case 2 from the TFC O&UP, Rev 3A with changes or inputs noted in the sections below.

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

Modify the model to incorporate the assumptions given in Table 1. Major changes to the scenario are listed below.

1. Use the WTP processing rates assumed in TFC O&UP, Rev. 3A and constrain deliveries to no earlier than two months after the end of the compliance verification activities from the current CHG baseline schedule. This is to maintain the CHG cost baseline for currently contracted work scope.
2. Use BBI data representing the content of the tanks as of 6/30/2001, referred to as the FY 2002 update. Most data was downloaded from TWINS between 12/3/2001 and 1/3/2002 with the exception of the S-112 inventory which was downloaded 4/8/2002.
3. Use FY 2002 update of waste generation projections and near-term operational plans. Interim Stabilization removes about 1.3 Mgal of saltwell liquor remaining in the SSTs.
4. Adjust processing capacities after 3/1/2018 to complete processing by 12/31/2028.
5. Use FY 2001 risk-based approach for sequencing SST retrieval.
6. Revise the ILAW and IHLW densities to 2.60 MT per cubic meter, the ILAW package capacity to 5.92 MT, and the IHLW canister capacity to 2.95 MT. The mass per package or canister changes occur in response to the change in the glass density.

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. Modify the model as needed to implement the assumptions given in Table 1.
2. Modify the reporting features in the model to obtain DST space evaluation data.
3. Update the density correlation parameters based on a recent evaluation performed by Ron Orme.

Requestor Information - For reporting modeling status and resolving issues.

Requestor/Contact: R. S. Popielarczyk, R. A. Dodd, and J. A. Voogd/ T. W. Crawford

Reference for Request:

Deliverable(s): Results from the HTWOS model documented as revision 4 of the TFC O&UP, and as a case in revision 1 of the SST Retrieval Sequence/DST Space Evaluation document (RPP-8554).

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

1. Issue TFC O&UP, Rev. 4 by September 30, 2002.
2. Support the schedule to issue RPP-8554, Rev. 1 to meet TPA milestone M-45-02K, due by September 30, 2002.

Change Approval

Team Lead: R. A. Kirkbride _____	**Manager:** N. W. Kirch _____
Customer: T. W. Crawford_____	**Customer:** _____
Other: _____	**CACN: 106435**

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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-0182-170, *Waste Tank Summary Report for Month Ending May 31, 2002*. The inventory information for radiological and nonradiological hazardous constituent content is based on best basis inventory (BBI) data maintenance tool (BBIM), primarily obtained in December of 2001, as shown below. The BBIM contains information on more analytes than is generally available in the BBI. BBI information is supplemented by additional data in preparing the initial inventory input to HTWOS. The input compositions are provided in the Tank Farm Contractor Operation and Utilization Plan, HNF-SD-WM-SP-012, Rev 4.

Table B-1. Initial Inventory Input to HTWOS

Tank	BBIM Download Date	Effective Date[1]
Double Shell Tanks	12-3-01	6-30-01
AN-102	12-11-01	6-30-01
AZ-101	1-03-02	10-01-01[2]
SY-102	12-17-01	10-01-01[3]
Single Shell Tanks	12-03-01	6-30-01
S-112	4-10-02	6-30-01[4]

[1]Per TWINS, the effective date represents a data cut-off date. It indicates to users that newer sample data or transactions occurring after this date have not been considered as part of the best basis assessment.

[2]AZ-101 had not been updated through 6-30-01 in the 12-3-01 download, so a separate download was needed. A review of the transfer log for this tank shows no transfers other than water or condensate, so the 10-01-01 effective date also applies to the chemical and isotopic inventory as it was on 6-30-01, although some other part of the estimate had a later change.

[3]SY-102 had not been updated through 6-30-01 in the 12-03-01 download. The later download had an effective date of 10-01-01. The SY-102 data from 10-01-01 was manipulated during HTWOS input preparation to remove waste transferred into the tank after 6-30-01.

[4]New BBI data were published for tank S-112 on 4-8-02 and obtained on 4-10-02. These were used because of a significant increase to the tank waste volume compared to the previous data.

The initial inventory accounts for tank transfers through June 30, 2001, with the HTWOS model accounting for subsequent actual and planned transfers. The initial inventory transfers occurring between July 1, 2001 and May 31, 2002, were input manually into the model.

Other data modifications are necessary for final input into the Hanford Tank Waste Operations Simulator (HTWOS). The methods used to make the modifications are documented in (Hohl and Seidl 2001)

Specific adjustments include the following:

- For DSTs, data are compiled in two sets, one for liquids, which include supernatant only, and one for solids. The solids set includes solid phases and any liquids associated with solid phases. If data are available only as a whole tank total, a split into phases is estimated. Chemical cesium is estimated based on the isotopic content of Cs-137 and Cs-137 and specific ratios. Chemical strontium is calculated by subtracting Sr-90 from the BBI chemical Sr value. Chemical uranium is calculated by subtracting isotopic uranium from the BBI U-total value. Free hydroxide and bound hydroxide are calculated using several methods using charge balances, sample data, BBI data, and predictive equations. The method chosen depends on the data that are available.

- For SSTs, data are also compiled in two sets. The liquid data set includes the sum of the supernatant and all liquids associated with the solid phases (including "salt cake liquids," for example). The solid phase data set is just the solid portion. Some tanks that are on the salt-well pumping schedule do not have liquid fractions posted separately. For these cases, a liquid fraction is estimated using a separate model. Cesium, strontium, uranium, and hydroxide are calculated using the same or similar methods as the DST inventory. For those tanks that will be salt well pumped, the data are adjusted as needed so the inventory has at least enough liquid phase waste to match the projected volume to be pumped. (For some tanks this means numerically transferring some material from the solids to the liquids phase.) Total inventories are not changed. This information represents the initial inventory.

  A separate spreadsheet calculation is also performed to estimate the volume of water required to retrieve the waste. This spreadsheet starts with the inventory remaining after salt well pumping, and applies the wash factors to the solid phase of the inventory. Two water additions are then estimated, one to reach a 5 molar sodium solution in the liquids, and the other to reach a 10 wt% solids slurry. (Density changes occurring with water addition are included by using the density correlation in the TFCO&UP, Rev 4, Appendix I.) The larger required volume of water is retained for further use in HTWOS. The reason for applying the wash factors to the SST data is that significant amounts of water will be added during retrieval. The additions will be used to mobilized SST waste constituents.

B1.1.1 Application of Wash Factors by the HTWOS Model

The HTWOS model uses SST data that have already had water wash factors applied. For DSTs, HTWOS models the partition of the solids phases (solids and associated liquid) so that the total

aqueous phase has a single composition, and the solids reported are "dry". This partition uses thermodynamic data and does not exactly replicate the solid/liquid phase data presented by the BBI, although the total inventory remains the same. In general, water wash factors were developed based on analysis of centrifuged solids, which are wet. Therefore, the product of the HTWOS solid/liquid partition is not suitable for direct application of wash factors, but it does represent the expected as-delivered, unwashed composition of HLW solids from DSTs. HTWOS compares the original solids mass with the partitioned mass for each constituent and computes a revised wash factor. The revised wash factors are used for DST solids to complete the wash step in the WTP portion of the HTWOS model.

The as-delivered partition compositions identified in Figure B-1 show that the SSTs have had 100% of the water wash factor applied, since this is a reasonable approximation of the dissolution that will occur during retrieval. Only a portion of each water wash factor is applied to analytes in DST solids in order to reach the as-delivered composition, since DSTs will not require as much water for retrieval. The as-delivered compositions are reported in the TFCO&UP, Rev 4, and are compared to the WTP contract feed specifications. The solids have not been washed in the WTP at this point, and so are unwashed.

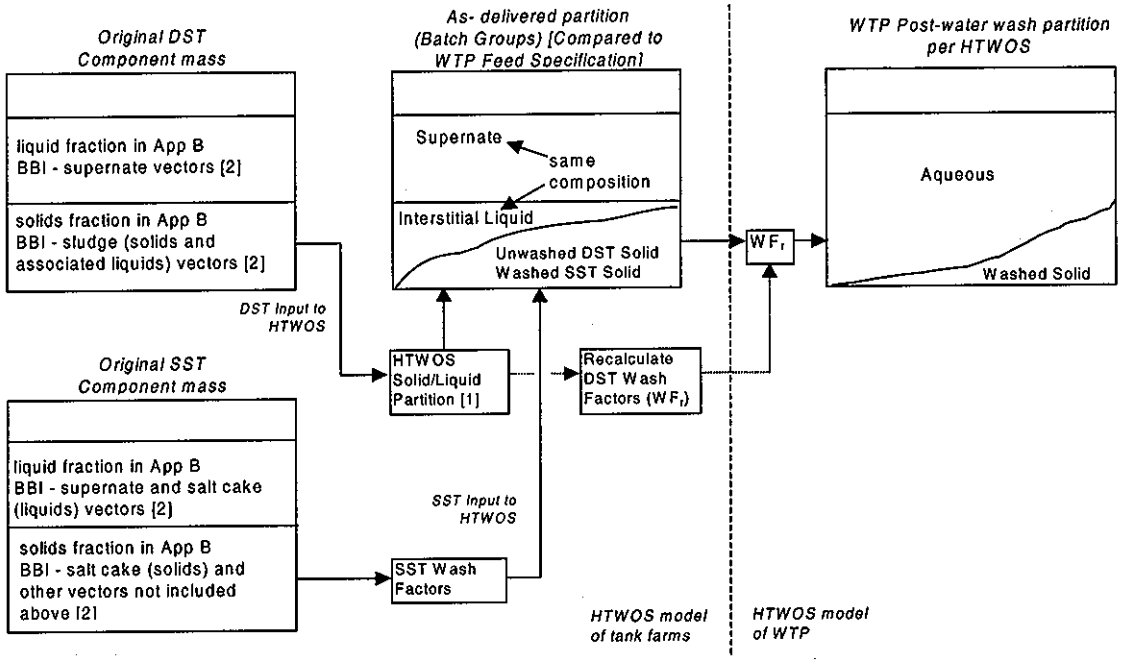
HTWOS extends the model through the WTP, and applies the balance of the DST wash factors in the WTP water wash step. The TFCO&UP also publishes the post-water wash composition. At this point, all water wash factors have been applied.

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, generally quarterly, the inventory data used for the HTWOS model is updated annually to ensure consistency of output throughout the fiscal year.

Figure B-1.

Initial Quantity HLW Sludge Partitioning in HTWOS

There are two routes to post-wash partition: DST sludge x HTWOS partition x modified wash factor to washed solids, and SST sludge x wash factor to washed solids.



[1] Partition assumes supernate and interstitial liquids have the same composition, and that the solids density is 3 kg/L.
[2] Vectors are sources of characterization data, including samples and estimates. Inputs to HTWOS are compiled from BBI and other data (vectors).

B 1.2 SINGLE-SHELL TANK RETRIEVAL RATES

The model used available data for technology-specific retrieval rates for all SST retrievals. The complete modeling basis is documented in HNF-SD-WM-SP-012, Rev. 4, *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, Rev. 4.

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-0182-170, 2002, *Waste Tank Summary Report for Month Ending May 31, 2002*, CH2M HILL Hanford Group, Inc., Richland, Washington.

HNF-SD-WM-SP-012, 2002, *Tank Farm Contractor Operation and Utilization Plan*, Rev. 4, 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.

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APPENDIX C

SINGLE-SHELL TANK RISK FACTORS, CALCULATIONS, AND RANKINGS

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C1.0. FINAL ENVIRONMENTAL IMPACT STATEMENT UNIT RISK FACTORS

Table C-1 lists, by analyte, the groundwater, airborne, and chemical unit concentration 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 Risk/[Ci/mL][1]	Airborne Factor mrem/Ci exhumed[2]	Chemical Factor Risk/[g/mL)][3]
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

[1]Risk for isotopes is defined as the increased probability of the exposed receptor contracting a cancer (incidence) or dying from cancer (fatality). The groundwater risk factors are expressed in terms of risk per unit concentration of isotope in the groundwater. The data are based on the groundwater pathway of the Industrial exposure scenario in the EIS. Units used in the EIS were clarified by Strenge (2002).

[2]The airborne unit risk factors are expressed in terms of mrem per Ci of isotope exhumed by well drilling. The data are based on the post-well driller intruder scenario of the EIS. This scenario includes airborne exposure as well as ingestion. However, the dominant pathway is from air exposure. The conversion factor between dose (mrem) and risk (cancer probability) is a constant. Therefore the relative ranking in units of mrem and risk is the same.

[3]Risk for chemicals is defined as the Hazard Index, which is the ratio of average daily intake to a reference dose. The chemical risk factors are expressed in terms of risk per (g/ml) concentration of chemical in the groundwater. The data are based on the groundwater pathway of the Industrial exposure scenario in the EIS. Units used in the EIS were clarified by Strenge (2002).

C2.0 SAMPLE CALCULATIONS

i = analyte

AF_i = analyte airborne dose factor [mrem/Ci exhumed]

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

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

C_i = analyte inventory (Ci) (for Case 3 this is Ci/unit waste volume)

K_i = analyte inventory (kg) (for Case 3 this is kg/unit waste volume)

C2.1 Relative Groundwater Risk

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

C2.3 Relative Airborne Risk

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

C2.3 Relative Chemical Risk

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

Note: The analyte inventories are assumed to be proportional to the concentrations that would be found in the groundwater and in the exhumed waste. This is a reasonable assumption given that the isotopes of interest in the groundwater are soluble and mobile, and that exhumed material contains tank waste. The calculation does not result in a number that represents actual risk, since the groundwater concentrations and amounts exhumed were not needed and were not used. Rather, the results provide a relative risk ranking to distinguish the inventories in each SST.

C3.0 SINGLE-SHELL TANK RISK RANKINGS

Table C-2 lists the risk ratings for the single-shell tank waste volume as of June 30, 2001 (except for Tank S-112, which is as of April 8, 2002).

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

Risk Rankings - Prepared from Best Basis Inventory 12/2001

SST Tank	Waste Volume July 2001 [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
A-101	8.77E+02	3.82E+08	91	0.20%	4.16E+05	46	0.50%	3.06E+10	16	1.57%
A-102	4.10E+01	9.03E+08	70	0.48%	4.54E+05	42	0.54%	5.44E+09	76	0.28%
A-103	3.71E+02	1.43E+09	57	0.77%	3.05E+05	57	0.36%	1.04E+10	57	0.53%
A-104	2.80E+01	1.22E+08	114	0.07%	8.57E+05	16	1.02%	3.31E+08	135	0.02%
A-105	3.70E+01	8.01E+08	74	0.43%	3.34E+06	6	3.99%	1.81E+09	108	0.09%
A-106	1.25E+02	7.57E+08	76	0.40%	1.50E+06	9	1.79%	1.15E+10	54	0.59%
AX-101	6.62E+02	2.65E+08	99	0.14%	3.54E+05	55	0.42%	1.99E+10	37	1.02%
AX-102	3.00E+01	1.01E+08	119	0.05%	2.93E+05	58	0.35%	8.72E+08	121	0.04%
AX-103	1.12E+02	1.40E+09	58	0.75%	7.83E+05	20	0.94%	8.26E+09	65	0.42%
AX-104	8.00E+00	7.22E+08	78	0.39%	9.05E+05	14	1.08%	1.12E+08	140	0.01%
B-101	1.13E+02	2.95E+08	96	0.16%	9.43E+05	13	1.13%	2.93E+09	92	0.15%
B-102	3.20E+01	2.98E+07	128	0.02%	2.40E+03	143	0.00%	7.39E+08	124	0.04%
B-103	5.90E+01	1.07E+08	116	0.06%	4.39E+04	114	0.05%	1.42E+09	116	0.07%
B-104	3.71E+02	4.86E+08	87	0.26%	7.02E+04	106	0.08%	6.70E+09	71	0.34%
B-105	1.58E+02	3.50E+08	93	0.19%	3.88E+04	118	0.05%	7.99E+09	66	0.41%
B-106	1.17E+02	6.61E+08	81	0.35%	1.95E+04	127	0.02%	1.62E+09	111	0.08%
B-107	1.65E+02	3.03E+08	95	0.16%	2.06E+05	68	0.25%	1.87E+09	106	0.10%
B-108	9.40E+01	9.76E+07	120	0.05%	2.49E+03	141	0.00%	8.20E+08	122	0.04%
B-109	1.27E+02	8.22E+08	73	0.44%	2.71E+04	122	0.03%	5.21E+09	79	0.27%
B-110	2.46E+02	1.85E+08	109	0.10%	1.66E+05	78	0.20%	4.97E+09	82	0.26%
B-111	2.37E+02	9.38E+08	68	0.50%	1.79E+05	74	0.21%	5.02E+09	81	0.26%
B-112	3.30E+01	1.09E+08	115	0.06%	1.69E+03	144	0.00%	1.47E+09	113	0.08%
B-201	2.90E+01	2.16E+06	139	0.00%	8.32E+04	100	0.10%	1.72E+09	110	0.09%
B-202	2.70E+01	9.15E+06	135	0.00%	2.01E+04	126	0.02%	1.27E+09	117	0.07%
B-203	5.10E+01	3.94E+06	136	0.00%	3.43E+04	120	0.04%	2.45E+09	95	0.13%
B-204	5.00E+01	3.52E+06	137	0.00%	4.14E+04	117	0.05%	2.52E+09	94	0.13%
BX-101	4.30E+01	8.84E+07	123	0.05%	1.90E+05	72	0.23%	4.85E+08	130	0.02%
BX-102	9.60E+01	1.82E+07	131	0.01%	5.17E+05	33	0.62%	4.49E+08	133	0.02%
BX-103	7.10E+01	1.35E+08	113	0.07%	7.99E+05	18	0.95%	5.47E+08	128	0.03%
BX-104	9.30E+01	3.74E+09	7	2.00%	3.89E+05	50	0.46%	1.00E+10	58	0.52%

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

Risk Rankings - Prepared from Best Basis Inventory 12/2001

SST Tank	Waste Volume July 2001 [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
BX-105	5.10E+01	7.35E+08	77	0.39%	7.97E+04	102	0.10%	1.55E+10	47	0.80%
BX-106	3.80E+01	2.19E+08	105	0.12%	9.16E+04	95	0.11%	9.58E+09	61	0.49%
BX-107	3.45E+02	8.77E+08	71	0.47%	9.13E+04	96	0.11%	7.75E+09	68	0.40%
BX-108	2.60E+01	2.30E+08	101	0.12%	9.19E+03	133	0.01%	6.98E+08	125	0.04%
BX-109	1.93E+02	1.57E+09	56	0.84%	1.41E+04	132	0.02%	2.07E+09	101	0.11%
BX-110	2.07E+02	1.25E+09	59	0.67%	6.83E+04	108	0.08%	2.25E+10	32	1.16%
BX-111	1.62E+02	1.20E+09	60	0.64%	2.48E+04	123	0.03%	9.85E+09	60	0.51%
BX-112	1.65E+02	2.03E+08	107	0.11%	1.03E+05	92	0.12%	4.38E+09	85	0.23%
BY-101	3.87E+02	3.60E+09	9	1.92%	9.18E+04	94	0.11%	1.98E+10	38	1.02%
BY-102	2.77E+02	1.97E+09	43	1.05%	1.07E+05	89	0.13%	1.09E+10	56	0.56%
BY-103	4.00E+02	3.06E+09	19	1.63%	1.64E+05	79	0.20%	2.37E+10	28	1.22%
BY-104	3.26E+02	3.55E+09	12	1.90%	1.76E+05	75	0.21%	2.94E+10	19	1.51%
BY-105	5.03E+02	2.20E+09	35	1.17%	4.32E+05	44	0.52%	1.30E+10	52	0.67%
BY-106	5.62E+02	3.57E+09	11	1.91%	7.33E+04	105	0.09%	1.47E+10	50	0.76%
BY-107	2.66E+02	2.14E+09	36	1.14%	4.29E+04	115	0.05%	4.86E+09	83	0.25%
BY-108	2.28E+02	2.38E+09	30	1.27%	6.07E+04	110	0.07%	3.08E+09	90	0.16%
BY-109	2.90E+02	1.61E+09	52	0.86%	8.85E+04	98	0.11%	9.30E+09	62	0.48%
BY-110	3.98E+02	3.09E+09	18	1.65%	1.05E+05	90	0.13%	2.70E+10	22	1.39%
BY-111	4.59E+02	2.05E+09	38	1.09%	1.50E+05	82	0.18%	1.51E+10	48	0.78%
BY-112	2.91E+02	2.26E+09	33	1.21%	1.15E+05	86	0.14%	1.12E+11	1	5.77%
C-101	8.80E+01	9.18E+08	69	0.49%	4.57E+05	41	0.55%	1.46E+09	115	0.08%
C-102	3.16E+02	7.86E+08	75	0.42%	3.67E+06	4	4.39%	3.05E+09	91	0.16%
C-103	1.98E+02	7.04E+08	80	0.38%	5.56E+06	3	6.64%	2.36E+09	96	0.12%
C-104	2.63E+02	4.66E+09	2	2.49%	9.12E+06	2	10.90%	5.32E+09	77	0.27%
C-105	1.32E+02	1.60E+09	53	0.86%	2.46E+06	7	2.94%	1.50E+09	112	0.08%
C-106	4.80E+01	6.03E+07	127	0.03%	2.29E+05	66	0.27%	2.20E+08	138	0.01%
C-107	2.57E+02	1.03E+09	65	0.55%	3.54E+06	5	4.23%	3.68E+09	88	0.19%
C-108	6.60E+01	6.05E+07	126	0.03%	6.72E+03	136	0.01%	9.53E+08	120	0.05%
C-109	6.60E+01	6.17E+08	83	0.33%	8.20E+04	101	0.10%	6.24E+08	127	0.03%
C-110	1.78E+02	4.17E+08	90	0.22%	7.56E+04	104	0.09%	2.06E+09	103	0.11%
C-111	5.70E+01	4.25E+08	89	0.23%	2.41E+05	65	0.29%	4.83E+08	131	0.02%

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

Risk Rankings - Prepared from Best Basis Inventory 12/2001

SST Tank	Waste Volume July 2001 [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
C-112	1.04E+02	2.76E+09	24	1.48%	3.79E+05	51	0.45%	9.66E+08	119	0.05%
C-201	2.00E+00	2.73E+05	148	0.00%	6.93E+04	107	0.08%	9.40E+06	149	0.00%
C-202	1.00E+00	2.84E+05	147	0.00%	3.63E+04	119	0.04%	1.40E+07	148	0.00%
C-203	5.00E+00	5.43E+05	144	0.00%	1.82E+04	128	0.02%	2.28E+07	145	0.00%
C-204	3.00E+00	3.50E+05	145	0.00%	4.21E+02	146	0.00%	1.47E+07	147	0.00%
S-101	4.27E+02	2.00E+09	42	1.07%	5.44E+05	32	0.65%	5.46E+10	5	2.81%
S-102	4.92E+02	2.01E+09	40	1.07%	1.93E+05	70	0.23%	1.92E+10	40	0.99%
S-103	2.37E+02	2.25E+09	34	1.20%	2.44E+05	64	0.29%	2.16E+10	34	1.11%
S-104	2.94E+02	1.12E+09	62	0.60%	5.10E+05	34	0.61%	1.66E+10	43	0.85%
S-105	4.56E+02	2.75E+09	25	1.47%	4.91E+05	38	0.59%	4.46E+10	10	2.29%
S-106	4.55E+02	2.96E+09	22	1.58%	9.08E+04	97	0.11%	6.03E+10	4	3.10%
S-107	3.76E+02	1.63E+09	50	0.87%	1.57E+06	8	1.87%	2.54E+10	25	1.30%
S-108	4.32E+02	3.48E+09	14	1.86%	7.26E+05	22	0.87%	6.38E+10	3	3.28%
S-109	5.33E+02	3.22E+09	17	1.72%	1.11E+05	88	0.13%	2.99E+10	18	1.54%
S-110	3.90E+02	2.99E+09	20	1.60%	4.96E+05	37	0.59%	4.88E+10	9	2.51%
S-111	5.01E+02	1.63E+09	51	0.87%	5.47E+04	112	0.07%	3.80E+10	12	1.95%
S-112	5.23E+02	2.97E+09	21	1.59%	5.92E+05	29	0.71%	5.17E+10	8	2.66%
SX-101	4.29E+02	1.57E+09	55	0.84%	6.78E+05	24	0.81%	8.07E+10	2	4.15%
SX-102	5.14E+02	1.92E+09	45	1.02%	3.89E+05	49	0.46%	5.39E+10	6	2.77%
SX-103	5.18E+02	3.24E+09	15	1.73%	6.08E+05	27	0.73%	5.27E+10	7	2.71%
SX-104	4.46E+02	2.39E+09	29	1.27%	9.62E+05	12	1.15%	4.41E+10	11	2.27%
SX-105	4.84E+02	2.00E+09	41	1.07%	7.27E+05	21	0.87%	2.54E+10	24	1.31%
SX-106	3.97E+02	3.60E+09	10	1.92%	4.30E+05	45	0.51%	3.69E+10	13	1.90%
SX-107	1.02E+02	3.36E+08	94	0.18%	3.60E+05	54	0.43%	7.87E+09	67	0.41%
SX-108	8.70E+01	2.93E+08	97	0.16%	1.08E+06	10	1.30%	1.57E+10	46	0.81%
SX-109	2.49E+02	1.01E+09	66	0.54%	4.65E+05	40	0.56%	2.36E+10	29	1.21%
SX-110	6.20E+01	2.19E+08	104	0.12%	1.57E+05	80	0.19%	5.12E+09	80	0.26%
SX-111	1.22E+02	4.30E+08	88	0.23%	3.70E+05	53	0.44%	9.96E+09	59	0.51%
SX-112	1.08E+02	2.73E+08	98	0.15%	2.62E+05	61	0.31%	6.34E+09	74	0.33%
SX-113	3.10E+01	1.02E+08	118	0.05%	8.62E+03	134	0.01%	9.88E+07	141	0.01%
SX-114	1.65E+02	6.45E+08	82	0.34%	2.87E+05	60	0.34%	1.48E+10	49	0.76%

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

SST Tank	Waste Volume July 2001 [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
SX-115	1.20E+01	1.50E+07	133	0.01%	5.66E+05	31	0.68%	3.44E+08	134	0.02%
T-101	1.02E+02	5.81E+08	84	0.31%	9.18E+04	93	0.11%	4.03E+09	87	0.21%
T-102	3.20E+01	2.24E+08	103	0.12%	3.04E+04	121	0.04%	7.67E+08	123	0.04%
T-103	2.70E+01	9.61E+07	121	0.05%	2.04E+05	69	0.24%	4.51E+08	132	0.02%
T-104	3.17E+02	1.40E+08	112	0.08%	1.71E+05	76	0.20%	5.22E+09	78	0.27%
T-105	9.80E+01	3.62E+08	92	0.19%	1.46E+05	83	0.17%	3.15E+09	89	0.16%
T-106	2.10E+01	7.39E+07	125	0.04%	1.76E+04	129	0.02%	6.28E+08	126	0.03%
T-107	1.73E+02	2.37E+09	31	1.27%	1.12E+05	87	0.13%	1.96E+09	105	0.10%
T-108	4.40E+01	1.65E+07	132	0.01%	4.80E+03	139	0.01%	2.46E+08	136	0.01%
T-109	5.80E+01	1.90E+07	130	0.01%	2.65E+03	140	0.00%	2.21E+08	137	0.01%
T-110	3.69E+02	1.47E+08	110	0.08%	6.41E+04	109	0.08%	5.76E+09	75	0.30%
T-111	4.46E+02	8.28E+08	72	0.44%	2.62E+05	62	0.31%	1.24E+10	53	0.64%
T-112	6.70E+01	1.95E+07	129	0.01%	5.22E+04	113	0.06%	2.20E+09	98	0.11%
T-201	2.90E+01	1.83E+06	141	0.00%	7.62E+04	103	0.09%	2.05E+09	104	0.11%
T-202	2.10E+01	9.72E+05	143	0.00%	1.48E+04	131	0.02%	1.06E+09	118	0.05%
T-203	3.50E+01	1.64E+06	142	0.00%	2.33E+04	124	0.03%	2.07E+09	102	0.11%
T-204	3.80E+01	2.28E+06	138	0.00%	1.66E+04	130	0.02%	2.58E+09	93	0.13%
TX-101	8.70E+01	5.07E+08	86	0.27%	5.06E+05	35	0.61%	6.67E+09	72	0.34%
TX-102	2.17E+02	1.72E+09	48	0.92%	2.90E+05	59	0.35%	1.14E+10	55	0.59%
TX-103	1.57E+02	1.06E+09	63	0.57%	1.93E+05	71	0.23%	7.47E+09	69	0.38%
TX-104	6.50E+01	2.59E+08	100	0.14%	8.84E+04	99	0.11%	4.30E+09	86	0.22%
TX-105	6.09E+02	4.60E+09	4	2.46%	8.50E+05	17	1.02%	3.02E+10	17	1.56%
TX-106	3.41E+02	2.63E+09	27	1.41%	4.90E+05	39	0.59%	1.84E+10	41	0.95%
TX-107	3.60E+01	2.28E+08	102	0.12%	3.72E+05	52	0.44%	2.15E+09	100	0.11%
TX-108	1.34E+02	1.01E+09	67	0.54%	1.79E+05	73	0.21%	6.56E+09	73	0.34%
TX-109	3.84E+02	7.06E+08	79	0.38%	1.69E+05	77	0.20%	6.90E+09	70	0.36%
TX-110	4.62E+02	3.23E+09	16	1.73%	6.59E+05	25	0.79%	2.33E+10	30	1.20%
TX-111	3.70E+02	2.46E+09	28	1.31%	5.05E+05	36	0.60%	1.77E+10	42	0.91%
TX-112	6.49E+02	4.51E+09	5	2.41%	8.97E+05	15	1.07%	3.22E+10	15	1.66%
TX-113	6.53E+02	4.88E+09	1	2.61%	1.25E+05	85	0.15%	1.60E+10	45	0.82%
TX-114	5.35E+02	3.49E+09	13	1.86%	7.15E+05	23	0.85%	2.53E+10	26	1.30%

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

Risk Rankings - Prepared from Best Basis Inventory 12/2001

SST Tank	Waste Volume July 2001 [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
TX-115	5.68E+02	4.09E+09	6	2.18%	7.93E+05	19	0.95%	2.87E+10	20	1.48%
TX-116	6.31E+02	2.28E+09	32	1.22%	4.16E+05	47	0.50%	1.45E+10	51	0.75%
TX-117	6.26E+02	2.11E+09	37	1.13%	4.52E+05	43	0.54%	1.62E+10	44	0.83%
TX-118	2.86E+02	1.69E+09	49	0.90%	1.61E+07	1	19.23%	2.31E+10	31	1.19%
TY-101	1.18E+02	2.03E+08	106	0.11%	1.05E+05	91	0.13%	2.10E+10	36	1.08%
TY-102	6.40E+01	1.03E+08	117	0.06%	6.44E+03	137	0.01%	1.85E+09	107	0.10%
TY-103	1.62E+02	1.89E+09	46	1.01%	1.45E+05	84	0.17%	4.84E+09	84	0.25%
TY-104	4.30E+01	5.75E+08	85	0.31%	4.16E+04	116	0.05%	1.46E+09	114	0.08%
TY-105	2.31E+02	1.04E+09	64	0.56%	2.31E+04	125	0.03%	2.33E+09	97	0.12%
TY-106	2.10E+01	1.41E+08	111	0.08%	2.48E+03	142	0.00%	1.35E+08	139	0.01%
U-101	2.50E+01	7.45E+07	124	0.04%	7.78E+03	135	0.01%	1.76E+09	109	0.09%
U-102	2.93E+02	1.92E+09	44	1.03%	3.90E+05	48	0.47%	1.94E+10	39	1.00%
U-103	4.18E+02	2.69E+09	26	1.44%	2.48E+05	63	0.30%	2.61E+10	23	1.34%
U-104	1.22E+02	1.96E+08	108	0.10%	1.55E+05	81	0.19%	8.44E+09	64	0.43%
U-105	3.53E+02	4.64E+09	3	2.48%	1.05E+06	11	1.25%	2.25E+10	33	1.16%
U-106	1.72E+02	1.18E+09	61	0.63%	6.34E+05	26	0.76%	8.87E+09	63	0.46%
U-107	4.08E+02	2.96E+09	23	1.58%	5.96E+05	28	0.71%	2.48E+10	27	1.28%
U-108	4.68E+02	3.62E+09	8	1.93%	5.82E+05	30	0.70%	3.27E+10	14	1.68%
U-109	3.92E+02	1.77E+09	47	0.95%	5.99E+04	111	0.07%	2.14E+10	35	1.10%
U-110	1.86E+02	1.57E+09	54	0.84%	2.26E+05	67	0.27%	2.17E+09	99	0.11%
U-111	3.29E+02	2.04E+09	39	1.09%	3.21E+05	56	0.38%	2.81E+10	21	1.44%
U-112	4.90E+01	8.87E+07	122	0.05%	6.22E+03	138	0.01%	5.42E+08	129	0.03%
U-201	5.00E+00	1.07E+07	134	0.01%	6.10E+01	148	0.00%	8.35E+07	142	0.00%
U-202	5.00E+00	3.18E+05	146	0.00%	6.26E+01	147	0.00%	7.20E+07	143	0.00%
U-203	3.00E+00	2.72E+05	149	0.00%	5.97E+01	149	0.00%	6.19E+07	144	0.00%
U-204	3.00E+00	1.84E+06	140	0.00%	7.86E+02	145	0.00%	2.26E+07	146	0.00%

C4.0 REFERENCES

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

Strenge 2002, *Re: Unit Risk Factors for the TWRS EIS*, e-mail, Dennis L. Strenge, PNNL, to Julie Reddick, July 22, 2002.

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 2002 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 A-1 Assumption Matrix for the 2002 Single-shell Retrieval Sequence and Double-shell Tanks Space Evaluation.

    b. Table D-2 Waste Generation (Kgal/month) Spreadsheet for the 2002 OWVP.

    c. Table D-3 Double-Shell Tank Transfers thru 6/2004 to Support the 2002 OWVP.

    d. Table D-4 Salt Well Volumes and Flushes Updated for the 2002 OWVP Projections.

    e. Table D-5 Historical Transfers from 6/1/2001 through 5/31/2002.

2. Case 1 (Reference Case) will use essentially the same treatment rate as that used for TFCO & UP, Rev. 3A (processing completed in 2028); will use a risk based approach to retrieve SST wastes to support the treatment schedule as space within the DSTs will allow; and will incorporate 0.85 Mgal of space savings.

3. Case 2 ("Updated" RPP System Plan/Ecology Case 1b) will use a different treatment rate than Case 1 (processing completed later than 2040); will use a risk based approach to retrieve SST wastes to support the treatment schedule as space within the DSTs will allow; and will incorporates 3.0 Mgal of space savings.

4. Case 3 (MAI/Closure) uses additional treatment options to complete processing in 2028; will use a risk based approach to retrieve SST wastes to support the treatment schedule as space within the DSTs will allow; and will incorporates 3.0 Mgal of space savings.

5. All OWVP projections will start with the DST inventory on 6/30/2001. Transfers and tank usage will be updated based on information available thru 5/31/2002 (Tables 3 and 5 above).

6. W-314 project assumptions:

    a. AW-B pit work will occur from 4/2001 to 8/2003; AW-B assumed to be useable by 8/2/2002.
    b. AW-A pit work will occur from ~6/30/2001 to 2/2003; AW-A assumed to be useable by 9/15/2002.
    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 3.
    d. Cross-site line outage will occur from 10/1/2003 to 4/30/2004 .
    e. Other project assumptions and outage dates are listed in the assumption matrix (Table A-1)

7. Wastes in tank SY-101 will be transferred to tank AW-102 in 4/2003 for evaporation. After evaporation the concentrated waste will be transferred to tank AP-108.

The accelerated retrieval of tank S-112 will start in 6/2003. The next SST tanks to be retrieved are C-106, S-102, C-104, S-105, S-106, and S-103. Dates for starting these tanks are listed in the assumption matrix (table A-1)

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):	
Due Date: (Format the presentation of due dates to correspond with deliverables section.)	
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 for FY 2002

Percent Flush to Apply is Shown at the Bottom of the Table.										
OWVP02WGX1						37349				
TOTAL=PUREX+ PFP+222-S+ T PLANT+ WESF+ 300+ 400										
									TOTAL	
									Non-Tank	
	PUREX	PFP	222-S	T PLANT	TANK	WESF	300	400	Farms	
	Baseline	Baseline	Baseline	Baseline	FARM		Baseline	Baseline	Generations	
Fiscal	Case	Case	Case	Case			Case	Case		
Year	(Kgal/yr)	(Kgal/yr)	(Kgal/yr)	(Kgal/yr)	(Kgal/yr)	(Kgal/yr)	(Kgal/yr)	(Kgal/yr)	(Kgal/yr)	
2002	5.00	12.68	10.00	19.00	120.00	0.00	1.80	0.00	48.48	
2003	5.00	9.51	10.00	16.50	120.00	0.00	1.80	0.00	42.81	
2004	5.00	12.68	10.00	13.50	120.00	0.00	19.18	0.00	60.36	*
2005	5.00	9.51	10.00	10.50	120.00	0.00	17.72	0.00	52.73	
2006	5.00	0.00	10.00	7.50	120.00	0.00	28.74	0.00	51.24	
2007	5.00		10.00	4.70	120.00	0.00	8.19	0.00	27.89	
2008	5.00		10.00	3.00	120.00	0.00	2.70	0.00	20.70	*
2009	5.00		10.00	3.00	120.00	0.00	2.70	0.00	20.70	
2010	5.00		10.00	3.00	120.00	0.00	4.02	0.00	22.02	
2011	5.00		10.00	3.00	120.00	0.00	3.60	0.00	21.60	
2012	5.00		10.00	3.00	120.00	0.00	3.60	0.00	21.60	
2013	5.00		10.00	3.00	120.00	0.00	3.60	0.00	21.60	
2014	5.00		10.00	3.00	120.00	0.00	3.60	0.00	21.60	
2015	5.00		10.00	3.00	120.00	0.00	3.60	0.00	21.60	
2016	5.00		10.00	3.00	120.00	0.00	3.60	0.00	21.60	
2017	5.00		10.00	3.00	120.00	0.00	3.60	0.00	21.60	
2018	5.00		10.00	3.00	120.00	0.00	3.60	0.00	21.60	
2019	5.00		10.00	3.00	120.00	0.00	3.60	0.00	21.60	
2020	5.00		10.00	3.00	120.00	0.00	3.60	0.00	21.60	
2021	5.00		10.00	3.00	120.00	0.00	4.00	0.00	22.00	
2022	5.00		10.00	3.00	120.00	0.00	4.00	0.00	22.00	
2023	5.00		10.00	3.00	120.00	0.00	4.00	0.00	22.00	
2024	5.00		10.00	3.00	120.00	0.00	4.00	0.00	22.00	
2025	5.00		10.00	3.00	120.00	0.00	4.00	0.00	22.00	
2026	5.00		10.00	3.00	120.00	0.00	4.00	0.00	22.00	
2027	5.00		10.00	3.00	120.00	0.00	4.00	0.00	22.00	
2028	5.00		10.00	3.00	120.00	0.00	4.00	0.00	22.00	
TOT(Kgal)	135.00	44.38	270.00	134.70	3240.00	0.00	154.85	0.00	738.93	
Total is in kgal summed over all years										
RANGE =			20.7	-	60.4	Kgal/yr without Tank Farms				
RANGE =			140.7	-	180.4	Kgal/yr with Tank Farms				
% FLUSH	0		22	22	0	0	44	44		

Table D-3A. Double-Shell Tank Transfers thru 6/2004 to Support the 2002 DST Space Evaluation					
No	Transfer	Need Date	Summary Schedule Date (7/11/2002)	Reason for Transfer	Project and Other Interactions
1	SY-102 to SY-101		8/28/2002	Frees up space in SY-102; supports SWL pumping. SY-101 full for characterization (transfer to tank AW-102 in 4/2003 for evaporation, see transfer #15).	**Check jumper configuration in SY valve pits.**
2	AP-108 to AW-102		9/20/2002*	Stages dilute waste for evaporation in October 2002.	
3	AW-106 to AP-103		9/24/2002*	Transfer of CC waste out of AW-106 required before starting evaporation of second tank of waste.	**Need AW-B pit operational (W-314). Need jumper in AW-104-04A pit.**
4	AP-102 to AP-108 (~750 KGAL)	10/7/2002-11/15/2002	10/7/2002	Transfer needed to keep transfer # 5 from overfilling AP-102; supports SWL pumping.	**W-211 starts construction 10/21/02; pits 02A & 02D?**
5	SY-102 to AP-102	10/23/2002-11/22/2002	10/14/2002	SY-102 full; supports SWL pumping	**Use SN650 route; jumper arrangements in A-A and A-B-impacts to A-101 & AX-101.**
6	AP-102 to AP-108 (~350 KGAL)	10/28/2002-11/30/2002		Tops off AP-108 to keep evaporator campaigns on schedule; supports SWL pumping; AP-103 full for characterization (evaporate 3/2003)	**W-211 starts construction 10/21/02; pits 02A & 02D?**
7	AP-102 to AW-105		11/4/2002	Waste level in tank AW-105 must be increased in order for the flex and float pump to start; see transfer #9	**Need AW-A pit operational (W-314). Need COB boxes 503 and 505 upgraded or need waiver. Need jumper in AW-104-04A pit. Check pump in AW-105?**
8	AW-106 to AW-103		11/11/2002	Partial clean out of AW-106 prior to start of Evaporator Campaign 03-1 (2/2003); tops off AW-103.	**Need AW-B and AW-A pits operational (W-314). Need COB boxes 503 and 505 upgraded or waiver. Need jumper in AW-104-04A pit.**
9	AW-105 to AP-102		11/15/2002	Frees up space in AW-105 needed for	**Need AW-A pit**

Table D-3A. Double-Shell Tank Transfers thru 6/2004 to Support the 2002 DST Space Evaluation					
No	Transfer	Need Date	Summary Schedule Date (7/11/2002)	Reason for Transfer	Project and Other Interactions
				transfer # 10 and allows concentration of dilute waste in AW-105. Will require AP-102 to AW-105 transfer to get tank level high enough for flex and float pump start (#7).	**operational (W-314). Need COB boxes 503 and 505 upgraded or need waiver. Need jumper in AW-104-04A pit.**
10	AW-106 to AW-105		11/18/2002	Cleans out AW-106 prior to start of Evaporator Campaign 03-1 (2/2003).	**Need AW-B and AW-A pits operational (W-314). Need COB boxes 503 and 505 upgraded or waiver. Need jumper in AW-104-04A pit.**
11	AP-107 to AW-102		12/2/2002	Stages first tank of dilute waste for Evaporator Campaign 03-1 (2/2003-3/2003). Bulk of volume transferred in Dec. with balance in Feb. 2003.	
12	AW-106 to AW-105	~2/20/2003	**Not in Schedule**	Frees up space in AW-106 during Evaporator Campaign 03-1 (2/2003); tops off AW-105.	**Need jumper in AW-104-04A pit.**
13	AW-106 to AW-104	~2/22/2003	**Not in Schedule**	Frees up space in AW-106 during Evaporator Campaign 03-1 (2/2003).	**Need jumper in AW-104-04A pit.**
14	AP-108 to AW-102	3/2003	**Not in Schedule**	Stages second tank of dilute waste for Evaporator Campaign 03-1 scheduled for 2/2003-3/2003.	
15	SY-101 to AW-102		4/15/2003	Frees up space in SY-101 to support SST Retrieval. Stages first tank of waste for Evaporator Campaign 03-2 (7/2003-8/2003).	**Jumper with Over Pressurization Disk in 244-A DCRT pump pit; Jumper in A-A valve pit; Jumper in AW-104-04A pit. Could impact 244-BX transfer & any SWL pumping in A or AX farm?**
16	AW-106 to AW-104	~4-6/2003	**Not in Schedule**	Partial clean out of AW-106 prior to start of Evaporator Campaign 03-2 (7/2003-8/2003); tops off AW-104.	**Need jumper in AW-104-04A pit.**
17	AW-106 to AP-103	~4-6/2003	Not in Schedule	Partial clean out of AW-106 prior to start of Evaporator Campaign 03-2 (7/2003-8/2003); tops off	**Need AW-B pit operational (W-314).**

Table D-3A. Double-Shell Tank Transfers thru 6/2004 to Support the 2002 DST Space Evaluation					
No	Transfer	Need Date	Summary Schedule Date (7/11/2002)	Reason for Transfer	Project and Other Interactions
				AP-103.	**Need jumper in AW-104-04A pit.**
18	AW-106 to AP-108	~4-6/2003	Not in Schedule	Completes clean out of AW-106 prior to start of Evaporator Campaign 03-2 (7/2003-8/2003).	**Need jumper in AW-104-04A pit.**
19	SY-102 to AP-102	5/18/2003		SY-102 full; supports SWL pumping & SST Retrieval. May want to move this transfer up to precede the SY-101 to AW-102 transfer.	**Use SN650 route. Could impact 244-BX transfers & any SWL pumping in A or AX farm?**
20	AP-102 to AP-107	5/23/2003	**Not in Schedule**	Frees up space in AP-102 to support SST Retrieval (see transfer #23); fill AP-107 for evaporation in Evaporator Campaign 03-2 (8/2003).	**Need coordination between W-211 and Operations. Need transfer pump in O2D & jumpers in O2A pits. AP-107 full for characterization (evaporate 8/2003).**
21	SY-102 to SY-101	6/2003		Supports SST Retrieval of S-112.	
22	SY-102 to SY-101	7/2003		Supports SST Retrieval of S-112.	
23	SY-101 to AP-102	7/2003		Simultaneous transfer needed to keep transfer #22 from overfilling tank SY-101; supports SST Retrieval.	
24	AW-106 to AP-108	7-8/2003		Frees up space in AW-106 during Evaporator Campaign 03-2 (7/2003-8/2003).	
25	SY-102 to SY-101	8/2003		Supports SST Retrieval of S-112.	
26	SY-101 to AP-102	8/2003		Simultaneous transfer needed to keep transfer #25 from overfilling tank SY-101; supports SST Retrieval.	
27	AP-107 to AW-102	8/2003		Stages second tank of waste for Evaporator Campaign 03-2 (7/2003-8/2003). Frees up space for transfer #28	**Characterization of waste in AP-107 needed in three months (see transfer #20).**
28	AP-102 to AP-107	8/2003		Simultaneous transfer needed to keep transfer #26 from overfilling tank AP-102; AP-107 full for	

Table D-3A. Double-Shell Tank Transfers thru 6/2004 to Support the 2002 DST Space Evaluation					
No	Transfer	Need Date	Summary Schedule Date (7/11/2002)	Reason for Transfer	Project and Other Interactions
				evaporator characterization.	
29	SY-102 to SY-101	9/2003		Supports SST Retrieval of S-112.	
30	SY-101 to AP-102	9/2003		Simultaneous transfer needed to keep transfer #29 from overfilling tank SY-101; supports SST Retrieval.	**Final cross-site before cross-site outage begins in October 2003.**
31	SY-102 to SY-101	10/2003		Supports SST Retrieval of S-112.	
32	SY-102 to SY-101	11/2003		Supports SST Retrieval of S-112.	
33	AP-107 to AW-102	1/2004		Stages one tank of waste for Evaporator Campaign 04-2 (1/2004).	
34	AW-106 to AP-107	1/2004		Cleans out AW-106 prior to start of Evaporator Campaign 04-1 (1/2004).	
35	AP-102 to AW-102	6/2004		Frees up space in AP-102 to prevent overfilling the tank; requires characterization ~2/2004; direct transfer to AW-102.	

*--Delayed transfer dates based on latest dates for Evaporator Campaigns--02-1 starts 9/9/2002; 02-2 starts 10/7/2002.

Table D-3B. Revised Evaporator Campaign Schedule to Support the 2002 DST Space Evaluation

Campaign	Start Date	Staging Tank (Staging Date to AW-102)	Original Waste Source	Waste Feed Type	Feed Volume (Kgal)	Receiver Tank for Concentrated Waste
02-1	3/2002	Cold Run				
02-2	9/9/2002	AP-107 (3/2002)	SY-102 to AP-107--- 9/2000 SY-102 to AP-107---11/2000	DN/DC DN/DC	~980	AP-103
03-1	10/7/2002	AP-108 (9/2002)	AP-102 to AP-108---- 3/2002	DN/DC	~1100	AW-103 (full) AW-105
03-2	2/2003	AP-107 (12/2002)	AP-102 to AP-107---- 6/2002	DN/DC	~1030	AW-105 (full) AW-104
03-3	3/2003	AP-108 (3/2003)	AP-102 to AP-108--- 10/2002	DN/DC	~1100	AW-104 (full) AP-103 (full) AP-108 (~4/2003)
03-4	7/2003	SY-101 (4/2003)	SY-101 to AW-102--- 4/2003 Direct transfer.	DN/DC DN/DC	~870	AP-108
03-5	8/2003	AP-107 (8/2003)	SY-102 to AP-102---- 5/2003 AP-102 to AP-107---- 5/2003	DN/DC	~1030	AP-108 (full) AP-107 (~1/2004)
04-1	1/2004	AP-107 (1/2004)	SY-101 to AP-102--- 7 & 8/2003 AP-102 to AP-107---- 8/2003	DN (S-112)	~1100	AP-107 (full)

Issue: Tank space will be extremely tight after Evaporator Campaign 03-1. SWL pumping should be winding down but the accelerated retrieval of S-112 will be retrieving wastes that need to be evaporated. Intermediate staging space for evaporator feeds will require one or more of the following alternatives:

1. Delay sending concentrated waste from tank AW-106 to AP farm and use AP tanks as temporary intermediate feed staging tanks for as long as possible.
2. Characterize wastes and stage for evaporation in 3 months.
3. Fill AP-102, stop all additions, characterize, and feed directly to AW-102 (stops use of AP-102 for up to 4 months). The other alternative is to characterize the waste in AP-102 and allow addition of a small volume of known wastes for approximately 3-4 months.

Use space in AN-106 (costly routing if space is needed before the new cross-site line tie in is completed).

Notes: DC = dilute complexed waste.
DN = dilute noncomplexed waste.

Table D-4. Saltwell Volumes and Flushes Updated for the 2002 DST Projections (p 1 of 5)

SWL0602AA.XLS		6/18/2002	Updated flush factors through 5/31/2002.													
SWL UPDATE INFO FROM DAVE VLADIMIROFF ON ~6/14/2002.																
PROJECTED NOS AGREE W/ ACTUALS THRU `5/31/2002																
200 EAST AREA																
	VOL.		PUMP				MO									
	(KGAL)	%	EFFIC		RETRIEVE		VOL									
	FROM	FLUSH	%	WASTE	TO	ORIGIN	(KGAL)									
TANK	REFR 1			TYPE	TANK	NAME	9/99	10/99	11/99	12/99	1/00	2/00	3/00	4/00	5/00	6/00
A-101		*0.4*		*DN*			*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*3*	*4*
AX-101		0.4		DN			0	0	0	0	0	0	0	0	0	0
BY-105		1.50		DN			0	0	0	0	0	0	0	0	0	0
BY-106		1.13		DN			0	0	0	0	0	0	0	0	0	0
C-103		0.6		DC			0	0	0	0	0	0	0	0	0	0
106-AN (C-103)							0	0	0	0	0	0	0	0	0	0
FLUSH							0	0	0	0	0	0	0	0	0	0
102-AP (BY FARM)							0	0	0	0	0	0	0	0	0	0
FLUSH							0	0	0	0	0	0	0	0	0	0
102-AP (A-101,AX-101)							0	0	0	0	0	0	0	0	3	4
FLUSH							0	0	0	0	0	0	0	0	1	1
TOT W/O FLUSH							0	0	0	0	0	0	0	0	3	4
TOT WITH FLUSH							0	0	0	0	0	0	0	0	5	5
200 WEST AREA																
	VOL.		PUMP				MO									
	(KGAL)	%	EFFIC		RETRIEVE		VOL									
	FROM	FLUSH	%	WASTE	TO	ORIGIN	(KGAL)									
TANK	REFR 1			TYPE	TANK	NAME	9/99	10/99	11/99	12/99	1/00	2/00	3/00	4/00	5/00	6/00
S-101		0.4		DN			0	0	0	0	0	0	0	0	0	0
S-102		2.17		DN			3	3	3	3	3	3	3	3	3	3
S-103		0.73		DN			3	3	3	3	0	0	0	0	0	0
S-106		0.31		DN			12	13	12	13	1	0	0	0	0	0
S-107		0.4		DN			0	0	0	0	0	0	0	0	0	0
S-109		0.4		DN			0	0	0	0	0	0	0	0	0	0
S-111		0.26		DN			0	0	0	0	0	0	0	0	0	0
S-112		0.4		DN			0	0	0	0	0	0	0	0	0	0
SX-101		1.26		DN			0	0	0	0	0	0	0	0	0	0
SX-102		0.6		DN			0	0	0	0	0	0	0	0	0	0
SX-103		1.24		DN			0	0	0	0	0	0	0	0	0	0
SX-104		0.4		DN			0	0	0	0	0	0	0	0	0	0
SX-105		1.43		DN			0	0	0	0	0	0	0	0	0	0
SX-106		0.96		DN			10	10	10	7	0	0	0	0	0	0
T-104		0.28		DN			0	0	0	0	0	0	0	0	0	0
T-110		0.28		DN			0	0	0	0	0	0	0	0	0	0
U-102		2.97		DC			0	0	0	0	3	7	7	7	7	7
U-103		1.54		DC			2	13	13	13	13	13	13	13	5	0
U-105		1.22		DC			0	0	0	8	13	12	13	12	13	12
U-106		1.65		DC&TRU			0	0	0	0	0	0	0	0	0	0
U-107		0.4		DN			0	0	0	0	0	0	0	0	0	0
U-108		0.4		DN			0	0	0	0	0	0	0	0	0	0
U-109		1.96		DC			0	0	0	0	0	0	6	9	10	9
U-111		0.4		DN			0	0	0	0	0	0	0	0	0	0
DN-SWL							29	30	29	26	4	3	3	3	3	3
FLUSH							23	24	23	20	8	7	7	7	7	7
DC-SWL							2	13	13	21	29	31	40	42	34	29
FLUSH							3	21	20	30	44	54	71	74	63	54
TOT W/O FLUSH							31	43	42	48	33	34	43	45	38	32
TOT WITH FLUSH							56	87	85	98	85	95	121	126	108	93
							31									
GRAND TOTAL W/O FLUSH							31	43	42	48	33	34	43	45	41	36
GRAND TOTAL WITH FLUSH							56	87	85	98	85	95	121	126	113	98
							9/99	10/99	11/99	12/99	1/00	2/00	3/00	4/00	5/00	6/00

Table D-4. Saltwell Volumes and Flushes Updated for the 2002 DST Projections (p 2 of 5)

SWL0602AA.XLS
SWL UPDATE INFO FROM DAVE VLADIMIROFF ON ~6/14/2002.
PROJECTED NOS AGREE W/ ACTUALS THRU '5/31/2002

200 EAST AREA

TANK	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
A-101	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AX-101	1	8	0	0	0	0	0	0	10	3	0	0	0	0	0	0	0	0
BY-105	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	3	3
BY-106	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	9	8
C-103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
106-AN ((	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLUSH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102-AP (E	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	12	11
FLUSH	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	14	14
102-AP (A	4	11	0	0	0	0	0	0	10	3	0	0	0	0	0	0	0	0
FLUSH	2	5	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0
TOT W/O I	4	11	0	0	0	0	0	0	10	3	0	0	15	0	0	0	12	11
TOT WITH	6	16	0	0	0	0	0	0	14	5	0	0	35	0	0	0	26	25
			23												28			
			32												54			

200 WEST AREA

TANK	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
S-101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S-102	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S-103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S-106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S-109	0	0	6	17	11	0	0	0	0	0	0	0	0	0	0	0	0	0
S-111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
S-112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-101	0	0	0	0	1	19	0	0	0	0	0	0	0	0	10	3	0	0
SX-102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
SX-103	0	0	0	1	18	16	14	11	11	9	8	28	0	0	7	3	1	0
SX-104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-105	0	44	35	45	13	6	7	2	0	2	0	0	0	0	0	0	0	0
SX-106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-102	7	7	4	4	4	4	3	3	3	2	2	0	3	1	0	0	0	0
U-103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-105	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-106	0	13	17	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	1	0
U-108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
U-109	10	9	5	5	4	4	2	0	0	0	0	1	4	0	0	0	0	0
U-111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DN-SWL	3	47	41	64	42	40	21	13	11	10	8	28	0	0	16	16	2	9
FLUSH	7	69	52	73	46	52	28	16	14	13	10	35	0	0	20	11	2	3
DC-SWL	22	29	26	18	8	8	5	3	3	2	2	0	7	2	1	0	0	0
FLUSH	47	60	50	37	20	19	14	8	8	7	7	0	15	5	2	0	0	0
TOT W/O I	26	76	67	81	51	48	27	16	14	13	10	28	7	2	17	16	2	9
TOT WITH	80	204	170	191	116	119	68	40	35	33	27	63	22	7	39	27	5	12
			526												312			
GRAND TO	30	87	67	81	51	48	27	16	23	16	10	28	22	2	17	16	14	20
GRAND TO	86	220	170	191	116	119	68	40	49	38	27	63	57	7	39	27	31	36
	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

Table D-4. Saltwell Volumes and Flushes Updated for the 2002 DST Projections (p 3 of 5)

SWL0602AA.XLS
SWL UPDATE INFO FROM DAVE VLADIMIROFF ON ~6/14/2002.
PROJECTED NOS AGREE W/ ACTUALS THRU 5/31/2002

200 EAST AREA

TANK	VOL. (KGAL) FROM REFR 1	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
							---->---PROJECTED------>										
A-101		57	159	45	56	68	3	30	25	15	12	10	8	7	5	4	3
AX-101		0	144	35	61	40	15	9	5	3	2	1	0	0	0	0	0
BY-105		0	0	0	0	0	0	14	13	10	9	7	6	5	4	4	3
BY-106		0	0	0	0	0	0	11	13	10	9	7	6	5	4	3	3
C-103		0	0	0	0	0	0	0	13	42	19	1	0	0	0	0	0
106-AN (C-103)		0	0	0	0	0	0	0	13	42	19	1	0	0	0	0	0
FLUSH		0	0	0	0	0	0	0	8	25	11	0	0	0	0	0	0
102-AP (BY FARM)		0	0	0	0	0	0	25	26	21	18	14	12	10	8	7	6
FLUSH		0	0	0	0	0	0	34	34	27	23	19	16	13	10	9	8
102-AP (A-101,AX-101)		57	304	80	117	108	18	39	30	18	14	11	8	7	5	4	3
FLUSH		33	222	76	44	45	7	16	12	7	6	4	3	3	2	2	1
TOT W/O FLUSH		57	304	80	117	108	18	65	69	81	51	25	20	17	13	11	9
TOT WITH FLUSH		90	526	156	161	153	26	114	122	140	91	49	40	33	25	23	18
										921							
										1,539							

200 WEST AREA

TANK	VOL. (KGAL) FROM REFR 1	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
							---->---PROJECTED------>										
S-101		0	0	0	0	0	3	12	10	8	7	5	5	4	2.9	2.73	2
S-102		0	0	0	0	2	5	5	5	4	4	4	4	4	3	4	3
S-103		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S-106		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S-107		0	0	0	0	0	0	11	8	5	4	4	4	3	2.6	2.56	2
S-109		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S-111		5	22	7	3	1	3	3	3	3	3	3	3	3	3	3	3
S-112		0	0	0	0	0	0	0	2	13	11	9	7	6	5	4	4
SX-101		0	0	0	0	0	6	8	7	6	5	4	4	3	2	2	2
SX-102		0	0	0	0	0	9	9	8	7	6	5	5	4	4	4	3
SX-103		0	0	0	0	0	2	2	2	2	2	2	2	2	1	2	2
SX-104		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-105		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-106		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-104		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-110		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-102		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-103		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-105		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-106		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-107		0	0	0	0	0	14	20	13	10	8	6	5	4	3	2	2
U-108		0	0	0	0	1	16	18	13	10	9	7	6	5	3	3	3
U-109		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-111		0	0	0	0	0	12	11	9	6	5	4	3	2	2	1	1
DN-SWL		4	22	7	3	4	70	98	78	73	64	52	46	40	31	30	26
FLUSH		1	1	3	4	4	44	58	48	44	40	34	31	27	22	22	19
DC-SWL		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLUSH		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOT W/O FLUSH		4	22	7	3	4	70	98	78	73	64	52	46	40	31	30	26
TOT WITH FLUSH		5	23	10	7	8	115	156	126	117	103	86	77	67	53	52	45
										387							
GRAND TOTAL W/O FL		62	326	87	120	112	88	163	147	154	115	78	67	57	44	42	35
GRAND TOTAL WITH F		96	549	166	168	161	140	270	248	257	194	135	117	100	78	75	63
		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

Table D-4. Saltwell Volumes and Flushes Updated for the 2002 DST Projections (p 4 of 5)

SWL0602AA.XLS																		
SWL UPDATE INFO FROM DAVE VLADIMIROFF ON ~6/14/2002.																		
PROJECTED NOS AGREE W/ ACTUALS THRU 5/31/2002																		
200 EAST AREA																		
	VOL.																	
	(KGAL)																	
	FROM																	
TANK	REFR 1	5/03	6/03	7/03	8/03	9/03	10/03	11/03	12/03	1/04	2/04	3/04	4/04	5/04	6/04	7/04	8/04	9/04
A-101		3	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0
AX-101		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BY-105		3	2	2	2	1	1	1	0	0	0	0	0	0	0	0	0	0
BY-106		2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
C-103		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
106-AN (C-103)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLUSH		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102-AP (BY FARM)		5	4	3	3	2	1	1	0	0	0	0	0	0	0	0	0	0
FLUSH		6	5	4	4	3	2	1	0	0	0	0	0	0	0	0	0	0
102-AP (A-101,AX-101)		3	2	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0
FLUSH		1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
TOT W/O FLUSH		8	6	5	4	3	2	1	0	0	0	0	0	0	0	0	0	0
TOT WITH FLUSH		15	12	11	9	7	4	2	0	0	0	0	0	0	0	0	0	0
						173												*3*
						332												6
200 WEST AREA																		
	VOL.																	
	(KGAL)																	
	FROM																	
TANK	REFR 1	5/03	6/03	7/03	8/03	9/03	10/03	11/03	12/03	1/04	2/04	3/04	4/04	5/04	6/04	7/04	8/04	9/04
S-101		2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
S-102		3	3	3	3	3	3	2	2	1	0	0	0	0	0	0	0	0
S-103		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S-106		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S-107		2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	0	0
S-109		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S-111		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
S-112		3	2	2	2	1	1	1	1	0	0	0	0	0	0	0	0	0
SX-101		2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
SX-102		3	2	2	2	2	2	1	1	1	1	1	1	1	1	1	0	0
SX-103		2	1	2	2	1	2	1	1	1	1	1	1	1	1	1	1	1
SX-104		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-105		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SX-106		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-104		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-110		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-102		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-103		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-105		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-106		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-107		1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-108		2	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
U-109		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-111		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DN-SWL		23	20	18	16	14	12	10	10	8	5	5	5	5	5	5	4	4
FLUSH		18	16	15	13	12	11	10	9	7	3	3	3	3	3	3	2	2
DC-SWL		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FLUSH		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOT W/O FLUSH		23	20	18	16	14	12	10	10	8	5	5	5	5	5	5	4	4
TOT WITH FLUSH		*40*	*35*	*32*	*29*	*26*	*23*	*20*	*19*	*14*	*8*	*8*	*8*	*8*	*8*	*8*	*7*	*6*
						380												78
GRAND TOTAL W/O FL		31	26	23	20	17	14	11	10	8	5	5	5	5	5	5	4	4
GRAND TOTAL WITH F		56	48	43	38	33	27	22	19	14	8	8	8	8	8	8	7	6
		5/03	6/03	7/03	8/03	9/03	10/03	11/03	12/03	1/04	2/04	3/04	4/04	5/04	6/04	7/04	8/04	9/04

Table D-4. Saltwell Volumes and Flushes Updated for the 2002 DST Projections (p 5 of 5)

SWL0602AA.XLS					
SWL UPDATE INFO FROM DAVE VLADIMIROFF ON ~6/14/2002.					
PROJECTED NOS AGREE W/ ACTUALS THRU `5/31/2002					
200 EAST AREA					
	VOL.			5/1/2002	
	(KGAL)	CROSS CHECK		VOL	
	FROM	TOTAL		REMAING	
TANK	REFR 1	(KGAL)	TANK	(KGAL)	
A-101		533	A-101	201	
AX-101		338	AX-101	73	
BY-105		102	BY-105	88	
BY-106		101	BY-106	77	
C-103		74	C-103	74	
106-AN (C-103)		106-AN (C-103)			
FLUSH		FLUSH			
102-AP (BY FARM)		102-AP (BY FARM)			
FLUSH		FLUSH			
102-AP (A-101,AX-101)		102-AP (A-101,AX-101)			
FLUSH		FLUSH			
TOT W/O FLUSH		TOT W/O FLUSH			
TOT WITH FLUSH		TOT WITH FLUSH			
200 WEST AREA					
	VOL.			5/1/2002	
	(KGAL)	CROSS CHECK		VOL	
	FROM	TOTAL		REMAING	
TANK	REFR 1	(KGAL)	TANK	(KGAL)	
S-101		68	S-101	68	
S-102		110	S-102	71	
S-103		14	S-103	0	
S-106		50	S-106	0	
S-107		58	S-107	58	
S-109		34	S-109	0	
S-111		127	S-111	85	
S-112		74	S-112	74	
SX-101		87	SX-101	55	
SX-102		87	SX-102	85	
SX-103		169	SX-103	43	
SX-104		0	SX-104	0	
SX-105		153	SX-105	0	
SX-106		38	SX-106	0	
T-104		0	T-104	0	
T-110		0	T-110	0	
U-102		87	U-102	0	
U-103		99	U-103	0	
U-105		88	U-105	0	
U-106		39	U-106	0	
U-107		98	U-107	87	
U-108		101	U-108	100	
U-109		78	U-109	0	
U-111		56	U-111	56	
DN-SWL		DN-SWL		1,295	
FLUSH		FLUSH			
DC-SWL		DC-SWL			
FLUSH		FLUSH			
TOT W/O FLUSH		TOT W/O FLUSH			
TOT WITH FLUSH		TOT WITH FLUSH			
GRAND TOTAL W/O FL		GRAND TOTAL W/O FLUSH			
GRAND TOTAL WITH F		GRAND TOTAL WITH FLUSH			

Table D-5. Historical Transfers* from 7/1/2001 through 5/31/2002 (p 1 of 6)

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							183
	LOSS	AY-101	UNKN	08/01/2001	08/31/2001	-1	182
	LOSS	AY-101	UNKN	09/01/2001	09/30/2001	-1	181
	LOSS	AY-101	UNKN	10/01/2001	10/31/2001	-1	180
	LOSS	AY-101	UNKN	11/01/2001	11/30/2001	-1	179
	LOSS	AY-101	UNKN	12/01/2001	12/31/2001	-2	177
	LOSS	AY-101	UNKN	02/01/2002	02/28/2002	-2	175
	GAIN	WATER	AY-101	02/07/2002	02/28/2002	7	182
	GAIN	WATER	AY-101	03/03/2002	03/04/2002	1	183
	LOSS	AY-101	UNKN	04/04/2002	04/04/2002	-1	182
AY-102							635
	LOSS	AY-102	UNKN	07/01/2001	07/31/2001	-3	632
	LOSS	AY-102	UNKN	08/01/2001	08/31/2001	-3	629
	LOSS	AY-102	UNKN	09/01/2001	09/30/2001	-4	625
	LOSS	AY-102	UNKN	10/01/2001	10/31/2001	-4	621
	LOSS	AY-102	UNKN	11/01/2001	11/30/2001	-3	618
	GAIN	NaNO2	AY-102	11/27/2001	11/30/2001	62	680
	GAIN	WATER	AY-102	11/27/2001	11/30/2001	1	681
	LOSS	AY-102	UNKN	12/01/2001	12/31/2001	-2	679
	LOSS	AY-102	UNKN	01/01/2002	01/31/2002	-4	675
	LOSS	AY-102	UNKN	02/01/2002	02/28/2002	-2	673
	LOSS	AY-102	UNKN	03/01/2002	03/31/2002	-2	671
	LOSS	AY-102	UNKN	04/01/2002	04/30/2002	-2	669
	LOSS	AY-102	UNKN	05/01/2002	05/31/2002	-2	667
AZ-101							944
	LOSS	AZ-101	UNKN	07/01/2001	07/31/2001	-3	941
	GAIN	WATER	AZ-101	07/07/2001	07/17/2001	12	953
	LOSS	AZ-101	UNKN	08/01/2001	08/31/2001	-4	949
	GAIN	WATER	AZ-101	08/19/2001	08/19/2001	6	955
	GAIN	WATER	AZ-101	08/19/2001	08/19/2001	1	956
	LOSS	AZ-101	UNKN	09/01/2001	09/30/2001	-3	953
	GAIN	UNKN	AZ-101	10/01/2001	10/31/2001	2	955
	GAIN	WATER	AZ-101	10/06/2001	10/06/2001	8	963
	GAIN	WATER	AZ-101	11/02/2001	11/02/2001	6	969
	GAIN	WATER	AZ-101	11/28/2001	11/28/2001	7	976
	LOSS	AZ-101	UNKN	12/01/2001	12/31/2001	-1	975
	GAIN	WATER	AZ-101	12/21/2001	12/21/2001	6	981
	LOSS	AZ-101	UNKN	01/01/2002	01/31/2002	-2	979
	GAIN	WATER	AZ-101	01/15/2002	01/15/2002	7	986
	LOSS	AZ-101	UNKN	02/01/2002	02/28/2002	-4	982
	GAIN	WATER	AZ-101	02/07/2002	02/07/2002	6	988
	LOSS	AZ-101	UNKN	03/01/2002	03/31/2002	-2	986
	GAIN	WATER	AZ-101	03/13/2002	03/13/2002	6	992
	LOSS	AZ-101	INST	03/15/2002	03/15/2002	-5	987
	LOSS	AZ-101	UNKN	04/01/2002	04/30/2002	-3	984
	GAIN	INST	AZ-101	04/03/2002	04/03/2002	5	989
	GAIN	WATER	AZ-101	04/30/2002	04/30/2002	6	995
	LOSS	AZ-101	INST	05/09/2002	05/09/2002	-5	990

Table D-5. Historical Transfers* from 6/1/2001 through 5/31/2002 (p 2 of 6)

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)
AZ-102							996
	GAIN	WATER	AZ-102	08/10/2001	08/12/2001	1	997
	LOSS	AZ-102	UNKN	11/01/2001	11/30/2001	-1	996
	LOSS	AZ-102	UNKN	12/01/2001	12/31/2001	-1	995
	LOSS	AZ-102	UNKN	01/01/2002	01/31/2002	-2	993
	LOSS	AZ-102	UNKN	02/01/2002	02/28/2002	-3	990
	LOSS	AZ-102	UNKN	03/01/2002	03/31/2002	-2	988
	LOSS	AZ-102	UNKN	04/01/2002	04/30/2002	-2	986
	LOSS	AZ-102	UNKN	05/01/2002	05/31/2002	-1	985
	GAIN	NAOH	AZ-102	05/15/2002	05/16/2002	9	994
SY-101							970
	LOSS	SY-101	UNKN	09/01/2001	09/30/2001	-1	969
	LOSS	SY-101	UNKN	02/01/2002	02/28/2002	-1	968
	LOSS	SY-101	UNKN	03/01/2002	03/31/2002	-1	967
	LOSS	SY-101	UNKN	05/01/2002	05/31/2002	-1	966
SY-102							1034
	GAIN	STWAT	SY-102	07/01/2001	07/31/2001	29	1063
	LOSS	SY-102	UNKN	07/01/2001	07/31/2001	-3	1060
	GAIN	WATER	SY-102	07/11/2001	07/11/2001	1	1061
	TRANSFER	U-109	SY-102	07/30/2001	07/30/2001	4	1065
	TRANSFER	U-102	SY-102	07/30/2001	07/30/2001	4	1069
	GAIN	STWAT	SY-102	08/01/2001	08/31/2001	7	1076
	TRANSFER	SY-102	AP-108	08/01/2001	08/03/2001	-138	938
	LOSS	SY-102	UNKN	08/01/2001	08/31/2001	-3	935
	TRANSFER	SY-102	AP-108	08/06/2001	08/10/2001	-22	913
	TRANSFER	U-109	SY-102	08/30/2001	08/30/2001	1	914
	TRANSFER	U-102	SY-102	08/30/2001	08/30/2001	1	915
	GAIN	STWAT	SY-102	09/01/2001	09/30/2001	23	938
	LOSS	SY-102	UNKN	09/01/2001	09/30/2001	-2	936
	TRANSFER	SX-103	SY-102	09/29/2001	09/29/2001	7	943
	TRANSFER	SX-101	SY-102	09/29/2001	09/29/2001	3	946
	GAIN	STWAT	SY-102	10/01/2001	10/31/2001	54	1000
	LOSS	SY-102	UNKN	10/01/2001	10/31/2001	-3	997
	TRANSFER	SX-101	SY-102	10/29/2001	10/29/2001	9	1006
	TRANSFER	SX-103	SY-102	10/29/2001	10/29/2001	3	1009
	TRANSFER	U-107	SY-102	10/29/2001	10/29/2001	11	1020
	TRANSFER	SX-103	SY-102	11/01/2001	11/29/2001	1	1021
	GAIN	STWAT	SY-102	11/01/2001	11/29/2001	5	1026
	LOSS	SY-102	UNKN	11/01/2001	11/30/2001	-1	1025
	GAIN	STWAT	SY-102	12/01/2001	12/31/2001	7	1032
	GAIN	UNKN	SY-102	12/01/2001	12/31/2001	3	1035
	TRANSFER	SX-102	SY-102	12/02/2001	12/30/2001	1	1036
	TRANSFER	U-108	SY-102	12/02/2001	12/30/2001	2	1038
	TRANSFER	S-111	SY-102	12/02/2001	12/30/2001	5	1043
	TRANSFER	S-111	SY-102	01/01/2002	01/31/2002	5	1048
	GAIN	STWAT	SY-102	01/01/2002	01/31/2002	3	1051
	TRANSFER	S-111	SY-102	02/01/2002	02/28/2002	22	1073
	GAIN	STWAT	SY-102	02/01/2002	02/28/2002	1	1074
	LOSS	SY-102	UNKN	02/01/2002	02/28/2002	-1	1073
	TRANSFER	S-111	SY-102	03/01/2002	03/31/2002	7	1080
	GAIN	STWAT	SY-102	03/01/2002	03/31/2002	3	1083

Table D-5. Historical Transfers* from 6/1/2001 through 5/31/2002 (p 3 of 6)

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)
SY-102	LOSS	SY-102	UNKN	03/01/2002	03/31/2002	-4	1079
cont'd	TRANSFER	SY-102	AP-102	03/14/2002	03/24/2002	-495	584
	TRANSFER	S-111	SY-102	04/01/2002	04/29/2002	3	587
	GAIN	STWAT	SY-102	04/01/2002	04/29/2002	4	591
	GAIN	UNKN	SY-102	04/01/2002	04/30/2002	2	593
	TRANSFER	S-111	SY-102	05/01/2002	05/30/2002	1	594
	TRANSFER	S-102	SY-102	05/01/2002	05/30/2002	2	596
	GAIN	STWAT	SY-102	05/01/2002	05/30/2002	4	600
	GAIN	UNKN	SY-102	05/01/2002	05/31/2002	1	601
SY-103							744
	GAIN	UNKN	SY-103	07/01/2001	07/31/2001	1	745
	LOSS	SY-103	UNKN	08/01/2001	08/31/2001	-3	742
	GAIN	UNKN	SY-103	09/01/2001	09/30/2001	1	743
	GAIN	UNKN	SY-103	10/01/2001	10/31/2001	1	744
	LOSS	SY-103	GAS	10/23/2001	10/24/2001	-5	739
	GAIN	UNKN	SY-103	01/01/2002	01/31/2002	1	740
	LOSS	SY-103	UNKN	02/01/2002	02/28/2002	-1	739
	GAIN	UNKN	SY-103	05/01/2002	05/31/2002	1	740
AW-101							1126
	GAIN	INST	AW-101	07/18/2001	07/18/2001	1	1127
	GAIN	UNKN	AW-101	09/01/2001	09/30/2001	1	1128
	LOSS	AW-101	UNKN	12/01/2001	12/31/2001	-1	1127
AW-102							88
	GAIN	UNKN	AW-102	07/01/2001	07/31/2001	1	89
	GAIN	WATER	AW-102	07/02/2001	07/10/2001	1	90
	GAIN	WATER	AW-102	09/01/2001	09/30/2001	4	94
	LOSS	AW-102	UNKN	10/01/2001	10/31/2001	-1	93
	GAIN	WATER	AW-102	11/15/2001	11/29/2001	1	94
	GAIN	WATER	AW-102	01/10/2002	01/31/2002	1	95
	GAIN	WATER	AW-102	03/02/2002	03/03/2002	6	101
	TRANSFER	AP-107	AW-102	03/07/2002	03/11/2002	928	1029
	GAIN	WATER	AW-102	04/01/2002	04/04/2002	32	1061
	GAIN	UNKN	AW-102	05/01/2002	05/31/2002	1	1062
AW-103							1102
	LOSS	AW-103	UNKN	12/01/2001	12/31/2001	-1	1101
	LOSS	AW-103	UNKN	03/01/2002	03/31/2002	-1	1100
AW-104							316
	LOSS	AW-104	UNKN	10/01/2001	10/31/2001	-1	315
	LOSS	AW-104	UNKN	12/01/2001	12/31/2001	-1	314
	LOSS	AW-104	UNKN	04/01/2002	04/30/2002	-1	313
AW-105							426
	LOSS	AW-105	UNKN	01/01/2002	01/31/2002	-1	425
	LOSS	AW-105	UNKN	05/01/2002	05/31/2002	-1	424

Table D-5. Historical Transfers* from 6/1/2001 through 5/31/2002 (p 4 of 6)

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-106							297
	LOSS	AW-106	UNKN	09/01/2001	09/03/2001	-1	296
	LOSS	AW-106	UNKN	12/01/2001	12/31/2001	-1	295
	LOSS	AW-106	UNKN	01/01/2002	01/31/2002	-1	294
AN-101							253
	LOSS	AN-101	UNKN	10/01/2001	10/31/2001	-1	252
AN-102							1054
	GAIN	UNKN	AN-102	09/01/2001	09/01/2001	1	1055
	GAIN	WATER	AN-102	09/06/2001	09/06/2001	1	1056
	GAIN	NAOH	AN-102	09/21/2001	09/28/2001	26	1082
	GAIN	WATER	AN-102	09/21/2001	09/28/2001	1	1083
	LOSS	AN-102	UNKN	10/01/2001	10/31/2001	-1	1082
	LOSS	AN-102	UNKN	11/01/2001	11/30/2001	-2	1080
	LOSS	AN-102	UNKN	12/01/2001	12/31/2001	-1	1079
	LOSS	AN-102	UNKN	01/01/2002	01/31/2002	-1	1078
	LOSS	AN-102	UNKN	02/01/2002	02/28/2002	-1	1077
AN-103							957
	GAIN	UNKN	AN-103	07/01/2001	07/31/2001	1	958
	GAIN	UNKN	AN-103	10/01/2001	10/31/2001	1	959
	GAIN	UNKN	AN-103	11/01/2001	11/30/2001	1	960
	LOSS	AN-103	UNKN	12/01/2001	12/31/2001	-2	958
	LOSS	AN-103	UNKN	02/01/2002	02/28/2002	-1	957
	GAIN	WATER	AN-103	04/01/2002	04/30/2002	1	958
AN-104							1052
	GAIN	INST	AN-104	07/16/2001	07/16/2001	1	1053
	GAIN	UNKN	AN-104	11/01/2001	11/30/2001	1	1054
	LOSS	AN-104	UNKN	12/01/2001	12/31/2001	-1	1053
	LOSS	AN-104	UNKN	02/01/2002	02/28/2002	-1	1052
	GAIN	UNKN	AN-104	05/01/2002	05/31/2002	1	1053
AN-105							1128
	LOSS	AN-105	INST	07/16/2001	07/16/2001	-3	1125
	GAIN	UNKN	AN-105	08/01/2001	08/31/2001	1	1126
	GAIN	UNKN	AN-105	09/01/2001	09/30/2001	1	1127
	LOSS	AN-105	UNKN	12/01/2001	12/31/2001	-1	1126
	GAIN	WATER	AN-105	05/16/2002	05/31/2002	1	1127
AN-106							38
AN-107							1039
	GAIN	UNKN	AN-107	08/01/2001	08/31/2001	1	1040
	GAIN	UNKN	AN-107	11/01/2001	11/30/2001	1	1041
	LOSS	AN-107	UNKN	12/01/2001	12/31/2001	-1	1040
	GAIN	WATER	AN-107	01/28/2002	01/31/2002	1	1041
	LOSS	AN-107	UNKN	02/01/2002	02/28/2002	-1	1040
	GAIN	NAOH	AN-107	02/06/2002	02/28/2002	42	1082
	GAIN	WATER	AN-107	02/06/2002	02/28/2002	1	1083

Table D-5. Historical Transfers* from 6/1/2001 through 5/31/2002 (p 5 of 6)

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)
AP-101							1113
	GAIN	UNKN	AP-101	07/01/2001	07/31/2001	1	1114
	LOSS	AP-101	UNKN	01/01/2002	01/31/2002	-1	1113
AP-102							1088
	GAIN	UNKN	AP-102	08/01/2001	08/31/2001	1	1089
	TRANSFER	BY-106	AP-102	11/01/2001	11/29/2001	20	1109
	TRANSFER	BY-105	AP-102	11/01/2001	11/29/2001	16	1125
	GAIN	STWAT	AP-102	11/12/2001	11/12/2001	5	1130
	GAIN	WATER	AP-102	11/13/2001	11/19/2001	1	1131
	TRANSFER	AP-102	AP-106	11/13/2001	11/19/2001	-1039	92
	LOSS	AP-102	UNKN	11/30/2001	11/30/2001	-2	90
	GAIN	WATER	AP-102	11/30/2001	11/30/2001	1	91
	GAIN	STWAT	AP-102	12/01/2001	12/31/2001	10	101
	GAIN	UNKN	AP-102	12/01/2001	12/31/2001	1	102
	TRANSFER	BY-105	AP-102	12/01/2001	12/30/2001	2	104
	TRANSFER	BY-106	AP-102	12/01/2001	12/30/2001	5	109
	TRANSFER	A-101	AP-102	01/01/2002	01/31/2002	57	166
	GAIN	STWAT	AP-102	01/01/2002	01/31/2002	33	199
	TRANSFER	AX-101	AP-102	02/01/2002	02/28/2002	144	343
	TRANSFER	A-101	AP-102	02/01/2002	02/28/2002	159	502
	GAIN	STWAT	AP-102	02/01/2002	02/28/2002	222	724
	LOSS	AP-102	UNKN	02/01/2002	02/28/2002	-3	721
	TRANSFER	AX-101	AP-102	03/01/2002	03/31/2002	35	756
	TRANSFER	A-101	AP-102	03/01/2002	03/31/2002	45	801
	GAIN	STWAT	AP-102	03/01/2002	03/31/2002	76	877
	TRANSFER	SY-102	AP-102	03/14/2002	03/24/2002	495	1372
	GAIN	WATER	AP-102	03/14/2002	03/24/2002	22	1394
	TRANSFER	AP-102	AP-108	03/18/2002	03/22/2002	-352	1042
	TRANSFER	AP-102	AP-107	03/24/2002	03/25/2002	-57	985
	TRANSFER	AX-101	AP-102	04/01/2002	04/30/2002	61	1046
	TRANSFER	A-101	AP-102	04/01/2002	04/29/2002	56	1102
	GAIN	STWAT	AP-102	04/01/2002	04/29/2002	44	1146
	GAIN	UNKN	AP-102	04/01/2002	04/30/2002	3	1149
	TRANSFER	AP-102	AP-107	04/18/2002	04/18/2002	-177	972
	TRANSFER	AX-101	AP-102	05/01/2002	05/30/2002	40	1012
	TRANSFER	A-101	AP-102	05/01/2002	05/30/2002	68	1080
	GAIN	STWAT	AP-102	05/01/2002	05/30/2002	45	1125
	LOSS	AP-102	UNKN	05/01/2002	05/30/2002	-4	1121
AP-103							281
	GAIN	UNKN	AP-103	07/01/2001	07/31/2001	1	282
	LOSS	AP-103	UNKN	11/01/2001	11/30/2001	-1	281
AP-104							1108
	LOSS	AP-104	UNKN	01/01/2002	01/31/2002	-1	1107
	LOSS	AP-104	UNKN	04/01/2002	04/30/2002	-1	1106

Table D-5. Historical Transfers* from 6/1/2001 through 5/31/2002 (p 6 of 6)

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)
AP-105							1133
	GAIN	UNKN	AP-105	07/01/2001	07/31/2001	1	1134
	LOSS	AP-105	UNKN	11/01/2001	11/30/2001	-1	1133
	LOSS	AP-105	UNKN	01/01/2002	01/31/2002	-1	1132
	LOSS	AP-105	UNKN	04/01/2002	04/30/2002	-1	1131
AP-106							621
	GAIN	UNKN	AP-106	08/01/2001	08/31/2001	1	622
	LOSS	AP-106	UNKN	09/01/2001	09/30/2001	-1	621
	GAIN	UNKN	AP-106	11/01/2001	11/30/2001	1	622
	TRANSFER	AP-106	AP-108	11/08/2001	11/11/2001	-522	100
	TRANSFER	AP-108	AP-106	11/10/2001	11/10/2001	3	103
	TRANSFER	AP-102	AP-106	11/13/2001	11/19/2001	1039	1142
	LOSS	AP-106	UNKN	12/01/2001	12/31/2001	-1	1141
	LOSS	AP-106	UNKN	03/01/2002	03/31/2002	-1	1140
AP-107							980
	LOSS	AP-107	UNKN	07/01/2001	07/31/2001	-1	979
	LOSS	AP-107	UNKN	10/01/2001	10/31/2001	-2	977
	LOSS	AP-107	UNKN	11/01/2001	11/30/2001	-1	976
	LOSS	AP-107	UNKN	12/01/2001	12/31/2001	-2	974
	LOSS	AP-107	UNKN	01/01/2002	01/31/2002	-1	973
	LOSS	AP-107	UNKN	02/01/2002	02/28/2002	-1	972
	LOSS	AP-107	UNKN	03/01/2002	03/31/2002	-3	969
	TRANSFER	AP-107	AW-102	03/07/2002	03/11/2002	-928	41
	TRANSFER	AP-102	AP-107	03/24/2002	03/25/2002	57	98
	LOSS	AP-107	UNKN	04/01/2002	04/30/2002	-1	97
	GAIN	WATER	AP-107	04/09/2002	04/09/2002	1	98
	TRANSFER	AP-102	AP-107	04/18/2002	04/18/2002	177	275
	LOSS	AP-107	UNKN	05/01/2002	05/31/2002	-2	273
AP-108							37
	GAIN	UNKN	AP-108	07/01/2001	07/31/2001	1	38
	GAIN	STWAT	AP-108	07/01/2001	07/31/2001	21	59
	GAIN	WATER	AP-108	07/11/2001	07/11/2001	7	66
	TRANSFER	BY-105	AP-108	07/30/2001	07/30/2001	9	75
	TRANSFER	BY-106	AP-108	07/30/2001	07/30/2001	6	81
	TRANSFER	SY-102	AP-108	08/01/2001	08/03/2001	138	219
	GAIN	WATER	AP-108	08/01/2001	08/03/2001	9	228
	TRANSFER	SY-102	AP-108	08/06/2001	08/10/2001	22	250
	GAIN	WATER	AP-108	08/06/2001	08/10/2001	19	269
	LOSS	AP-108	UNKN	10/01/2001	10/31/2001	-1	268
	TRANSFER	AP-106	AP-108	11/08/2001	11/11/2001	522	790
	TRANSFER	AP-108	AP-106	11/10/2001	11/10/2001	-3	787
	LOSS	AP-108	UNKN	11/30/2001	11/30/2001	-2	785
	LOSS	AP-108	UNKN	03/01/2002	03/31/2002	-2	783
	TRANSFER	AP-102	AP-108	03/18/2002	03/22/2002	352	1135
	STWAT--Water added during saltwell liquid pumping						

*Transactions have been summarized to reduce the number of records and still explain net inventory changes.

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APPENDIX E

GENERAL FACILITY DESCRIPTIONS

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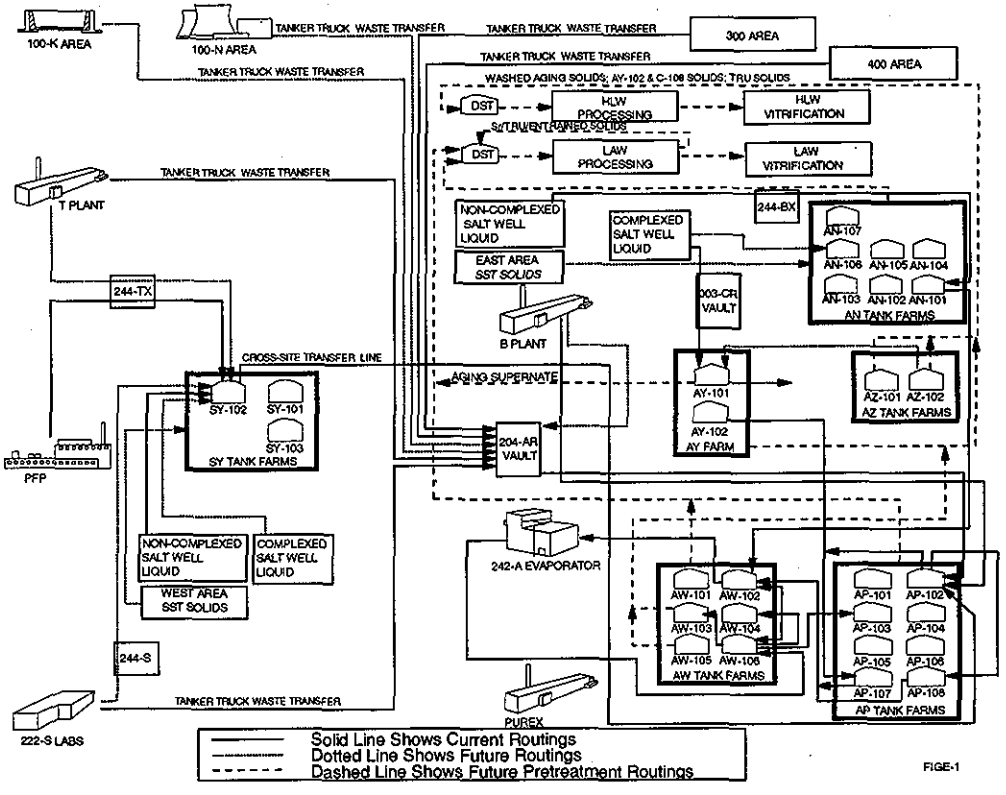
E1.0 SINGLE-SHELL TANKS

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 1 (reference case) projection and includes facility operating dates, waste generation volumes, waste volume reduction factors, flushes, and other pertinent assumptions. Assumptions unique to the Case 2 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 waste generation projection (Table D-2) lists the waste generations for each year for facilities that presented a range of waste generation rates (e.g., T-Plant varied from 3 to 17 Kgal/year during the period from fiscal year 2002 through 2028). 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.

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 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 2002). Based on facility input, no wastes were projected for the Waste Encapsulation and Storage Facility (Brist 2002). 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 2003, 2004, and 2005 (Flyckt 2002). 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 (Flyckt 2002).

- 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 (Flyckt 2002). 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 (Flyckt 2002).

- 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 DSTs formerly 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). The Flammable Gas Watch List has been closed (Roberson 2001). However, the tank farm authorization basis maintains flammability controls over the tanks based on assigning them to flammability facility groups. To avoid creating conditions that will put additional tanks on the Flammable Gas Facility Group Lists, 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 2002 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. After 2018, the projection shows that the evaporator isn't needed. The WTP will have ten years of operating experience and will have treated a sufficient volume of waste to make space available. Time is available between startup and 2018 to review the need for evaporator operations as treatment progresses.

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 Reduction (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 (Durnil 2002):

- Stabilization of plutonium residues by muffle furnace calcination
- Stabilization of plutonium solutions by oxalate 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 45 Kgal of additional waste from 2002 through 2005 (Durnil 2002). 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 (Vogt 2002). 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 2002 through 2018 for all projection cases (Vogt 2002). 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:For the 2001 projection cases, the pumpable saltwell liquid volume remaining as of June 1998 was estimated to be 4.0 Mgal (Field and Vladimiroff 1999). Saltwell liquid pumping that has occurred since June 1998 and recently revised porosity estimates, have resulted in a remaining pumpable liquid estimate of 1.3 Mgal as of May 1, 2002 (Fort 2002). Approximately 0.65 Mgal of saltwell liquid (without flush) had been pumped in FY 2002 through April 30, 2002. For all projection cases, all saltwell liquid was assumed to be pumped from FY 2002 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 14, 2002 (Vladimiroff 2002). 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 2002 through 2004 was approximately 68 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 2002 through 2004 was approximately 1.3 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 Flammable Gas Facility Group 1 Tank. Addition of waste to a SY-103 requires verification that the minimum time to reach 25% of the lower flammability limit for the tank vapor space, assuming the loss of primary ventilation, will remain greater than seven days. Additions to waste designated as feed to the WTP is prohibited without written approval from ORP (Fowler 2002). Prior to closure of the Watch List in August of 2001, Tank SY-103 was a Flammable Gas Watch List Tank. Additions to Watch List Tanks were prohibited. Additions to SY-103 are no longer prohibited, but are restricted, as described above.

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)

Saltwell Pumping Schedule for 25% Saltcake/15% Sludge Porosity (Fort 2002)					
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	1	0	37	0	38
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
2001	66	0	547	330	943
1989-2001 Total	1,025	105	2,289	1,169	4,588
Projected Saltwell Liquid Pumping from 2002 to 2004 (without flush)					
2002	867	55	387	0	1,309
2003	154	19	380	0	553
2004	3	0	78	0	81
2002-2004 Total	1,024	74	845	0	1,943
Grand Total	2,049	179	3,134	1,169	6,531

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 found to be necessary to remove the waste and transfer it to the DST system, based on the assumption that SST waste will be retrieved at a 5 molar sodium concentration or 10wt% solids concentration, plus the water additions needed for pumping. 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 the majority 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 9.8 Mgal of sludge and 21.4 Mgal of saltcake (HNF-EP-0182-170, 2002). Dilution of these solids for retrieval and processing results in a total retrieved volume of approximately 91 Mgal (HNF-SD-WM-SP-012, 2002). 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 3b 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 all projections is 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).
- In addition, new milestones proposed for retrieval of waste in tanks C-106, S-105, S-106, and S-103 are included in all early retrieval sequences.

The remaining SST retrieval sequence for each case is based on the risk based selection process. For Cases 1 and 2, tanks are ranked based on risk per tank. The Case 3 sequence is based on risk per unit waste volume, grouped into tank farm at a time retrieval. The timing for each retrieval sequence is linked to the availability of DST space, which is affected by the assumed rates of WTP and supplemental treatment processing.

The retrieval sequence, durations, and volumes for both Case 2 and Case 3 projections are shown in Appendices 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 waste unloading facility 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 assumes that T Plant waste is transferred to the DST system. Based on information supplied by T Plant engineers (Barmettlor 2001), the projected volume for T Plant is 17 Kgal in FY 2003 decreasing to 3 Kgal/ year by FY 2008. The exact waste volume generation projected for each year is shown in Table D-2. All projection cases use 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 treatment 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 from the WTP after the initial phase of WTP operations, 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.
- In FY 2002, $NaNO_2$ will be added to tank AZ-102 to mitigate a low caustic condition. (Addition of caustic to tank AY-102 was completed in November of 2001).

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 two non-aging waste tanks in FY 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 AZ-101 starting in FY 2014. 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 waste volume generation assumptions.

- Tank AP-102 currently is receiving tanker truck shipments via the 204-AR waste unloading facility from T Plant and the 300 Area.

- Tank AP-102 will be used to receive all A, AX, and BY farm saltwell liquids in the 200 East Area after June 2001 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. Tank AN-106 will be used to receive saltwell liquid from tank C-103.

- 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 2002 and 2003.

Tank	Caustic Addition, Kgal	Date
Tank AY-102	62 Kgal of $NaNO_2$ plus flush	Completed in Nov 2001
Tank AN-107	112.5 Kgal of 19 M NaOH plus flush	Added 42 Kgal in Feb 2002; To be completed in FY 2003
Tank AZ-102	7.6 Kgal of 19 M NaOH plus flush	Completed in May 2002
Tank AN-106	4.9 Kgal of 8 M NaOH plus flush	To be completed by Sept 2002

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 AP-102 (FY 2002-2028)
200 West Dilute Receiver Tank	Tank SY-102 (FY 2002-2028)
200 East Saltwell Liquid Receivers	Tank AP-102
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

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 was 4.8, 6.3, and 3.7 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. 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. Near term cross-site transfers are shown in Table 5-8.

All three projection cases assumed that approximately 35 Kgal of water would be needed to flush after each cross-site transfer. Through 2003, approximately six cross-site transfers are needed to accommodate the volume of saltwell liquid being pumped, waste retrieved from tank S-112, and tank SY-101 waste. Based on the projected cross-site testing and transfers anticipated, a pumping volume of 3.6 Mgal was projected through September of 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 Case 1 (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;

    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 activated 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 (Vogt 2002).

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 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 waste unloading facility 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, 2000, or 2001. Based on the facility inputs, all three projection cases estimated that 2 to 29 Kgal/year of miscellaneous waste would be sent from 300 Area Facilities to tank farms. See Table D-2 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 PHASE 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. The Initial Phase would include waste tank supernatant processing, LAW immobilization, and HLW immobilization (Washenfelder 1996a). The scale of processing during the Initial Phase has been established to demonstrate the technical and commercial capability of the plant. Subsequent to the Initial Phase, the Enhanced WTP Operations phase 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, 2002). 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 varies by case and is presented in the following sections.

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

Activity	Case 1	Case 2	Case 3
Ready to deliver first LAW batch	11/1/07	5/12/07	5/12/07
Ready to deliver first HLW batch	11/1/07	5/12/07	5/12/07
Start LAW facility hot commissioning	12/31/07	7/12/07	7/12/07
Start HLW facility hot commissioning	12/31/07	7/12/07	7/12/07
Start pretreatment facility services	1/1/08	10/30/07	10/30/07
LAW vitrification services	1/1/08 (2.24 MTD) 2/1/11 (27 MTD) 3/1/18 (157.5 MTD)	10/30/07 (45 MTD) 3/22/08 (32 MTD) 3/1/18 (64 MTD)	10/30/07 (~6.3 MTD) 1/31/10 (19 MTD)
HLW vitrification services	1/1/08 (0.16 MTD) 2/1/11 (1.0 MTD) 3/1/18 (10.3 MTD)	11/8/07 (3 MTD) 3/22/08 (2 MTD) 3/1/18 (4 MTD)	11/8/07 (0.77 MTD) 1/31/10 (4.08 MTD)
Supplemental TRU Treatment	N/A	N/A	12/31/07 (1000 MT solids/yr)
Mission Acceleration Initiative Supplemental Treatment of 5 M sodium low Cs supernate from SSTs	N/A	N/A	8/31/08 (3 gpm) 9/1/10 (5 gpm)

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 in all cases (HNF-SD-WM-SP-012, 2002).

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 in WTP. Initial Phase 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 Phase extended order would process sludge from Tanks SY-102 (retrieved to AZ-101), C-107, AW-103, and AW-104.

In projections prior to 2001, 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 then, 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 LAW and HLW treatment ramp up rates used for all cases are listed in Section E2.17, above. Incorporation of low activity waste in glass is assumed according to the "Gimpel Rule" for Cases 1 and 2. The Gimpel rule provides an estimate of the amount of SO_3 that can be tolerated in LAW glass. For Case, 3, the LAW glass is assumed to be 18 wt% sodium oxide. In Case 3, high sulfate waste is treated separately from the LAW glass process. Table E-5, below, shows the processing schedule, sequence of waste processed, and the approximate sodium quantity processed for the reference projection case (Case 1).

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 1 Projection.

Tank	Waste Type	Envelope	Delivered Volume With solids (Kgal)	Approximate Quantity of Sodium Delivered (MT Na)	Existing or Future Waste	Modeled Delivery Range
AP-101	DSSF	A	1,083	~532	Existing	12/31/2007
Vendor	NCAW Supernate	B	1,848	~525	Existing	12/31/2007 - 05/19/2008
AN-102	CC	C	1,033	~973	Existing	06/28/2011 - 04/09/2013
AN-104	DSSF	A	1,372	~817	Existing	02/20/2007 - 04/20/2014
AN-107	CC	C	793	~574	Existing	11/04/2014
AN-105	DSSF	A	1,448	~869	Existing	04/17/2013 - 10/26/2015
SY-101	CC	A	2,128	~1,281	Existing	04/15/2016 - 10/11/2016
AN-103	DSS	A	1,712	~1,039	Existing	06/04/2015 - 02/08/2018
AW-101	DSSF	A	1,800	~1,096	Existing	10/30/2015 - 04/15/2018
AW-104	DSSF	A	681	~400	Future	04/23/2016 - 05/23/2018

CC = complexant concentrate waste

DSS = double-shell slurry

DSSF = double-shell slurry feed

NCAW = neutralized current acid waste

E2.18 ENHANCED WTP OPERATIONS PROCESSING

The scale of processing during the Initial Phase has been established to demonstrate the technical and commercial capability of the plant. The subsequent Enhanced WTP Operations period 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 enhanced WTP Operations period has been increased to allow completion of all processing by the end of FY 2028, for Cases 1 and 3. Case 2 results in processing that extends beyond 2040.

E2.19 WATCH LIST/SAFETY

The Watch List has been closed (Rasmussen 2001). However, removal of the Watch List designation alone does not allow use of all the headspace in former Watch List tanks. The existing waste in a Watch List tank may require dilution and/or treatment before the waste can be added. The reclassification and treatment of former 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 was removed from the watch list (Huntoon 2001).

Tank SY-103 Retrieval. For Case 1, the waste in Tank SY-103 will be diluted to approximately 7 M sodium and transferred to Tank AN-101. The transfer to Tank AN-101 will occur in FY 2014.

All three projection cases assume that timely permission is obtained to remove waste from the former watch list tanks used as LAW feed sources. All three cases assume that the authorization basis is amended to support all activities related to Initial Phase 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 (HNF-SD-WM-ER-029, FY 1999), 2.28 Mgal of emergency space was reserved in case of a double-shell leak per DOE Order 435.1. In revision 26 (FY 2000) 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, an additional 1.14 Mgal of space have been reserved for the possibility of a LAW or HLW return, for a total of 2.28 Mgal. 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-101 will be designated as the dedicated emergency tank. The remaining emergency space is distributed primarily within the waste receiver tanks (AP-102 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. Controls are in place to maintain safe operation of former watch list tanks. These controls may restrict waste transfers.
- **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 re-concentrate.
- **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 2002. 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

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. While failure is possible, this study does not remove any DSTs from service for the purposes of modeling. Any new DSTs identified as needed are required for storage space and not for replacement. 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

All three projection cases 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. For additional information on DST construction, see Section 5.6.

E2.24 DOUBLE-SHELL TANK SOLIDS VOLUMES

Solids volumes in the DSTs as of June 30, 2001, are shown in Table E-7 (HNF-EP-0182-159, 2001). 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	108	AN-101	-	AP-101	-	AP-108	-
AY-102	171	AN-102	139	AP-102	-	AW-101	388
AZ-101	52	AN-103	459	AP-103	-	AW-102	30
AZ-102	105	AN-104	445	AP-104	-	AW-103	313
SY-101	275	AN-105	492	AP-105	89	AW-104	223
SY-102	71	AN-106	17	AP-106	-	AW-105	255
SY-103	372	AN-107	247	AP-107	-	AW-106	239
Note--solids volumes as of 6/30/2001.							

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 2002.

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
SX-101	SY-102	10/01/01	10/01/01	9	0	0
U-107	SY-102	10/01/01	10/01/01	11	0	0
SX-103	SY-102	10/01/01	10/01/01	3	0	0
WATER	SY-102	10/02/01	10/02/01	54	0	0
SX-103	SY-102	11/01/01	11/01/01	1	0	0
BY-105	AP-102	11/01/01	11/01/01	3	0	0
BY-106	AP-102	11/04/01	11/04/01	12	0	0
AP-108	AP-106	11/08/01	11/08/01	3	0	0
AP-106	AP-108	11/11/01	11/13/01	522	0	0
WATER	AP-102	11/12/01	11/12/01	26	0	0
AP-102	AP-106	11/19/01	11/24/01	1039	0	0
WASH-WATER	AY-102	11/27/01	11/27/01	62	0	0
WATER	SY-102	11/30/01	11/30/01	5	0	0
SX-102	SY-102	12/01/01	12/01/01	1	0	0
BY-105	AP-102	12/01/01	12/01/01	2	0	0
S-111	SY-102	12/01/01	12/01/01	5	0	0
U-108	SY-102	12/01/01	12/01/01	2	0	0
BY-106	AP-102	12/03/01	12/03/01	5	0	0
WATER	AP-102	12/04/01	12/04/01	10	0	0
S-111	SY-102	01/01/02	01/01/02	5	0	0
A-101	AP-102	01/01/02	01/01/02	57	0	0
WATER	AP-102	01/02/02	01/02/02	33	0	0
WATER	SY-102	01/02/02	01/02/02	3	0	0
AX-101	AP-102	02/01/02	02/01/02	144	0	0
A-101	AP-102	02/01/02	02/01/02	159	0	0
WATER	AP-102	02/02/02	02/03/02	220	0	0
S-111	SY-102	02/03/02	02/03/02	22	0	0
WATER	AN-107	02/28/02	02/28/02	2	0	0
WASH-CAUSTIC	AN-107	02/28/02	02/28/02	42	0	0
S-111	SY-102	03/01/02	03/01/02	7	0	0
AX-101	AP-102	03/01/02	03/01/02	35	0	0
A-101	AP-102	03/01/02	03/01/02	45	0	0
AP-107	AW-102	03/11/02	03/15/02	928	0	0
SY-102	AP-102	03/14/02	03/15/02	225	0	0
AP-102	AP-108	03/22/02	03/23/02	352	0	0
SY-102	AP-102	03/23/02	03/24/02	270	0	0
AP-102	AP-107	03/24/02	03/24/02	57	0	0
WATER	AP-102	03/24/02	03/24/02	97	0	0

Table F-2. Transactions for Fiscal Year 2002.

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
S-111	SY-102	04/01/02	04/01/02	3	0	0
A-101	AP-102	04/01/02	04/01/02	56	0	0
AX-101	AP-102	04/01/02	04/01/02	61	0	0
WATER	SY-102	04/02/02	04/02/02	6	0	0
AP-102	AP-107	04/18/02	04/18/02	177	0	0
WATER	AP-102	04/29/02	04/29/02	46	0	0
WATER	AN-103	04/30/02	04/30/02	1	0	0
AX-101	AP-102	05/01/02	05/01/02	37	0	0
A-101	AP-102	05/01/02	05/01/02	68	0	0
WATER	AP-102	05/02/02	05/02/02	44	0	0
S-102	SY-102	05/03/02	05/03/02	2	0	0
U-108	SY-102	05/03/02	05/03/02	1	0	0
S-111	SY-102	05/03/02	05/03/02	1	0	0
WATER	SY-102	05/04/02	05/04/02	4	0	0
WATER	AW-102	05/05/02	05/05/02	1	0	0
WATER	AZ-101	05/09/02	05/09/02	46	0	0
WASH-CAUSTIC	AZ-102	05/15/02	05/15/02	9	0	0
U-111	SY-102	06/13/02	04/26/03	56	0	22
U-108	SY-102	06/13/02	09/26/03	99	0	39
AP-102	AP-107	06/15/02	06/19/02	860	0	0
U-107	SY-102	06/18/02	07/07/03	87	0	35
AX-101	AP-102	06/20/02	01/12/03	36	0	15
S-102	SY-102	06/20/02	01/20/04	69	0	149
S-111	SY-102	06/20/02	09/29/04	84	0	22
SX-101	SY-102	06/23/02	11/19/03	55	0	69
SX-102	SY-102	06/25/02	07/29/04	85	0	34
SX-103	SY-102	06/26/02	09/29/04	43	0	46
A-101	AP-102	06/28/02	09/29/03	133	0	53
S-101	SY-102	06/28/02	10/12/03	68	0	27
34L87	AP-102	07/01/02	07/01/02	0	0	0
SPN87	SY-102	07/01/02	07/01/02	2	0	0
EVAPF	AP-102	07/01/02	07/01/02	10	0	0
TAL88	AP-102	07/01/02	07/01/02	2	0	0
PXTCO	AP-102	07/01/02	07/01/02	5	0	0
WATER	SY-102	07/02/02	07/02/02	1	0	0
WATER	AP-102	07/02/02	07/02/02	0	0	0
WATER	AP-102	07/02/02	07/02/02	0	0	0
WATER	AP-102	07/02/02	07/02/02	1	0	0
BY-105	244-BX	07/12/02	07/21/02	4	0	7
BY-106	244-BX	07/17/02	07/21/02	2	0	2

Table F-2. Transactions for Fiscal Year 2002.

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
S-107	SY-102	07/18/02	01/28/04	58	0	23
244-BX	AP-102	07/21/02	07/21/02	15	0	0
BY-106	244-BX	07/21/02	07/27/02	3	0	4
BY-105	244-BX	07/21/02	07/27/02	3	0	5
244-BX	AP-102	07/27/02	07/28/02	15	0	0
BY-106	244-BX	07/28/02	08/04/02	3	0	4
BY-105	244-BX	07/28/02	08/04/02	3	0	5
EVAPF	AP-102	08/01/02	08/01/02	10	0	0
TAL88	AP-102	08/01/02	08/01/02	2	0	0
34L87	AP-102	08/01/02	08/01/02	0	0	0
WATER	AP-102	08/02/02	08/02/02	0	0	0
WATER	AP-102	08/02/02	08/02/02	0	0	0
244-BX	AP-102	08/04/02	08/04/02	15	0	0
BY-106	244-BX	08/04/02	08/11/02	3	0	4
BY-105	244-BX	08/04/02	08/11/02	3	0	5
S-112	SY-102	08/09/02	03/04/03	74	0	30
244-BX	AP-102	08/11/02	08/11/02	15	0	0
BY-106	244-BX	08/11/02	08/19/02	3	0	4
BY-105	244-BX	08/11/02	08/19/02	3	0	5
244-BX	AP-102	08/19/02	08/19/02	15	0	0
BY-106	244-BX	08/19/02	08/27/02	3	0	4
BY-105	244-BX	08/19/02	08/27/02	3	0	5
244-BX	AP-102	08/27/02	08/27/02	15	0	0
BY-106	244-BX	08/27/02	09/05/02	3	0	4
BY-105	244-BX	08/27/02	09/05/02	3	0	5
WASH-WATER	SY-102	08/28/02	08/28/02	24	0	0
SY-102	SY-101	08/28/02	08/28/02	170	0	0
34L87	AP-102	09/01/02	09/01/02	0	0	0
TAL88	AP-102	09/01/02	09/01/02	2	0	0
EVAPF	AP-102	09/01/02	09/01/02	10	0	0
WATER	AP-102	09/02/02	09/02/02	0	0	0
WATER	AP-102	09/02/02	09/02/02	0	0	0
244-BX	AP-102	09/05/02	09/05/02	15	0	0
BY-106	244-BX	09/05/02	09/14/02	3	0	4
BY-105	244-BX	09/05/02	09/14/02	3	0	5
AW-102	242-A	09/09/02	09/15/02	958	0	0
242-A	AW-106	09/09/02	09/15/02	577	0	0
242-A	LERF	09/09/02	09/15/02	381	0	0
C-103	AN-106	09/09/02	11/08/02	74	0	44
244-BX	AP-102	09/14/02	09/14/02	15	0	0

Table F-2. Transactions for Fiscal Year 2002.

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
BY-106	244-BX	09/14/02	09/23/02	3	0	4
BY-105	244-BX	09/14/02	09/23/02	3	0	5
AP-108	AW-102	09/20/02	09/25/02	1100	0	0
244-BX	AP-102	09/23/02	09/23/02	15	0	0
BY-106	244-BX	09/23/02	10/03/02	3	0	4
BY-105	244-BX	09/23/02	10/03/02	3	0	5
WASH-WATER	AW-106	09/24/02	09/24/02	1	0	0
AW-106	AP-103	09/24/02	09/27/02	608	0	0

Table F-3. Transactions for Fiscal Year 2003

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
EVAPF	AP-102	10/01/02	10/01/02	10	0	0
SPN87	SY-102	10/01/02	10/01/02	2	0	0
TAL88	AP-102	10/01/02	10/01/02	1	0	0
TNS88	AP-102	10/01/02	10/01/02	1	0	0
34L87	AP-102	10/01/02	10/01/02	0	0	0
WATER	SY-102	10/02/02	10/02/02	1	0	0
WATER	AP-102	10/02/02	10/02/02	0	0	0
WATER	AP-102	10/02/02	10/02/02	0	0	0
WATER	AP-102	10/02/02	10/02/02	0	0	0
244-BX	AP-102	10/03/02	10/03/02	15	0	0
BY-106	244-BX	10/03/02	10/14/02	3	0	4
BY-105	244-BX	10/03/02	10/14/02	3	0	5
AP-102	AP-108	10/07/02	10/09/02	586	0	0
AW-102	242-A	10/07/02	10/14/02	1100	0	0
242-A	AW-106	10/07/02	10/14/02	675	0	0
242-A	LERF	10/07/02	10/14/02	425	0	0
SY-102	AP-102	10/10/02	10/12/02	462	0	0
244-BX	AP-102	10/14/02	10/14/02	15	0	0
BY-106	244-BX	10/14/02	10/25/02	3	0	4
BY-105	244-BX	10/14/02	10/25/02	3	0	5
244-BX	AP-102	10/25/02	10/25/02	15	0	0
BY-106	244-BX	10/25/02	11/06/02	3	0	4
BY-105	244-BX	10/25/02	11/06/02	3	0	5
AP-102	AP-108	10/28/02	10/29/02	360	0	0
WASH-WATER	AW-106	11/01/02	11/01/02	1	0	0
34L87	AP-102	11/01/02	11/01/02	0	0	0
EVAPF	AP-102	11/01/02	11/01/02	10	0	0
AW-106	AW-103	11/01/02	11/01/02	43	0	0
TAL88	AP-102	11/01/02	11/01/02	1	0	0
WATER	AP-102	11/02/02	11/02/02	0	0	0
WATER	AP-102	11/02/02	11/02/02	0	0	0
AP-102	AW-105	11/04/02	11/04/02	163	0	0
244-BX	AP-102	11/06/02	11/06/02	15	0	0
BY-106	244-BX	11/06/02	11/18/02	3	0	4
BY-105	244-BX	11/06/02	11/18/02	3	0	5
AW-105	AP-102	11/15/02	11/16/02	305	0	0
WASH-WATER	AW-106	11/18/02	11/18/02	1	0	0
244-BX	AP-102	11/18/02	11/19/02	15	0	0
AW-106	AW-105	11/18/02	11/21/02	602	0	0

Table F-3. Transactions for Fiscal Year 2003

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
BY-106	244-BX	11/19/02	12/02/02	3	0	4
BY-105	244-BX	11/19/02	12/02/02	3	0	5
TAL88	AP-102	12/01/02	12/01/02	1	0	0
34L87	AP-102	12/01/02	12/01/02	0	0	0
EVAPF	AP-102	12/01/02	12/01/02	10	0	0
WATER	AP-102	12/02/02	12/02/02	0	0	0
WATER	AP-102	12/02/02	12/02/02	0	0	0
244-BX	AP-102	12/02/02	12/02/02	15	0	0
AP-107	AW-102	12/02/02	12/07/02	1027	0	0
BY-106	244-BX	12/02/02	12/17/02	3	0	3
BY-105	244-BX	12/02/02	12/17/02	3	0	5
244-BX	AP-102	12/17/02	12/17/02	15	0	0
BY-106	244-BX	12/17/02	01/02/03	3	0	3
BY-105	244-BX	12/17/02	01/02/03	3	0	5
SPN87	SY-102	01/01/03	01/01/03	2	0	0
EVAPF	AP-102	01/01/03	01/01/03	10	0	0
TAL88	AP-102	01/01/03	01/01/03	1	0	0
34L87	AP-102	01/01/03	01/01/03	0	0	0
WATER	SY-102	01/02/03	01/02/03	1	0	0
WATER	AP-102	01/02/03	01/02/03	0	0	0
WATER	AP-102	01/02/03	01/02/03	0	0	0
244-BX	AP-102	01/02/03	01/02/03	15	0	0
BY-106	244-BX	01/02/03	01/20/03	3	0	3
BY-105	244-BX	01/02/03	01/20/03	3	0	5
244-BX	AP-102	01/30/03	01/30/03	15	0	0
BY-106	244-BX	01/30/03	02/18/03	3	0	3
BY-105	244-BX	01/30/03	02/18/03	3	0	5
34L87	AP-102	02/01/03	02/01/03	0	0	0
EVAPF	AP-102	02/01/03	02/01/03	10	0	0
TAL88	AP-102	02/01/03	02/01/03	1	0	0
AW-102	242-A	02/01/03	02/08/03	1027	0	0
242-A	AW-106	02/01/03	02/08/03	796	0	0
242-A	LERF	02/01/03	02/08/03	230	0	0
WATER	AP-102	02/02/03	02/02/03	0	0	0
WATER	AP-102	02/02/03	02/02/03	0	0	0
244-BX	AP-102	02/18/03	02/18/03	15	0	0
BY-106	244-BX	02/18/03	03/12/03	3	0	3
BY-105	244-BX	02/18/03	03/12/03	3	0	5
WASH-WATER	AW-106	02/20/03	02/20/03	1	0	0
AW-106	AW-105	02/20/03	02/21/03	260	0	0

Table F-3. Transactions for Fiscal Year 2003

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
WASH-WATER	AW-106	02/22/03	02/22/03	1	0	0
AW-106	AW-104	02/22/03	02/24/03	576	0	0
TAL88	AP-102	03/01/03	03/01/03	1	0	0
EVAPF	AP-102	03/01/03	03/01/03	10	0	0
34L87	AP-102	03/01/03	03/01/03	0	0	0
AP-108	AW-102	03/01/03	03/05/03	959	0	0
WATER	AP-102	03/02/03	03/02/03	0	0	0
WATER	AP-102	03/02/03	03/02/03	0	0	0
AW-102	242-A	03/06/03	03/12/03	959	0	0
242-A	AW-106	03/06/03	03/12/03	650	0	0
242-A	LERF	03/06/03	03/12/03	308	0	0
244-BX	AP-102	03/12/03	03/12/03	15	0	0
BY-106	244-BX	03/12/03	04/06/03	3	0	3
BY-105	244-BX	03/12/03	04/06/03	3	0	5
WASH-WATER	AW-106	03/20/03	03/20/03	1	0	0
AW-106	AW-104	03/20/03	03/21/03	255	0	0
SPN87	SY-102	04/01/03	04/01/03	2	0	0
34L87	AP-102	04/01/03	04/01/03	0	0	0
TAL88	AP-102	04/01/03	04/01/03	1	0	0
EVAPF	AP-102	04/01/03	04/01/03	10	0	0
WATER	SY-102	04/02/03	04/02/03	1	0	0
WATER	AP-102	04/02/03	04/02/03	0	0	0
WATER	AP-102	04/02/03	04/02/03	0	0	0
244-BX	AP-102	04/06/03	04/06/03	15	0	0
BY-106	244-BX	04/06/03	05/05/03	3	0	3
BY-105	244-BX	04/06/03	05/05/03	3	0	5
SY-101	AW-102	04/15/03	04/19/03	834	0	0
WASH-WATER	AW-106	04/20/03	04/20/03	1	0	0
AW-106	AP-103	04/20/03	04/21/03	213	0	0
WASH-WATER	AW-106	05/01/03	05/01/03	1	0	0
34L87	AP-102	05/01/03	05/01/03	0	0	0
TAL88	AP-102	05/01/03	05/01/03	1	0	0
EVAPF	AP-102	05/01/03	05/01/03	10	0	0
AW-106	AP-108	05/01/03	05/02/03	187	0	0
WATER	AP-102	05/02/03	05/02/03	0	0	0
WATER	AP-102	05/02/03	05/02/03	0	0	0
SY-102	AP-102	05/04/03	05/06/03	472	0	0
244-BX	AP-102	05/05/03	05/05/03	15	0	0
BY-106	244-BX	05/05/03	06/08/03	3	0	3
BY-105	244-BX	05/05/03	06/08/03	4	0	5

Table F-3. Transactions for Fiscal Year 2003

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
AP-102	AP-107	05/10/03	05/15/03	1028	0	0
S-112	SPARE-113	05/25/03	05/25/03	8	0	0
SPARE-113	SPARE-114	05/25/03	05/25/03	8	0	0
C-106	SPARE-113	05/25/03	05/25/03	8	0	0
SPARE-113	SPARE-114	05/25/03	05/25/03	8	0	0
ZNL87	SY-102	06/01/03	06/01/03	7	0	0
EVAPF	AP-102	06/01/03	06/01/03	10	0	0
TAL88	AP-102	06/01/03	06/01/03	1	0	0
34L87	AP-102	06/01/03	06/01/03	0	0	0
S-112	SY-102	06/01/03	11/29/03	2795	5	0
WATER	SY-102	06/02/03	06/02/03	2	0	0
WATER	AP-102	06/02/03	06/02/03	0	0	0
WATER	AP-102	06/02/03	06/02/03	0	0	0
244-BX	AP-102	06/08/03	06/08/03	15	0	0
BY-106	244-BX	06/08/03	07/21/03	3	0	3
BY-105	244-BX	06/08/03	07/21/03	4	0	5
WASH-WATER	SY-102	06/23/03	06/23/03	24	0	0
SY-102	SY-101	06/23/03	06/25/03	467	0	0
EVAPF	AP-102	07/01/03	07/01/03	10	0	0
SPN87	SY-102	07/01/03	07/01/03	2	0	0
34L87	AP-102	07/01/03	07/01/03	0	0	0
PXTCO	AP-102	07/01/03	07/01/03	5	0	0
TAL88	AP-102	07/01/03	07/01/03	1	0	0
AW-102	242-A	07/01/03	07/06/03	834	0	0
242-A	AW-106	07/01/03	07/06/03	682	0	0
242-A	LERF	07/01/03	07/06/03	152	0	0
WATER	SY-102	07/02/03	07/02/03	1	0	0
WATER	AP-102	07/02/03	07/02/03	1	0	0
WATER	AP-102	07/02/03	07/02/03	0	0	0
WATER	AP-102	07/02/03	07/02/03	0	0	0
WASH-WATER	SY-102	07/20/03	07/20/03	24	0	0
SY-102	SY-101	07/20/03	07/21/03	250	0	0
244-BX	AP-102	07/21/03	07/21/03	15	0	0
BY-106	244-BX	07/21/03	09/15/03	3	0	3
BY-105	244-BX	07/21/03	09/15/03	4	0	5
SY-101	AP-102	07/31/03	08/03/03	700	0	0
WASH-WATER	AW-106	08/01/03	08/01/03	1	0	0
WASH-WATER	AP-107	08/01/03	08/01/03	1	0	0
TAL88	AP-102	08/01/03	08/01/03	1	0	0
EVAPF	AP-102	08/01/03	08/01/03	10	0	0

Table F-3. Transactions for Fiscal Year 2003

From	To	Start Date	End Date	Liquid Volume (Kgal)	Solid Volume (Kgal)	Dilution Water (Kgal)
34L87	AP-102	08/01/03	08/01/03	0	0	0
AW-106	AP-108	08/01/03	08/04/03	620	0	0
AP-107	AW-102	08/01/03	08/06/03	1027	0	0
WATER	AP-102	08/02/03	08/02/03	0	0	0
WATER	AP-102	08/02/03	08/02/03	0	0	0
WASH-WATER	SY-102	08/03/03	08/03/03	24	0	0
SY-102	SY-101	08/03/03	08/05/03	472	1	0
AP-102	AP-107	08/10/03	08/13/03	750	0	0
WASH-WATER	SY-102	08/20/03	08/20/03	24	0	0
SY-102	SY-101	08/20/03	08/21/03	250	0	0
AW-102	242-A	08/20/03	08/27/03	1027	0	0
242-A	AW-106	08/20/03	08/27/03	573	0	0
242-A	LERF	08/20/03	08/27/03	454	0	0
WASH-WATER	AW-106	08/21/03	08/21/03	1	0	0
AW-106	AP-108	08/21/03	08/22/03	241	0	0
TAL88	AP-102	09/01/03	09/01/03	1	0	0
EVAPF	AP-102	09/01/03	09/01/03	10	0	0
34L87	AP-102	09/01/03	09/01/03	0	0	0
SY-101	AP-102	09/01/03	09/04/03	700	0	0
WATER	AP-102	09/02/03	09/02/03	0	0	0
WATER	AP-102	09/02/03	09/02/03	0	0	0
AP-102	AP-107	09/10/03	09/11/03	277	0	0
WASH-WATER	SY-102	09/15/03	09/15/03	24	0	0
244-BX	AP-102	09/15/03	09/15/03	15	0	0
SY-102	SY-101	09/15/03	09/17/03	499	1	0
BY-106	244-BX	09/15/03	10/10/03	1	0	1
BY-105	244-BX	09/15/03	12/07/03	4	0	6
SY-101	AP-102	09/29/03	10/01/03	495	0	0

APPENDIX G

SINGLE-SHELL TANK RETRIEVAL SEQUENCE FOR CASE 2

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G1.0 Single-Shell Retrieval Sequence for Case 2

Table G-1. Single-Shell Retrieval Sequence for Case 2.

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	6/1/2003	196	12/14/2003	2,794,515	5,038	2,799,553
241-C-106	11/1/2003	60	12/31/2003	88,735	1,779	90,513
241-S-102	12/1/2005	167	5/17/2006	686,322	6,678	693,000
241-C-104	5/30/2007	185	12/1/2007	713,293	53,907	767,200
241-S-105	3/31/2008	301	1/26/2009	1,190,377	2,077	1,192,454
241-S-106	6/30/2008	2562	7/6/2015	1,411,173	5,495	1,416,667
241-S-103	9/30/2008	244	6/1/2009	606,333	3,284	609,617
241-S-108	8/20/2009	2534	7/28/2016	1,656,349	3,107	1,659,455
241-S-107	8/20/2009	106	12/4/2009	1,011,110	32,065	1,043,176
241-S-101	12/7/2009	1818	11/29/2014	1,322,984	42,994	1,365,979
241-C-107	1/1/2012	184	7/3/2012	461,106	28,366	489,472
241-C-103	6/27/2012	420	8/21/2013	1,318,274	49,586	1,367,860
241-C-102	9/1/2013	44	10/15/2013	1,031,373	38,087	1,069,460
241-C-112	10/22/2013	28	11/19/2013	366,424	15,096	381,520
241-C-105	3/31/2014	530	9/12/2015	1,577,158	58,497	1,635,655
241-U-105	9/30/2014	315	8/11/2015	937,001	10,133	947,134
241-U-106	10/1/2014	71	12/11/2014	398,945	2,037	400,982
241-BX-103	10/2/2014	29	10/31/2014	236,313	9,905	246,218
241-BX-104	10/3/2014	151	3/3/2015	782,356	29,790	812,146
241-S-109	12/2/2014	1428	10/30/2018	1,787,581	1,040	1,788,621
241-U-108	12/19/2014	847	4/14/2017	957,736	20,463	978,199
241-BY-104	2/15/2015	1029	12/10/2017	1,097,414	10,851	1,108,265
241-U-107	9/3/2015	616	5/11/2017	887,874	9,841	897,714
241-BY-110	11/9/2015	900	4/27/2018	1,034,653	12,766	1,047,419
241-S-110	7/31/2016	792	10/1/2018	1,132,560	16,594	1,149,154
241-U-102	4/26/2017	346	4/7/2018	638,934	11,411	650,345
241-A-106	11/26/2017	26	12/22/2017	385,789	12,554	398,343
241-BY-111	12/14/2017	536	6/3/2019	1,023,526	24,614	1,048,139
241-U-111	12/30/2017	291	10/17/2018	683,726	9,556	693,281
241-AX-103	12/30/2017	35	2/3/2018	236,631	2,293	238,924
241-A-102	4/26/2018	6	5/2/2018	60,282	2,067	62,349
241-BY-112	4/30/2018	508	9/20/2019	1,261,428	22,607	1,284,035
241-A-101	9/10/2018	283	6/20/2019	992,440	2,902	995,343
241-U-103	10/1/2018	834	1/12/2021	1,097,046	8,927	1,105,973
241-S-111	10/4/2018	115	1/27/2019	747,528	31,585	779,113
241-TX-113	10/17/2018	1655	4/29/2023	2,125,035	16,279	2,141,314
241-TX-118	10/30/2018	246	7/3/2019	774,402	7,329	781,732
241-SX-108	1/27/2019	26	2/22/2019	179,403	3,742	183,145
241-SX-104	3/1/2019	603	10/24/2020	1,118,414	11,343	1,129,757
241-B-101	6/4/2019	44	7/18/2019	254,460	6,770	261,230
241-TX-105	7/7/2019	1379	4/16/2023	1,658,231	17,044	1,675,274
241-BY-101	9/20/2019	477	1/9/2021	1,347,178	25,117	1,372,296
241-SX-106	11/3/2020	156	4/8/2021	976,526	12,755	989,280
241-TX-112	12/6/2020	2572	12/22/2027	1,841,212	18,153	1,859,365
241-TX-115	12/25/2020	2178	12/12/2026	1,597,853	16,052	1,613,906
241-SX-105	1/9/2021	142	5/31/2021	873,618	5,551	879,168
241-BY-106	1/12/2021	594	8/29/2022	1,336,866	12,873	1,349,739
241-TX-114	5/14/2021	2326	9/26/2027	1,540,017	15,164	1,555,181
241-SX-101	12/11/2021	142	5/2/2022	1,059,742	10,455	1,070,197
241-BX-102	4/16/2023	51	6/6/2023	664,160	25,115	689,276
241-S-104	4/29/2023	56	6/24/2023	1,422,008	47,197	1,469,205
241-SX-103	11/9/2023	95	2/12/2024	1,395,555	3,713	1,399,268

Table G-1. Single-Shell Retrieval Sequence for Case 2.

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)
241-BY-103	2/12/2024	430	4/17/2025	1,236,889	20,782	1,257,670
241-BY-108	4/17/2025	53	6/9/2025	528,741	13,676	542,416
241-BY-105	6/9/2025	313	4/18/2026	1,312,629	34,594	1,347,223
241-BY-107	4/18/2026	96	7/23/2026	853,291	12,388	865,679
241-BY-102	3/10/2027	155	8/12/2027	931,582	15,780	947,362
241-SX-109	8/12/2027	41	9/22/2027	1,119,586	35,068	1,154,654
241-TX-110	8/15/2027	355	8/4/2028	1,304,336	14,400	1,318,735
241-C-101	9/22/2027	27	10/19/2027	631,536	22,832	654,369
241-TX-101	9/27/2027	98	1/3/2028	504,934	17,668	522,602
241-TX-111	10/2/2027	192	4/11/2028	999,290	11,590	1,010,880
241-SX-102	10/19/2027	158	3/25/2028	1,152,277	4,607	1,156,884
241-TX-106	12/8/2027	543	6/3/2029	1,021,441	4,321	1,025,762
241-T-107	1/31/2028	457	5/2/2029	560,266	19,536	579,802
241-U-109	3/25/2028	497	8/4/2029	742,024	12,169	754,193
241-SX-111	5/2/2029	28	5/30/2029	578,859	19,981	598,840
241-TX-117	5/4/2029	1105	5/13/2032	1,349,359	16,963	1,366,322
241-TX-116	5/8/2029	1147	6/28/2032	1,635,896	33,598	1,669,494
241-SX-107	6/9/2029	12	6/21/2029	579,799	20,366	600,164
241-BY-109	6/21/2029	67	8/27/2029	735,588	15,289	750,877
241-TY-103	6/30/2029	60	8/29/2029	429,142	17,626	446,768
241-TX-107	7/9/2029	7	7/16/2029	83,134	1,089	84,222
241-BX-109	8/4/2029	41	9/14/2029	261,286	10,420	271,705
241-U-110	8/7/2029	582	3/12/2031	899,852	32,282	932,134
241-AX-101	8/27/2029	151	1/25/2030	1,036,327	5,889	1,042,216
241-TX-102	9/1/2029	603	4/27/2031	603,514	5,707	609,220
241-BX-110	9/2/2029	232	4/22/2030	635,013	9,746	644,759
241-BX-111	9/21/2029	205	4/14/2030	524,319	7,784	532,103
241-SX-114	4/14/2030	23	5/7/2030	611,802	20,055	631,856
241-SX-112	4/22/2030	26	5/18/2030	401,189	14,055	415,245
241-B-107	5/18/2030	30	6/17/2030	359,166	14,981	374,147
241-T-111	6/15/2030	692	5/7/2032	644,609	24,694	669,303
241-A-103	8/16/2030	43	9/28/2030	848,324	3,858	852,181
241-BX-101	4/27/2031	27	5/24/2031	269,369	10,712	280,081
241-AX-102	11/18/2031	6	11/24/2031	50,437	1,285	51,722
241-B-111	5/7/2032	44	6/20/2032	289,338	11,530	300,868
241-TX-103	5/10/2032	92	8/10/2032	404,926	3,775	408,702
241-TY-105	5/26/2032	53	7/18/2032	453,225	19,640	472,865
241-TX-108	6/9/2032	90	9/7/2032	356,894	3,732	360,626
241-BX-107	6/20/2032	146	11/13/2032	897,149	35,730	932,879
241-B-110	7/23/2032	136	12/6/2032	349,984	14,895	364,879
241-C-111	8/5/2032	25	8/30/2032	328,357	11,654	340,011
241-SX-110	8/10/2032	25	9/4/2032	266,033	8,922	274,955
241-T-104	8/13/2032	115	12/6/2032	598,538	21,025	619,563
241-U-104	8/30/2032	26	9/25/2032	401,534	13,929	415,464
241-TX-109	9/3/2032	542	2/27/2034	480,648	9,212	489,860
241-T-105	9/10/2032	336	8/12/2033	358,846	13,009	371,855
241-TY-101	9/12/2032	139	1/29/2033	965,376	35,400	1,000,776
241-BX-112	11/5/2032	41	12/16/2032	338,922	13,019	351,941
241-BX-106	12/6/2032	34	1/9/2033	258,371	10,030	268,401
241-C-109	1/2/2033	25	1/27/2033	303,449	11,942	315,391
241-BX-105	6/25/2033	33	7/28/2033	299,370	11,407	310,777
241-B-104	6/29/2033	56	8/24/2033	492,452	9,781	502,233
241-T-101	8/16/2033	177	2/9/2034	303,109	13,181	316,290
241-B-103	8/26/2033	22	9/17/2033	122,785	3,784	126,570
241-C-110	1/15/2034	32	2/16/2034	325,482	12,554	338,036

Table G-1. Single-Shell Retrieval Sequence for Case 2.

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)
241-B-204	2/9/2034	2	2/11/2034	74,616	2,897	77,513
241-TX-104	2/12/2034	9	2/21/2034	110,968	5,751	116,719
241-T-110	2/16/2034	164	7/30/2034	340,903	13,882	354,785
241-T-112	3/3/2034	25	3/28/2034	104,245	4,273	108,518
241-TY-104	3/8/2034	160	8/15/2034	151,803	6,179	157,982
241-T-102	3/31/2034	133	8/11/2034	235,391	9,150	244,540
241-B-105	6/14/2034	145	11/6/2034	835,729	8,489	844,217
241-B-203	6/19/2034	2	6/21/2034	85,801	3,188	88,989
241-B-109	6/24/2034	33	7/27/2034	399,639	14,385	414,024
241-B-106	7/3/2034	27	7/30/2034	150,027	5,464	155,491
241-SX-113	7/30/2034	11	8/10/2034	186,127	7,145	193,273
241-B-112	8/14/2034	17	8/31/2034	50,930	2,296	53,226
241-T-203	8/16/2034	2	8/18/2034	50,445	1,946	52,391
241-U-112	8/18/2034	27	9/14/2034	275,011	9,930	284,941
241-T-204	8/21/2034	2	8/23/2034	57,118	2,233	59,351
241-C-108	11/4/2034	25	11/29/2034	244,826	8,630	253,456
241-B-108	11/8/2034	222	6/18/2035	267,526	8,967	276,493
241-B-102	6/20/2035	9	6/29/2035	63,007	1,953	64,960
241-BX-108	6/24/2035	4	6/28/2035	89,079	3,957	93,035
241-TY-102	7/19/2035	129	11/25/2035	200,182	1,989	202,171
241-T-108	7/24/2035	4	7/28/2035	30,897	1,375	32,272
241-T-109	7/30/2035	111	11/18/2035	152,344	1,467	153,811
241-A-105	10/13/2035	19	11/1/2035	213,133	7,908	221,040
241-SX-115	11/18/2035	7	11/25/2035	9,288	609	9,896
241-TY-106	11/21/2035	213	6/21/2036	135,727	5,415	141,142
241-T-103	11/22/2035	209	6/18/2036	149,206	5,948	155,154
241-B-202	3/23/2036	1	3/24/2036	43,901	1,735	45,635
241-B-201	3/25/2036	1	3/26/2036	96,849	3,701	100,549
241-AX-104	5/29/2036	8	6/6/2036	86,382	3,488	89,870
241-U-101	6/21/2036	4	6/25/2036	135,198	5,003	140,201
241-U-201	6/26/2036	2	6/28/2036	18,942	736	19,677
241-U-204	7/1/2036	2	7/3/2036	27,227	1,029	28,257
241-T-106	7/1/2036	2	7/3/2036	105,615	4,267	109,882
241-T-201	7/6/2036	1	7/7/2036	78,196	2,976	81,171
241-T-202	7/20/2036	1	7/21/2036	27,980	1,112	29,092
241-U-202	8/7/2036	1	8/8/2036	15,930	620	16,550
241-U-203	8/21/2036	1	8/22/2036	13,103	511	13,614
241-A-104	3/20/2037	16	4/5/2037	231,943	8,784	240,726
241-C-203	9/8/2037	2	9/10/2037	16,685	682	17,367
241-C-204	9/17/2037	2	9/19/2037	10,502	439	10,941
241-C-202	9/26/2037	1	9/27/2037	8,278	347	8,625
241-C-201	10/1/2037	1	10/2/2037	8,180	349	8,529

G2.0 Risk Reduction Curves for Case 2

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

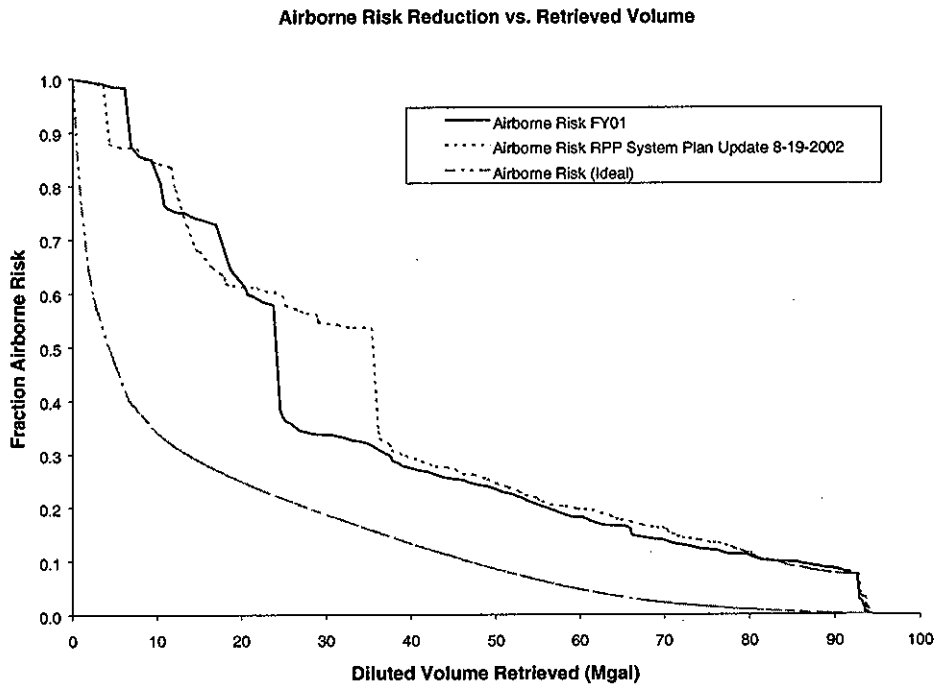


Figure G-2. Case 2 Groundwater Risk Reduction Versus Volume Retrieved

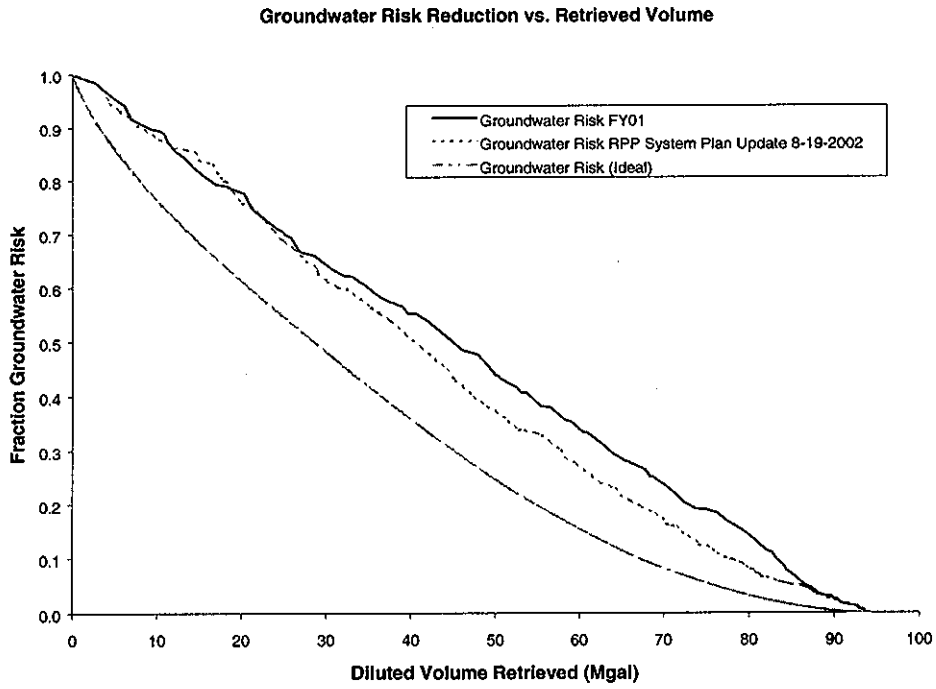


Figure G-3. Case 2 Chemical Risk Reduction Versus Volume Retrieved

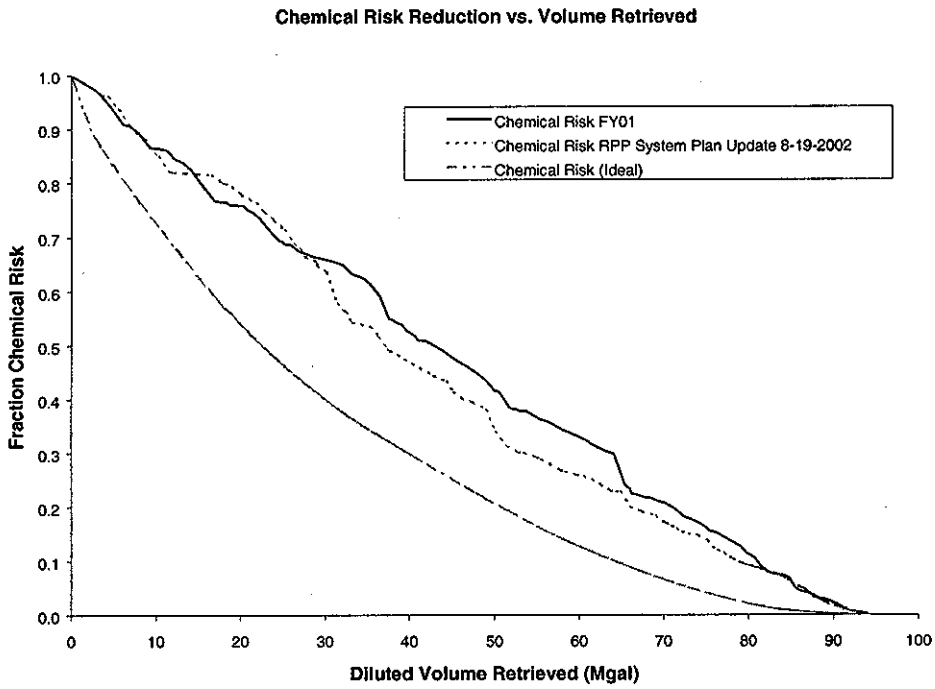


Figure G-4. Case 2 Airborne Risk Reduction Over Time.

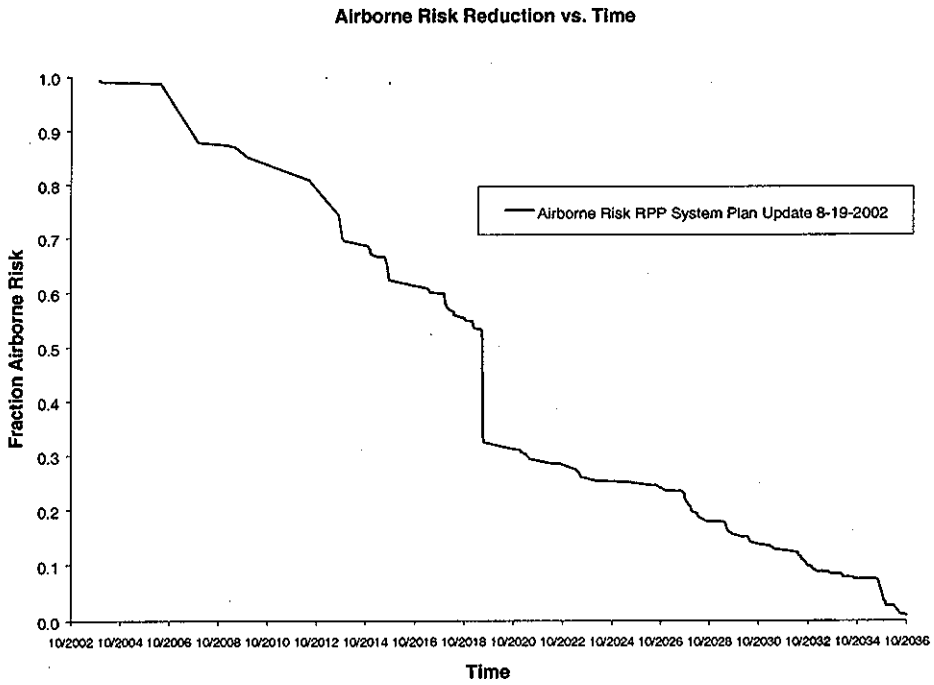


Figure G-5. Case 2 Groundwater Risk Reduction Over Time

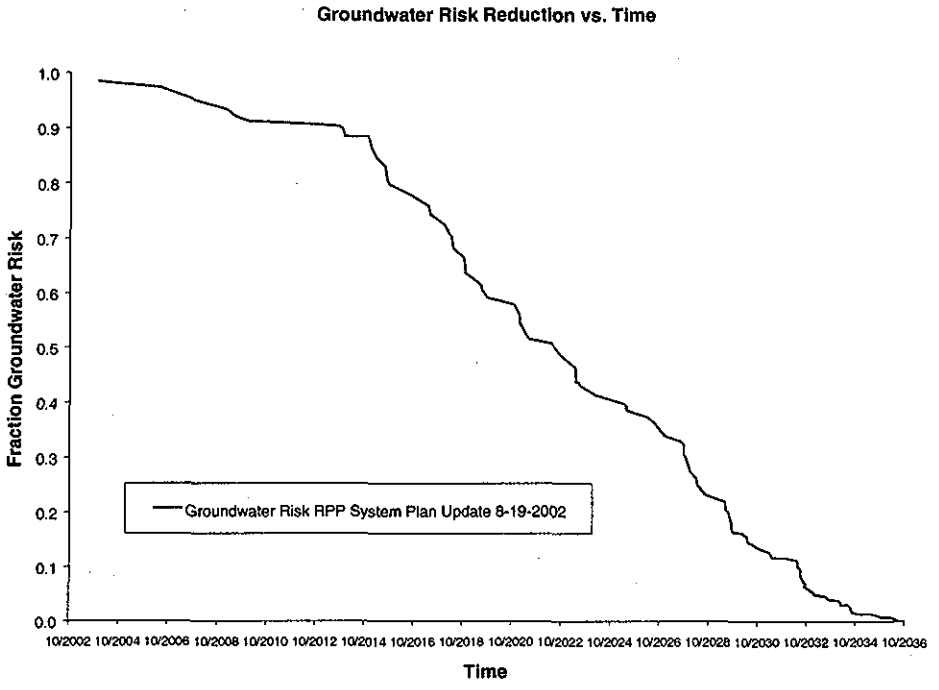
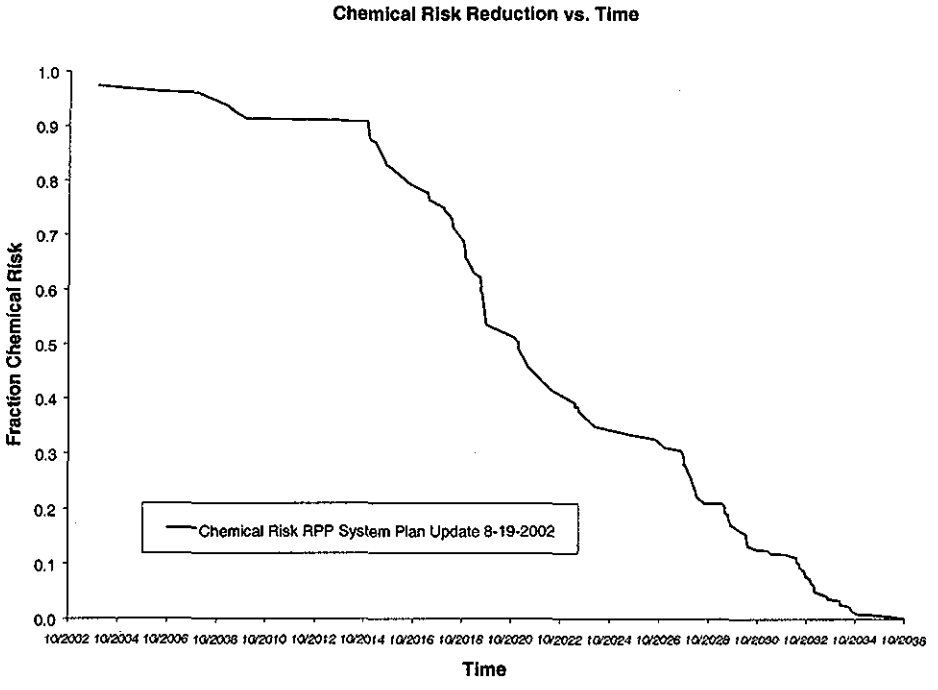


Figure G-6. Case 2 Chemical Risk Reduction Over Time



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	6/1/2003	196	12/14/2003	2,794,556	5,038	2,799,593
241-C-106	11/1/2003	60	12/31/2003	88,121	1,779	89,899
241-C-201	2/5/2004	2	2/7/2004	8,162	349	8,512
241-C-202	2/15/2004	2	2/17/2004	8,253	347	8,600
241-C-203	3/1/2004	4	3/5/2004	16,637	682	17,319
241-C-204	3/15/2004	2	3/17/2004	10,471	439	10,910
241-S-102	12/1/2005	168	5/18/2006	686,122	7,078	693,200
241-C-104	5/30/2007	185	12/1/2007	712,250	54,950	767,200
241-TY-101	10/2/2007	616	6/9/2009	954,361	35,400	989,760
241-TY-102	10/3/2007	31	11/3/2007	191,363	1,989	193,352
241-TY-103	10/7/2007	608	6/6/2009	415,172	17,625	432,797
241-TY-104	10/7/2007	22	10/29/2007	143,081	6,177	149,257
241-TY-105	10/8/2007	614	6/13/2009	440,242	19,639	459,881
241-U-101	10/8/2007	4	10/12/2007	133,801	5,002	138,803
241-TY-106	10/12/2007	6	10/18/2007	134,757	5,415	140,172
241-U-102	10/12/2007	1399	8/11/2011	624,251	11,411	635,662
241-U-103	10/20/2007	906	4/13/2010	1,071,403	8,926	1,080,329
241-SX-101	11/4/2007	1349	7/15/2011	1,040,492	10,455	1,050,947
241-S-105	3/31/2008	313	2/7/2009	1,142,195	2,077	1,144,271
241-S-106	6/30/2008	356	6/21/2009	1,363,350	5,495	1,368,845
241-S-103	9/30/2008	86	12/25/2008	581,265	3,284	584,550
241-SX-102	5/23/2009	888	10/28/2011	1,133,741	4,607	1,138,348
241-T-101	6/12/2009	782	8/3/2011	297,717	13,180	310,897
241-T-102	6/17/2009	763	7/20/2011	234,938	9,149	244,088
241-C-107	1/9/2010	184	7/12/2010	445,632	28,363	73,995
241-U-201	10/15/2010	1	10/16/2010	18,826	736	19,562
241-U-202	11/1/2010	1	11/2/2010	15,868	620	16,488
241-U-203	11/15/2010	1	11/16/2010	13,022	511	13,533
241-B-201	11/15/2010	8	11/23/2010	96,446	3,701	100,147
241-U-204	12/1/2010	2	12/3/2010	27,179	1,029	28,209
241-B-202	12/1/2010	3	12/4/2010	43,354	1,735	45,089
241-B-203	12/15/2010	7	12/22/2010	84,908	3,188	88,096
241-B-204	1/1/2011	6	1/7/2011	73,786	2,897	76,682
241-T-201	1/15/2011	7	1/22/2011	77,888	2,976	80,863
241-T-202	2/1/2011	2	2/3/2011	27,675	1,112	28,787
241-T-203	5/10/2011	4	5/14/2011	49,831	1,946	51,777
241-T-204	5/30/2011	5	6/4/2011	56,543	2,233	58,775
241-T-103	7/15/2011	7	7/22/2011	148,500	5,948	154,448
241-C-101	7/15/2011	26	8/10/2011	611,584	22,832	634,416
241-BY-101	7/20/2011	343	6/27/2012	1,240,113	25,117	1,265,230
241-BY-102	7/22/2011	387	8/12/2012	892,433	15,780	908,212
241-U-104	7/29/2011	151	12/27/2011	396,385	13,929	410,314
241-T-110	7/30/2011	42	9/10/2011	328,980	13,882	342,861
241-BY-103	8/3/2011	482	11/27/2012	1,175,771	20,782	1,196,552
241-C-102	10/27/2011	51	12/17/2011	1,016,306	38,087	1,054,393
241-T-111	10/30/2011	46	12/15/2011	623,335	24,693	648,028
241-BY-104	12/17/2011	341	11/22/2012	1,067,728	10,851	1,078,579
241-U-105	12/30/2011	858	5/6/2014	904,107	10,133	914,240
241-BY-105	7/8/2012	424	9/5/2013	1,273,852	34,622	1,308,473
241-BY-106	7/16/2012	444	10/3/2013	1,312,114	12,847	1,324,961
241-BY-107	8/24/2012	245	4/26/2013	837,621	12,388	850,009
241-C-103	11/27/2012	40	1/6/2013	1,317,344	49,586	1,366,930

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-BY-108	12/7/2012	156	5/12/2013	507,103	13,675	520,778
241-C-105	4/26/2013	58	6/23/2013	1,574,119	58,497	1,632,616
241-BY-109	4/28/2013	145	9/20/2013	670,551	15,288	685,839
241-A-101	5/21/2013	241	1/17/2014	996,485	2,902	999,387
241-C-108	6/26/2013	35	7/31/2013	230,117	8,628	238,745
241-C-109	8/3/2013	38	9/10/2013	298,515	11,942	310,457
241-TX-101	9/5/2013	28	10/3/2013	496,972	17,668	514,640
241-C-110	9/13/2013	33	10/16/2013	308,416	12,553	320,969
241-TX-102	9/20/2013	123	1/21/2014	583,713	5,706	589,420
241-TX-103	10/4/2013	126	2/7/2014	390,689	3,775	394,464
241-TX-104	10/17/2013	13	10/30/2013	107,109	5,750	112,858
241-C-111	10/18/2013	44	12/1/2013	322,064	11,654	333,717
241-TX-105	11/6/2013	306	9/8/2014	1,602,991	17,043	1,620,035
241-C-112	12/4/2013	68	2/10/2014	357,572	15,095	372,667
241-A-102	1/20/2014	6	1/26/2014	57,353	2,066	59,419
241-BY-110	1/21/2014	112	5/13/2014	1,002,704	12,766	1,015,470
241-BY-111	1/26/2014	281	11/3/2014	985,365	24,613	1,009,978
241-BY-112	2/8/2014	309	12/14/2014	1,229,978	22,607	1,252,585
241-U-106	5/9/2014	376	5/20/2015	391,693	2,037	393,730
241-A-104	6/2/2014	16	6/18/2014	231,626	8,784	240,409
241-A-103	6/2/2014	54	7/26/2014	829,508	3,858	833,365
241-A-105	6/21/2014	31	7/22/2014	206,513	7,907	214,420
241-A-106	7/25/2014	37	8/31/2014	362,832	12,553	375,385
241-AX-101	7/29/2014	338	7/2/2015	1,022,150	5,889	1,028,039
241-AX-102	9/3/2014	6	9/9/2014	48,368	1,284	49,652
241-TX-106	9/8/2014	310	7/15/2015	976,423	4,321	980,745
241-TX-107	9/16/2014	7	9/23/2014	80,699	1,089	81,788
241-AX-103	9/23/2014	46	11/8/2014	228,747	2,293	231,040
241-TX-108	11/3/2014	126	3/9/2015	343,768	3,732	347,500
241-AX-104	11/11/2014	169	4/29/2015	86,315	3,489	89,803
241-TX-109	3/17/2015	73	5/29/2015	384,697	9,211	393,907
241-TX-110	3/22/2015	291	1/7/2016	1,254,126	14,400	1,268,526
241-U-107	5/23/2015	479	9/13/2016	837,857	9,840	847,697
241-TX-111	6/8/2015	305	4/8/2016	958,275	11,590	969,864
241-TX-112	9/22/2015	497	1/31/2017	1,773,350	18,153	1,791,503
241-TX-113	2/29/2016	894	8/11/2018	2,007,782	16,279	2,024,061
241-TX-114	4/16/2016	652	1/28/2018	1,472,998	15,164	1,488,162
241-U-108	9/16/2016	494	1/23/2018	934,958	20,463	955,421
241-TX-115	2/3/2017	383	2/21/2018	1,542,762	16,052	1,558,814
241-TX-116	2/6/2017	498	6/19/2018	1,582,217	33,598	1,615,815
241-U-109	1/26/2018	929	8/12/2020	707,722	12,166	719,888
241-BX-101	2/21/2018	27	3/20/2018	267,042	10,712	277,754
241-TX-117	3/6/2018	584	10/11/2019	1,252,098	16,962	1,269,061
241-BX-102	3/21/2018	52	5/12/2018	663,255	25,115	688,370
241-BX-103	5/16/2018	29	6/14/2018	232,481	9,904	242,385
241-BX-104	6/14/2018	55	8/8/2018	779,923	29,790	809,713
241-BX-105	6/21/2018	36	7/27/2018	291,522	11,407	302,929
241-TX-118	7/12/2018	212	2/9/2019	645,552	7,329	652,881
241-BX-106	7/30/2018	23	8/22/2018	253,220	10,029	263,249
241-BX-107	8/8/2018	78	10/25/2018	875,652	35,729	911,381
241-BX-108	8/18/2018	8	8/26/2018	82,933	3,955	86,888
241-BX-109	8/26/2018	36	10/1/2018	242,459	10,418	252,877
241-BX-110	8/30/2018	74	11/12/2018	588,743	9,746	598,489
241-BX-111	10/3/2018	265	6/25/2019	505,531	7,784	513,314
241-BX-112	10/28/2018	239	6/24/2019	330,637	13,018	343,655

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-101	6/11/2019	90	9/9/2019	1,288,120	42,994	1,331,114
241-S-104	9/11/2019	62	11/12/2019	1,397,953	47,197	1,445,150
241-B-101	10/11/2019	44	11/24/2019	246,850	6,769	253,619
241-B-102	11/16/2019	10	11/26/2019	54,823	1,951	56,774
241-SX-103	11/22/2019	360	11/16/2020	1,373,692	3,713	1,377,405
241-B-103	11/24/2019	22	12/16/2019	107,105	3,782	110,887
241-B-104	11/26/2019	46	1/11/2020	466,625	9,780	476,406
241-B-105	12/16/2019	357	12/7/2020	693,856	8,488	702,344
241-B-106	1/13/2020	26	2/8/2020	134,161	5,461	139,622
241-S-107	1/15/2020	153	6/16/2020	973,610	32,065	1,005,674
241-SX-104	1/15/2020	268	10/9/2020	1,081,332	11,343	1,092,676
241-B-107	2/19/2020	309	12/24/2020	322,622	14,978	337,600
241-U-110	8/15/2020	571	3/9/2022	881,887	32,281	914,168
241-SX-105	12/8/2020	225	7/21/2021	858,207	5,551	863,758
241-B-108	12/9/2020	23	1/1/2021	229,876	8,964	238,839
241-B-109	12/15/2020	34	1/18/2021	346,056	14,381	360,438
241-B-110	12/27/2020	44	2/9/2021	330,716	14,894	345,610
241-B-111	1/2/2021	45	2/16/2021	273,364	11,528	284,892
241-SX-106	1/17/2021	402	2/23/2022	959,555	12,754	972,309
241-B-112	1/21/2021	17	2/7/2021	48,252	2,295	50,547
241-S-108	2/7/2021	372	2/14/2022	1,583,821	7,520	1,591,341
241-S-109	2/12/2021	854	6/16/2023	1,745,559	4,438	1,749,997
241-T-104	2/16/2021	60	4/17/2021	577,272	21,024	598,297
241-T-105	4/17/2021	95	7/21/2021	355,225	13,009	368,233
241-T-106	7/21/2021	4	7/25/2021	101,718	4,266	105,984
241-T-107	7/25/2021	152	12/24/2021	519,707	19,535	539,242
241-SX-107	12/6/2021	80	2/24/2022	572,714	20,365	593,080
241-T-108	12/24/2021	3	12/27/2021	29,954	1,374	31,328
241-T-109	12/27/2021	22	1/18/2022	114,287	1,466	115,753
241-T-112	1/18/2022	24	2/11/2022	103,586	4,273	107,859
241-S-110	3/12/2022	203	10/1/2022	1,113,741	16,594	1,130,335
241-U-111	3/12/2022	614	11/16/2023	661,623	9,556	671,179
241-SX-108	3/16/2022	232	11/3/2022	166,701	3,741	170,443
241-SX-109	3/16/2022	243	11/14/2022	1,091,032	35,067	1,126,099
241-S-111	10/12/2022	79	12/30/2022	722,556	31,584	754,141
241-SX-110	11/3/2022	32	12/5/2022	260,456	8,921	269,377
241-SX-111	11/17/2022	46	1/2/2023	569,718	19,981	589,699
241-SX-112	12/24/2022	44	2/6/2023	395,492	14,055	409,547
241-SX-113	1/5/2023	31	2/5/2023	186,079	7,145	193,224
241-SX-114	6/30/2023	104	10/12/2023	596,043	20,054	616,098
241-SX-115	10/16/2023	6	10/22/2023	9,064	608	9,672
241-U-112	11/24/2023	39	1/2/2024	263,125	9,929	273,054

H2.0 Risk Reduction Curves for Case 3

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

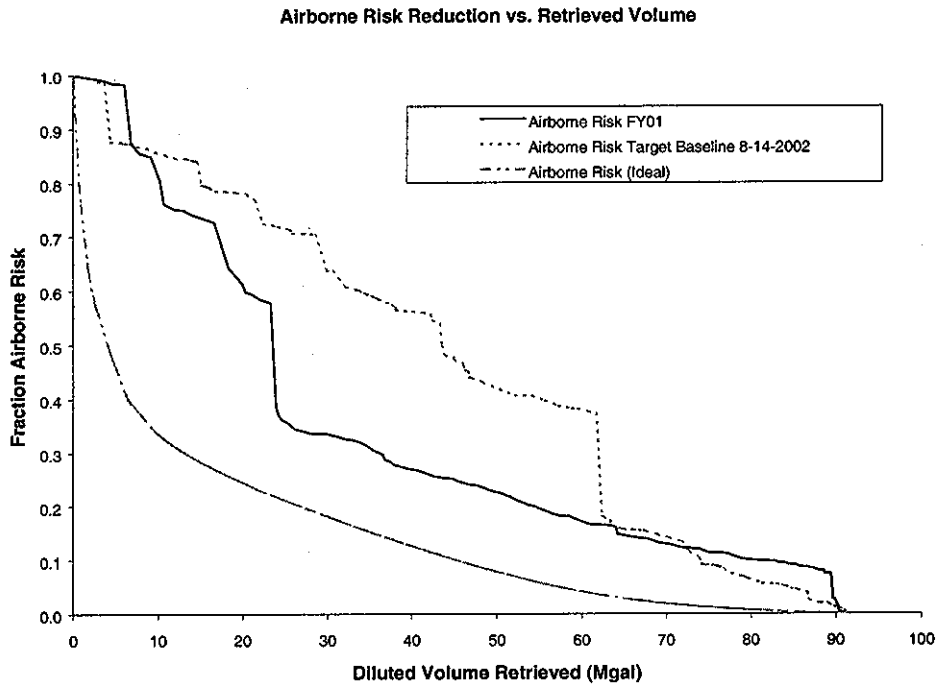


Figure H-2. Case 3 Groundwater Risk Reduction Versus Volume Retrieved.

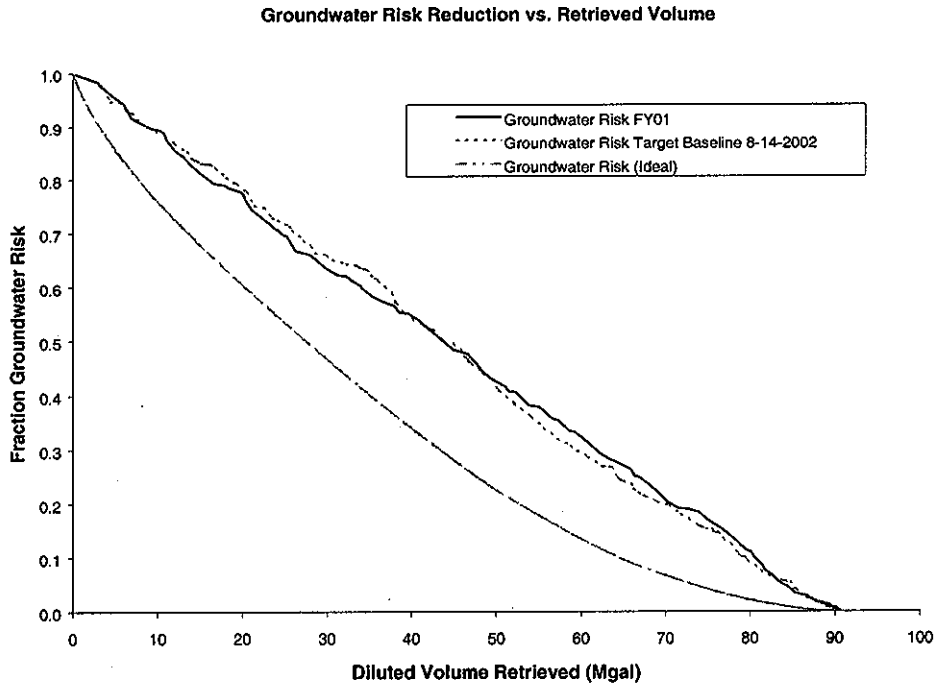


Figure H-3. Case 3 Chemical Risk Reduction Versus Volume Retrieved.

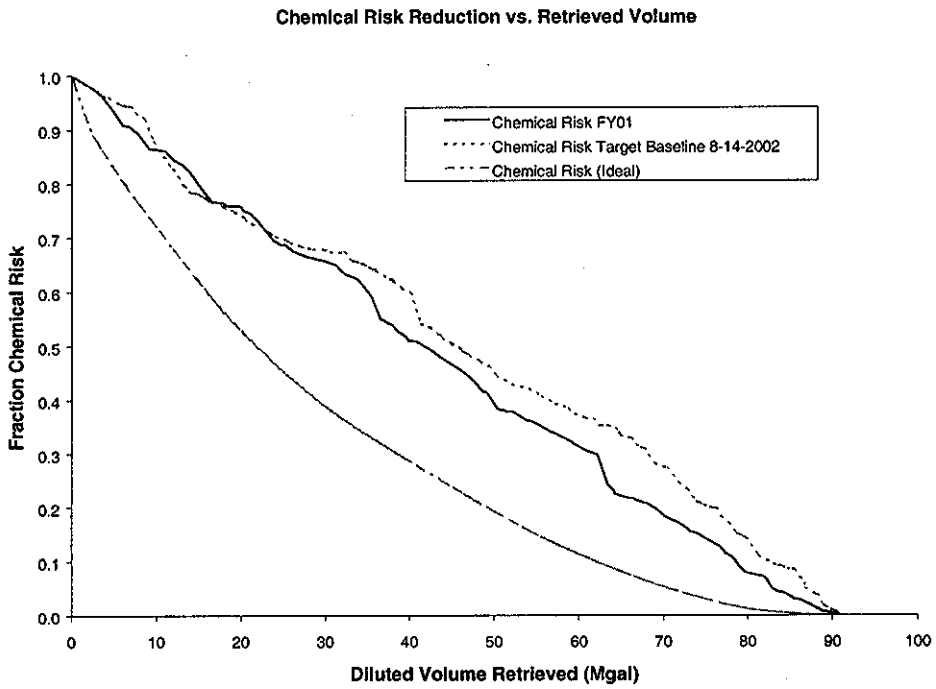


Figure H-4. Case 3 Airborne Risk Reduction Over Time.

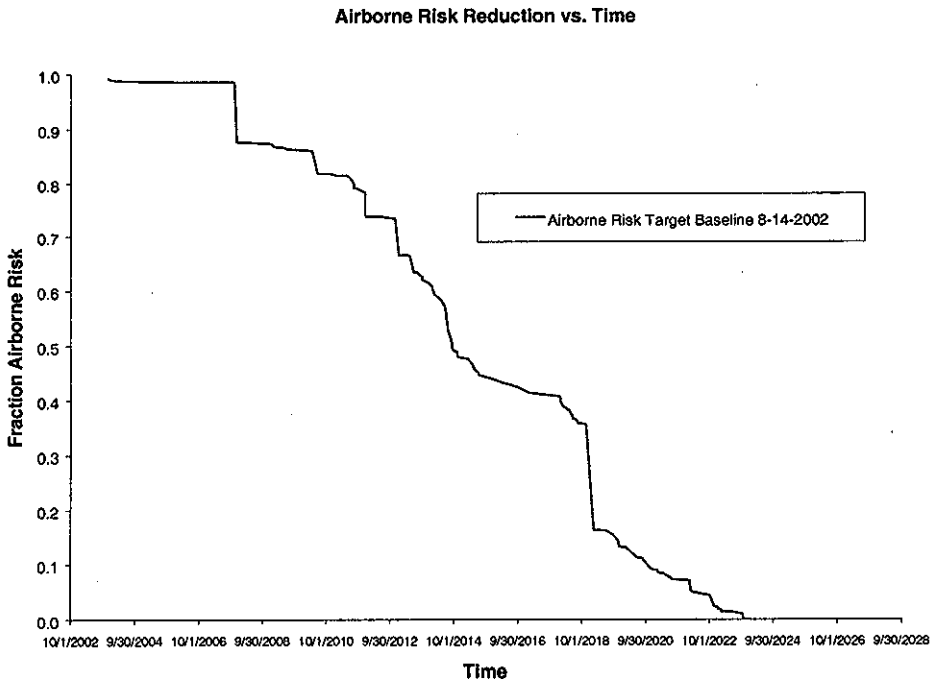


Figure H-5. Case 3 Groundwater Risk Reduction Over Time.

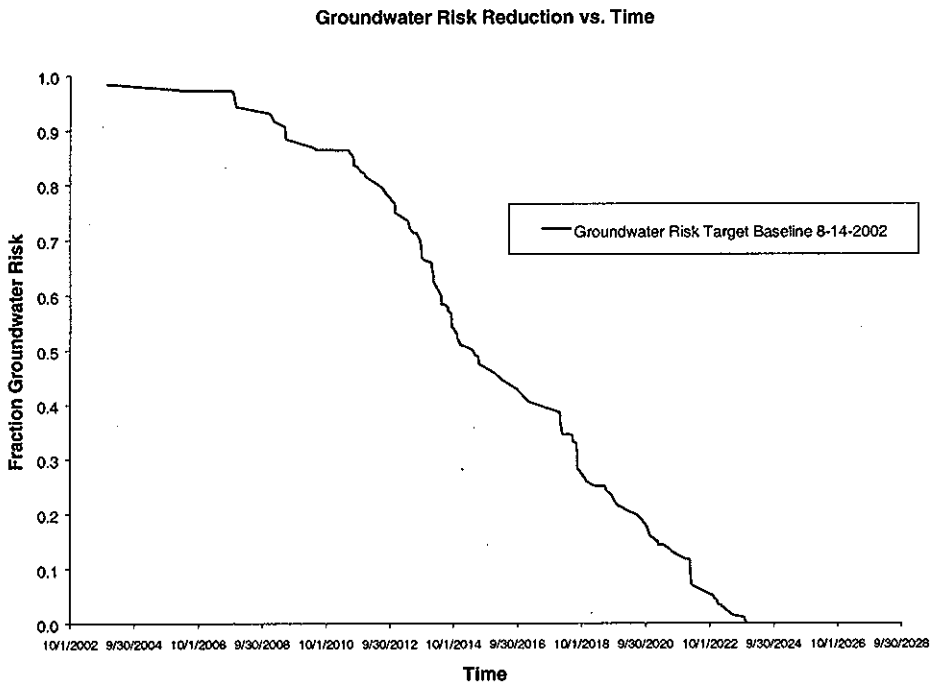
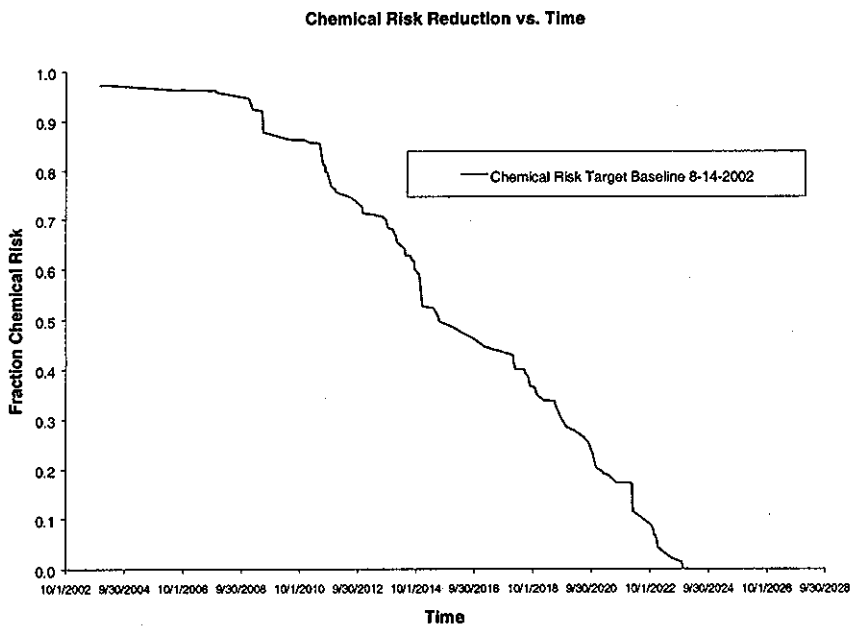


Figure H-6. Case 3 Chemical Risk Reduction Over Time.



APPENDIX I

SINGLE-SHELL TANK RETRIEVAL SEQUENCE FOR CASE 3B

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I1.0 Single-Shell Retrieval Sequence for Case 3b

Table I-1. Single-Shell Retrieval Sequence for Case 3b.

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	6/1/2003	196	12/14/2003	2,794,556	5,038	2,799,593
241-C-106	11/1/2003	60	12/31/2003	88,121	1,779	89,899
241-C-201	2/5/2004	2	2/7/2004	8,162	349	8,512
241-C-202	2/15/2004	2	2/17/2004	8,253	347	8,600
241-C-203	3/1/2004	4	3/5/2004	16,637	682	17,319
241-C-204	3/15/2004	2	3/17/2004	10,471	439	10,910
241-S-102	12/1/2005	168	5/18/2006	686,122	7,078	693,200
241-C-104	5/30/2007	185	12/1/2007	712,250	54,950	767,200
241-TY-101	10/2/2007	616	6/9/2009	954,361	35,400	989,760
241-TY-102	10/3/2007	31	11/3/2007	191,363	1,989	193,352
241-TY-103	10/7/2007	608	6/6/2009	415,172	17,625	432,797
241-TY-104	10/7/2007	22	10/29/2007	143,081	6,177	149,257
241-TY-105	10/8/2007	614	6/13/2009	440,242	19,639	459,881
241-U-101	10/8/2007	4	10/12/2007	133,801	5,002	138,803
241-TY-106	10/12/2007	6	10/18/2007	134,757	5,415	140,172
241-U-102	10/12/2007	1399	8/11/2011	624,251	11,411	635,662
241-U-103	10/20/2007	906	4/13/2010	1,071,403	8,926	1,080,329
241-SX-101	11/4/2007	1349	7/15/2011	1,040,492	10,455	1,050,947
241-S-105	3/31/2008	313	2/7/2009	1,142,195	2,077	1,144,271
241-S-106	6/30/2008	356	6/21/2009	1,363,350	5,495	1,368,845
241-S-103	9/30/2008	86	12/25/2008	581,265	3,284	584,550
241-SX-102	5/23/2009	888	10/28/2011	1,133,741	4,607	1,138,348
241-T-101	6/12/2009	782	8/3/2011	297,717	13,180	310,897
241-T-102	6/17/2009	763	7/20/2011	234,938	9,149	244,088
241-C-107	1/9/2010	184	7/12/2010	445,632	28,363	473,995
241-U-201	10/15/2010	1	10/16/2010	18,826	736	19,562
241-U-202	11/1/2010	1	11/2/2010	15,868	620	16,488
241-U-203	11/15/2010	1	11/16/2010	13,022	511	13,533
241-B-201	11/15/2010	8	11/23/2010	96,446	3,701	100,147
241-U-204	12/1/2010	2	12/3/2010	27,179	1,029	28,209
241-B-202	12/1/2010	3	12/4/2010	43,354	1,735	45,089
241-B-203	12/15/2010	7	12/22/2010	84,908	3,188	88,096
241-B-204	1/1/2011	6	1/7/2011	73,786	2,897	76,682
241-T-201	1/15/2011	7	1/22/2011	77,888	2,976	80,863
241-T-202	2/1/2011	2	2/3/2011	27,675	1,112	28,787
241-T-203	5/10/2011	4	5/14/2011	49,831	1,946	51,777
241-T-204	5/30/2011	5	6/4/2011	56,543	2,233	58,775
241-T-103	7/15/2011	7	7/22/2011	148,500	5,948	154,448
241-C-101	7/15/2011	26	8/10/2011	611,584	22,832	634,416
241-BY-101	7/20/2011	343	6/27/2012	1,240,113	25,117	1,265,230
241-BY-102	7/22/2011	387	8/12/2012	892,433	15,780	908,212
241-U-104	7/29/2011	151	12/27/2011	396,385	13,929	410,314
241-T-110	7/30/2011	42	9/10/2011	328,980	13,882	342,861
241-BY-103	8/3/2011	482	11/27/2012	1,175,771	20,782	1,196,552
241-C-102	10/27/2011	51	12/17/2011	1,016,306	38,087	1,054,393
241-T-111	10/30/2011	46	12/15/2011	623,335	24,693	648,028
241-BY-104	12/17/2011	341	11/22/2012	1,067,728	10,851	1,078,579
241-U-105	12/30/2011	397	1/30/2013	904,107	10,133	914,240
241-BY-105	7/8/2012	264	3/29/2013	1,273,852	34,622	1,308,473
241-BY-106	7/16/2012	255	3/28/2013	1,312,114	12,847	1,324,961
241-BY-107	8/24/2012	155	1/26/2013	837,621	12,388	850,009
241-U-106	10/1/2012	55	11/25/2012	391,693	2,037	393,730

Table I-1. Single-Shell Retrieval Sequence for Case 3b.

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)
241-C-103	11/27/2012	40	1/6/2013	1,317,344	49,586	1,366,930
241-BY-108	12/3/2012	57	1/29/2013	507,103	13,675	520,778
241-U-107	12/13/2012	148	5/10/2013	837,857	9,840	847,697
241-BY-109	1/16/2013	84	4/10/2013	670,551	15,288	685,839
241-C-105	1/26/2013	77	4/13/2013	1,574,119	58,497	1,632,616
241-A-101	2/16/2013	400	3/23/2014	996,485	2,902	999,387
241-U-108	3/24/2013	163	9/3/2013	934,958	20,463	955,421
241-TX-101	3/29/2013	28	4/26/2013	496,972	17,668	514,640
241-TX-102	4/12/2013	98	7/19/2013	583,713	5,706	589,420
241-TX-103	4/12/2013	64	6/15/2013	390,689	3,775	394,464
241-C-108	4/16/2013	36	5/22/2013	230,117	8,628	238,745
241-TX-104	4/28/2013	13	5/11/2013	107,109	5,750	112,858
241-BY-110	5/11/2013	121	9/9/2013	1,002,704	12,766	1,015,470
241-C-109	5/25/2013	70	8/3/2013	298,515	11,942	310,457
241-U-109	6/5/2013	177	11/29/2013	707,722	12,166	719,888
241-BY-111	7/8/2013	176	12/31/2013	985,365	24,613	1,009,978
241-BY-112	7/19/2013	279	4/24/2014	1,229,978	22,607	1,252,585
241-C-110	8/6/2013	200	2/22/2014	308,416	12,553	320,969
241-TX-105	9/3/2013	238	4/29/2014	1,602,991	17,043	1,620,035
241-U-110	9/9/2013	32	10/11/2013	881,887	32,281	914,168
241-U-111	11/28/2013	92	2/28/2014	661,623	9,556	671,179
241-TX-106	12/31/2013	175	6/24/2014	976,423	4,321	980,745
241-U-112	1/8/2014	40	2/17/2014	263,125	9,929	273,054
241-TX-107	2/21/2014	6	2/27/2014	80,699	1,089	81,788
241-C-111	2/25/2014	26	3/23/2014	322,064	11,654	333,717
241-TX-108	3/9/2014	121	7/8/2014	343,768	3,732	347,500
241-TX-109	3/23/2014	61	5/23/2014	384,697	9,211	393,907
241-C-112	3/25/2014	41	5/5/2014	357,572	15,095	372,667
241-A-102	4/23/2014	6	4/29/2014	57,353	2,066	59,419
241-A-103	5/2/2014	127	9/6/2014	829,508	3,858	833,365
241-A-104	5/7/2014	101	8/16/2014	231,626	8,784	240,409
241-TX-110	7/7/2014	171	12/25/2014	1,254,126	14,400	1,268,526
241-A-105	8/19/2014	19	9/7/2014	206,513	7,907	214,420
241-A-106	11/8/2014	27	12/5/2014	362,832	12,553	375,385
241-AX-101	12/7/2014	165	5/21/2015	1,022,150	5,889	1,028,039
241-TX-111	12/24/2014	132	5/5/2015	958,275	11,590	969,864
241-AX-102	2/11/2015	6	2/17/2015	48,368	1,284	49,652
241-AX-103	2/20/2015	35	3/27/2015	228,747	2,293	231,040
241-AX-104	3/30/2015	8	4/7/2015	86,315	3,489	89,803
241-TX-112	5/4/2015	241	12/31/2015	1,773,350	18,153	1,791,503
241-BX-101	5/21/2015	27	6/17/2015	267,042	10,712	277,754
241-BX-102	6/18/2015	51	8/8/2015	663,255	25,115	688,370
241-TX-113	6/21/2015	444	9/7/2016	2,007,782	16,279	2,024,061
241-TX-114	7/5/2015	291	4/21/2016	1,472,998	15,164	1,488,162
241-BX-103	8/13/2015	29	9/11/2015	232,481	9,904	242,385
241-TX-115	8/25/2015	509	1/15/2017	1,542,762	16,052	1,558,814
241-BX-104	9/11/2015	55	11/5/2015	779,923	29,790	809,713
241-BX-105	11/6/2015	33	12/9/2015	291,522	11,407	302,929
241-BX-106	12/9/2015	24	1/2/2016	253,220	10,029	263,249
241-BX-107	1/3/2016	77	3/20/2016	875,652	35,729	911,381
241-BX-108	3/21/2016	4	3/25/2016	82,933	3,955	86,888
241-BX-109	3/30/2016	36	5/5/2016	242,459	10,418	252,877
241-BX-110	4/22/2016	61	6/22/2016	588,743	9,746	598,489
241-BX-111	5/6/2016	48	6/23/2016	505,531	7,784	513,314
241-TX-116	6/15/2016	495	10/23/2017	1,582,217	33,598	1,615,815

Table I-1. Single-Shell Retrieval Sequence for Case 3b.

Tank	Retrieval start date	Retrieval duration (days)	Retrieval end date	Retrieved liquid vol. (gal)	Retrieved solids vol. (gal)	Total retrieved vol. (gal)
241-BX-112	6/23/2016	48	8/10/2016	330,637	13,018	343,655
241-S-101	8/9/2016	73	10/21/2016	1,288,120	42,994	1,331,114
241-S-104	8/10/2016	38	9/17/2016	1,397,953	47,197	1,445,150
241-SX-103	10/20/2016	93	1/21/2017	1,373,692	3,713	1,377,405
241-S-107	11/24/2016	61	1/24/2017	973,610	32,065	1,005,674
241-TX-117	12/12/2016	184	6/14/2017	1,252,098	16,962	1,269,061
241-B-101	1/15/2017	41	2/25/2017	246,850	6,769	253,619
241-TX-118	1/20/2017	235	9/12/2017	645,552	7,329	652,881
241-B-102	1/24/2017	10	2/3/2017	54,823	1,951	56,774
241-SX-104	1/24/2017	75	4/9/2017	1,081,333	11,343	1,092,676
241-B-103	2/3/2017	18	2/21/2017	107,105	3,782	110,887
241-B-104	2/21/2017	51	4/13/2017	466,625	9,780	476,406
241-B-105	2/25/2017	71	5/7/2017	693,856	8,488	702,344
241-SX-105	3/18/2017	168	9/2/2017	858,207	5,551	863,758
241-SX-106	4/9/2017	132	8/19/2017	959,555	12,754	972,309
241-B-106	4/16/2017	22	5/8/2017	134,161	5,461	139,622
241-B-107	5/8/2017	29	6/6/2017	322,622	14,978	337,600
241-B-108	5/24/2017	22	6/15/2017	229,876	8,964	238,839
241-B-109	6/8/2017	102	9/18/2017	346,056	14,382	360,438
241-B-110	6/14/2017	124	10/16/2017	330,716	14,894	345,610
241-SX-107	9/8/2017	12	9/20/2017	572,714	20,365	593,080
241-SX-108	9/17/2017	26	10/13/2017	166,701	3,741	170,443
241-S-108	9/19/2017	214	4/21/2018	1,583,821	7,520	1,591,341
241-B-111	9/21/2017	45	11/5/2017	273,364	11,528	284,892
241-B-112	9/22/2017	17	10/9/2017	48,252	2,295	50,547
241-T-104	10/16/2017	80	1/4/2018	577,272	21,024	598,297
241-SX-109	10/16/2017	36	11/21/2017	1,091,032	35,067	1,126,099
241-T-105	10/25/2017	53	12/17/2017	355,225	13,009	368,233
241-T-106	11/8/2017	3	11/11/2017	101,718	4,266	105,984
241-T-107	11/11/2017	32	12/13/2017	519,707	19,535	539,242
241-S-109	11/24/2017	265	8/16/2018	1,745,559	4,438	1,749,997
241-SX-110	12/7/2017	25	1/1/2018	260,456	8,921	269,377
241-SX-111	12/7/2017	28	1/4/2018	569,718	19,981	589,699
241-T-108	12/13/2017	3	12/16/2017	29,954	1,374	31,328
241-T-109	12/16/2017	17	1/2/2018	114,287	1,466	115,753
241-T-112	1/4/2018	24	1/28/2018	103,586	4,273	107,859
241-SX-112	3/23/2018	26	4/18/2018	395,492	14,055	409,547
241-SX-113	3/25/2018	12	4/6/2018	186,079	7,145	193,224
241-SX-114	4/15/2018	22	5/7/2018	596,043	20,054	616,098
241-SX-115	4/20/2018	6	4/26/2018	9,064	608	9,672
241-S-110	4/26/2018	75	7/10/2018	1,113,741	16,594	1,130,335
241-S-111	7/10/2018	51	8/30/2018	722,557	31,584	754,141

I2.0 Risk Reduction Curves for Case 3b

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

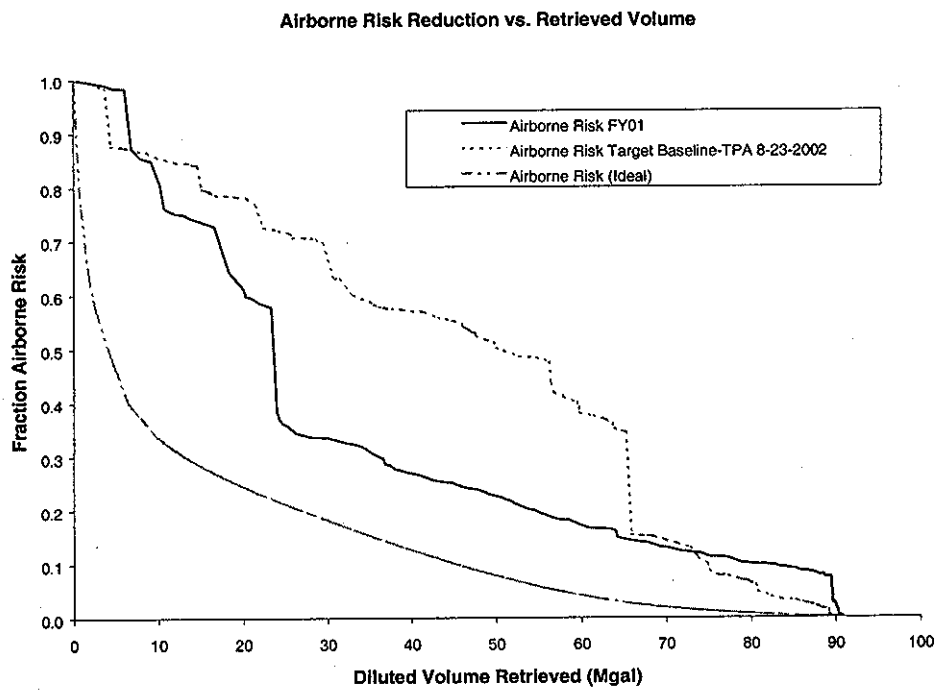

Figure I-2. Case 3b Groundwater Risk Reduction Versus Volume Retrieved

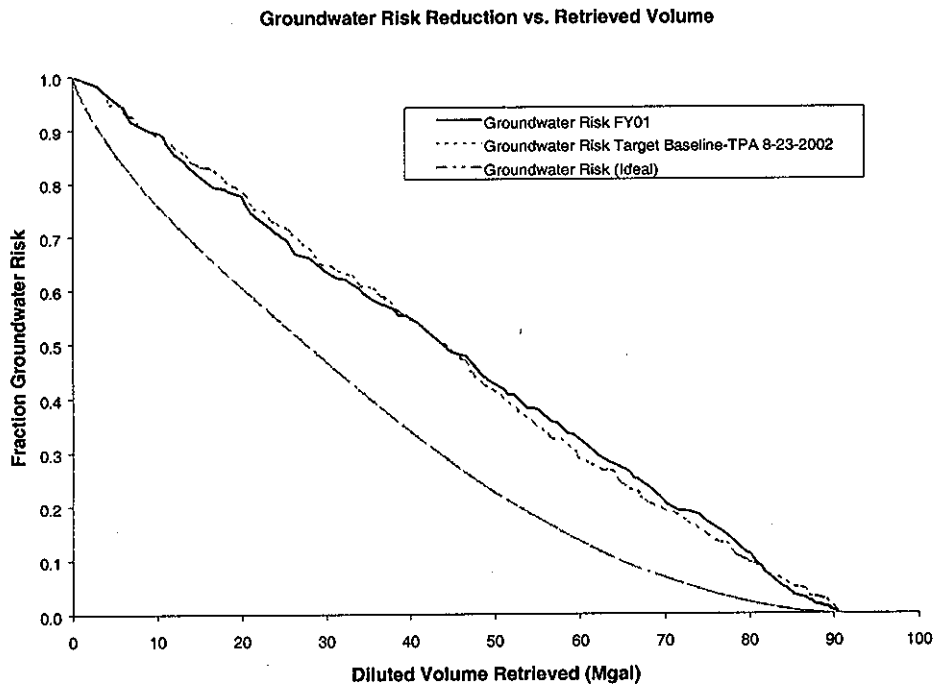

Figure I-3. Case 3b Chemical Risk Reduction Versus Volume Retrieved

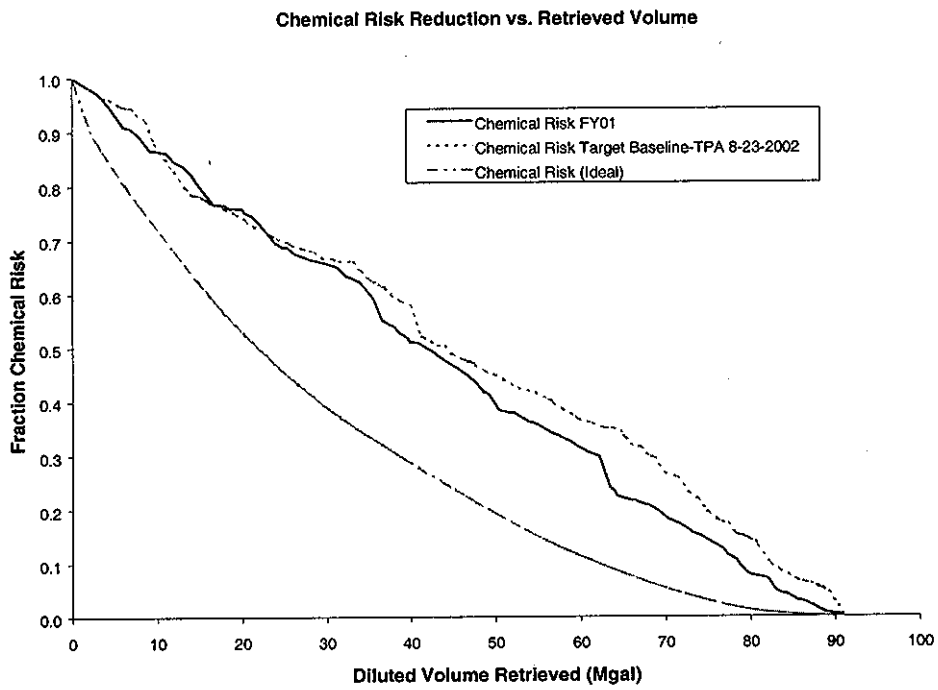

Figure I-4. Case 3b Airborne Risk Reduction Over Time.

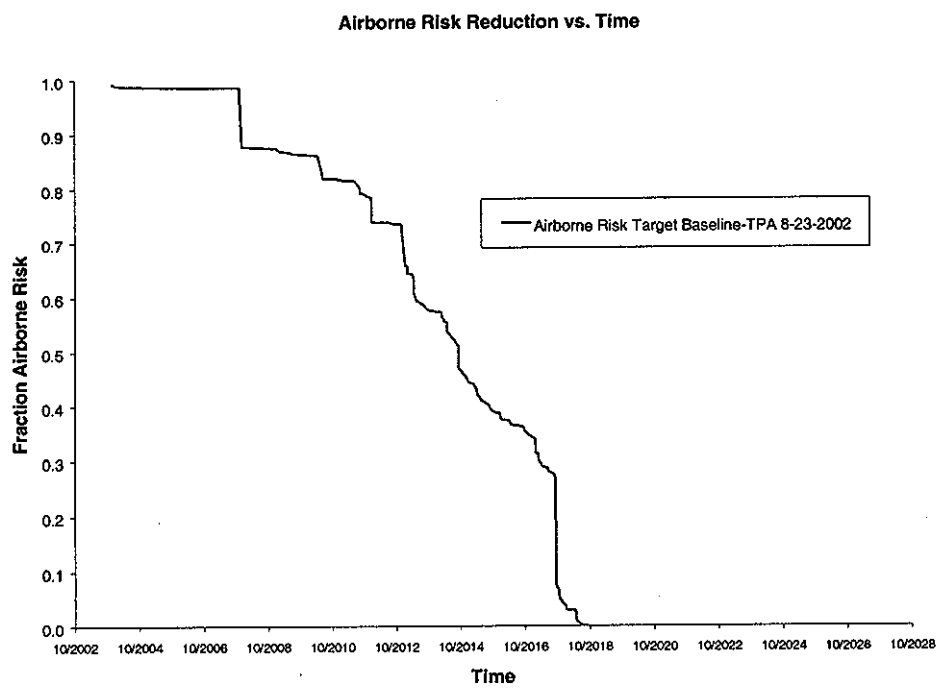

Figure I-5. Case 3b Groundwater Risk Reduction Over Time

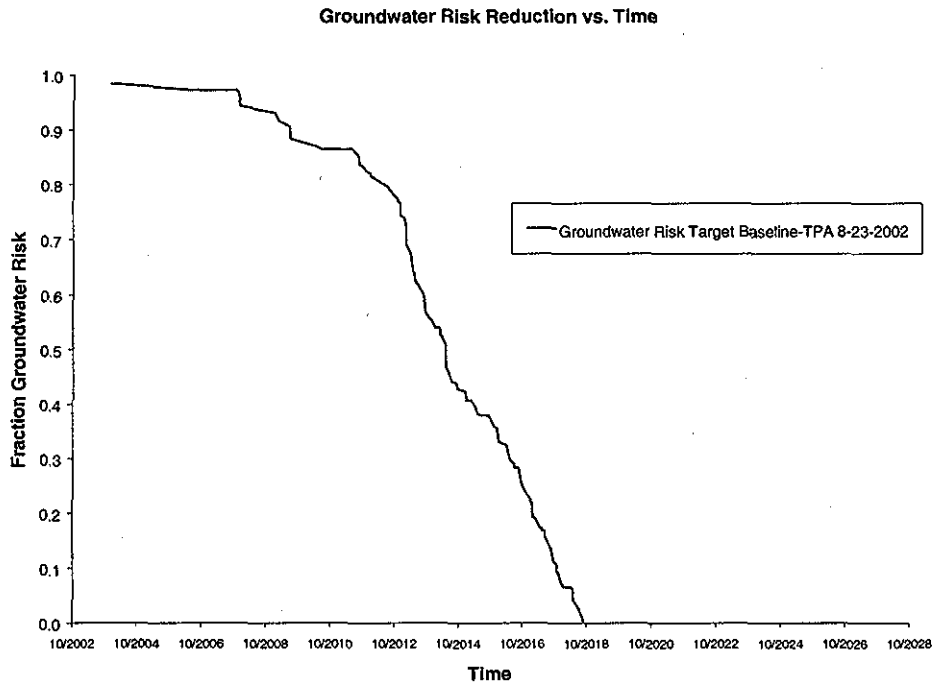
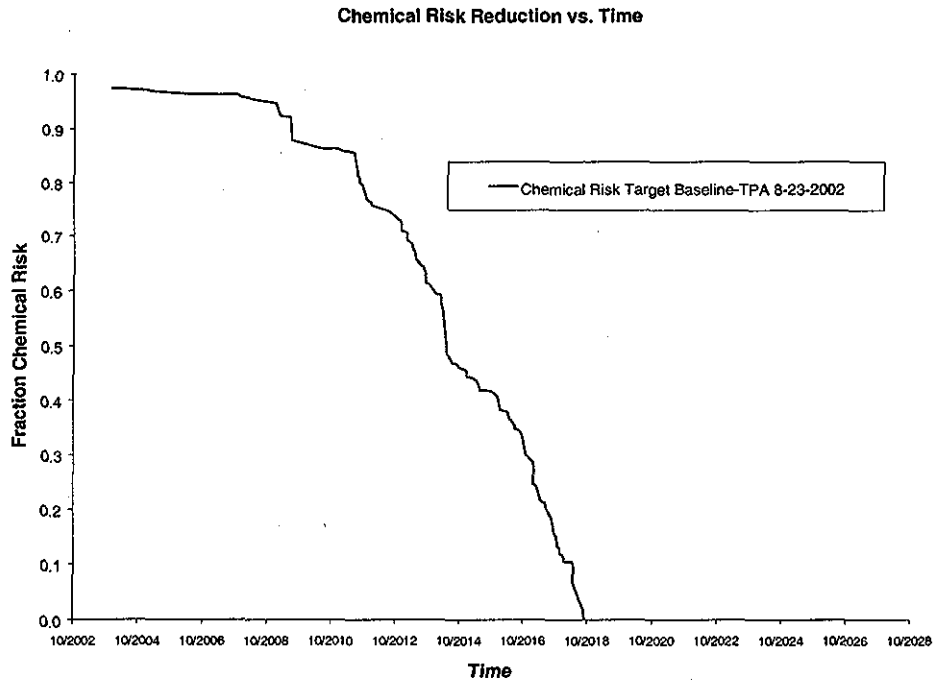
Figure I-6. Case 3b Chemical Risk Reduction Over Time