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**RELEASE STAMP**

AUG 24 1999
DATE
STA 4
HANFORD
RELEASE

A-7900-013-2 (10/97)
**ENGINEERING CHANGE NOTICE**

16. Design Verification Required
   - Yes
   - No

17. Cost Impact
   - **ENGINEERING**
     - Additional: $__________
   - **CONSTRUCTION**
     - Additional: $__________

18. Schedule Impact (days)
   - Improvement: __________
   - Delay: __________

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
   - Functional Design Criteria
   - Operating Specification
   - Criticality Specification
   - Conceptual Design Report
   - Equipment Spec.
   - Const. Spec.
   - Procurement Spec.
   - Vendor Information
   - OM Manual
   - FSAR/SAR
   - Safety Equipment List
   - Radiation Work Permit
   - Environmental Impact Statement
   - Environmental Report
   - Environmental Permit

   - Seismic/Stress Analysis
   - Interface Control Drawing
   - Calibration Procedure
   - Installation Procedure
   - Maintenance Procedure
   - Engineering Procedure
   - Operating Instruction
   - Operating Procedure
   - Operational Safety Requirement
   - IEFD Drawing
   - Cell Arrangement Drawing
   - Essential Material Specification
   - Fac. Proc. Samp. Schedule
   - Inspection Plan
   - Inventory Adjustment Request

   - Tank Calibration Manual
   - Health Physics Procedure
   - Spares Multiple Unit Listing
   - Test Procedures/Specification
   - Component Index
   - ASME Coded Item
   - Human Factor Consideration
   - Computer Software
   - Electric Circuit Schedule
   - ICRS Procedure
   - Process Control Manual/Plan
   - Process Flow Chart
   - Purchase Requisition
   - Tickler File

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

   - Document Number/Revision
   - Document Number/Revision
   - Document Number/Revision

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21. Approvals

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DEPARTMENT OF ENERGY
Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

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A-7900-013-3 (10/97)
Operational Waste Volume Projection

J. N. Strode/V. C. Boyles
Lockheed Martin Hanford, Corp.
Richland, WA 99352
U.S. Department of Energy Contract DE-AC06-96RL13200

EDT/ECN: 644164 Org Code: 74B40 B&R Code: EW 0020074
UC: 2070 Charge Code: 102609

Total Pages: PF 8-24-99

Key Words: Waste Volume Projection, Tank Space Management Board, Waste Volume Reduction, Double-Shell Tank, Evaporator, LERF

Abstract: Waste receipts to the double-shell tank system are analyzed and wastes through the year 2018 are projected based on assumption as of July 1999. A computer simulation of site operations is performed, which results in projections of tank fill schedules, tank transfers, evaporator operations, tank retrieval, and aging waste tank usage. This projection incorporates current budget planning and the clean-up schedule of the Tri-Party Agreement.

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# TABLE OF CONTENTS

## 1.0 SUMMARY

## 2.0 INTRODUCTION
- **2.1 PURPOSE**
- **2.2 METHODOLOGY**

## 3.0 GENERAL FACILITY DESCRIPTIONS AND ASSUMPTIONS
- **3.1 B PLANT/WESF**
- **3.2 242-A EVAPORATOR and LERF**
- **3.3 GROUT**
- **3.4 EFFLUENT TREATMENT FACILITY**
- **3.5 PFP**
- **3.6 PUREX**
- **3.7 S PLANT**
- **3.8 SALT WELL LIQUID PUMPING**
- **3.9 SINGLE-SHELL TANK SOLIDS RETRIEVAL**
- **3.10 T PLANT**
- **3.11 TANK FARMS**
- **3.12 UO, FACILITY**
- **3.13 WASTE SAMPLING AND CHARACTERIZATION FACILITY (WSCF)**
- **3.14 100 AREA**
- **3.15 300 AREA**
- **3.16 400 AREA**
- **3.17 PHASE 1B PRIVATIZATION PROCESSING**
- **3.18 PHASE 2 PRIVATIZATION PROCESSING**
- **3.19 WATCH LIST/SAFETY**
- **3.20 SPARE/CONTINGENCY SPACE**
- **3.21 WASTE SEGREGATION**
- **3.22 LOSS OF DST SPACE**
- **3.23 NEW DST CONSTRUCTION**
- **3.24 DST TANK SOLIDS LEVELS**
- **3.25 IMUST WASTES**
- **3.26 ASSUMPTION SUMMARY**

## 4.0 ASSUMPTIONS FOR PROJECTION CASES 2 AND 3
- **4.1 PROJECTION CASE 2 ASSUMPTIONS**
- **4.2 PROJECTION CASE 3 ASSUMPTIONS**

## 5.0 PROJECTION RESULTS
- **5.1 PROJECTION CASE 1 RESULTS**
- **5.2 PROJECTION CASE 2 RESULTS**
- **5.3 PROJECTION CASE 3 RESULTS**
- **5.4 ACTUAL WASTE GENERATION COMPARED TO MANAGEMENT LIMITS**

## 6.0 SPACE SAVING ALTERNATIVES

## 7.0 CONCLUSIONS

## 8.0 BIBLIOGRAPHY

## APPENDICES
- **APPENDIX A. Acronyms**
- **APPENDIX B. Transfers for Projections in FY 1998-2000**
TABLE OF CONTENTS (CONTINUED)

FIGURES
1. Comparison of the Tank Requirements for the 1999 Projection Cases . 3
2. Methodology of the OWVP ........................................... 7
3. Double-Shell Tank Requirements for Case 1--TPA Compliant ............ 40
4. Facility Waste Generation Graphic .................................. 42
5. Tank Fill Graphic .................................................... 42
6. Tank Levels During the Short Range Projection ........................ 44
7. Simplified Schematic of Current and Planned Routings .............. 45
8. Dilute Receiver Tanks and 242-A Evaporator Operations ............... 51
9. West Area Waste Generations and SY Tank Levels ................. 53
10. AN Farm Tank Levels .............................................. 54
11. AP Farm Tank Levels .............................................. 55
12. AW Farm Tank Levels .............................................. 56
13. Aging Tank Requirements ........................................... 57
14. Aging Waste Tank Usage ............................................ 58
15. Double-Shell Tank Requirements for the Case 2 Projection .......... 60
16. Double-Shell Tank Inventory and Space for the Case 2 Projection ... 62
17. Double-Shell Tank Requirements for the Case 3 Projection ........... 66
18. Monthly Facility Generations ....................................... 70
19. Comparison of Monthly Average Waste Generation to Target Rate .... 71
20. Monthly Contributions from SWL Pumping ........................... 72
21. Contributions from Facility TCO ................................... 73

TABLES
1. Summary of Assumptions For the 1999 Projection Cases .............. 4
2. Risk Assessment Summary for Waste Volume Projections ............. 5
3. Historical Evaporator Campaigns Since the 1994 Restart ............. 12
4. Salt Well Pumping Schedule for All Projections .......................... 16
5. Current Operational Tanks and Usage ................................ 19
6. Projected LAW Processing Schedule for Projection Case 1 ............. 25
7. Waste Compatibility Matrix ........................................ 27
8. DST Solids Levels (Kgal) ............................................ 28
9. Assumption Matrix .................................................. 29
10. Projected Processing Schedule for Case 3 ............................... 34
11. Spreadsheet of Waste Additions and Reductions for Case 1 .......... 41
12. Projected Tank Usage on 9/2001 for the Case 1 and 2 Projections ... 46
13. Evaporator WWR and LERF Additions for Case 1 Projection ............ 47
14. Evaporator Campaign Schedule for the Case 1 and 2 Projections ....... 48
15. Cross-site Transfer Schedule for Projection Case 1 and 2 ............. 49
16. Spreadsheet of Waste Additions and Reductions for Case 2 ......... 61
17. Spreadsheet of Waste Additions and Reductions for Case 3 .......... 67
18. Comparison of Average Monthly Waste Generation Rates ............ 68
1.0 SUMMARY

The Operational Waste Volume Projection (OWVP) presents a basis for evaluating future Double-Shell Tank (DST) space needs through FY 2018. This report presents a projected range of tank needs which is used to generate recommendations regarding site activities, waste management activities, facility requirements, and the need to build additional double-shell tanks. This document presents the results of three distinct projection cases. Operating assumptions for the three cases were established in June 1999. Operating assumptions and results are summarized below:

- Case 1 presents projected DST needs based on Tri-Party Agreement (TPA) milestones, River Protection Project (RPP) project planning guidance received in April 1999 (Taylor, 1999), and the current operational assumptions. With the TPA compliant single-shell tank (SST) solids retrieval schedule added, tank space requirements significantly exceed available space by the end of FY 2004. Options to reduce the tank space shortage would include adjusting the SST solids retrieval schedule to match available space, increasing the waste processing rates, and/or building additional double-shell tank space. Projected space requirements for Case 1 with only SST solids retrieved to meet Phase 1B High-Level Waste (HLW) processing needs fits within available space through FY 2018. Please see Section 5.1 for more details.

- Case 2 presents projected DST needs based on the project planning guidance received in April 1999 (Taylor, 1999) with a reduced SST solids retrieval rate (Kirkbride, 1999b). The projected space requirements for Case 2 with SST solids retrieval exceed available space by one tank in FY 2011 and again in FY 2014. This tank space shortage could be easily eliminated by shifting some of the SST solids retrieval volume in these two years to the period FY 2012-2013 when excess tank space is available. This projection was designed to identify the space available for SST solids retrieval. Please see Section 5.2 for more details.

- Case 3 presents projected DST space needs based on a British Nuclear Fuels Limited (BNFL) processing schedule that starts at a slower rate initially but ramps up to twice the processing rate used in projection Cases 1 and 2. Case 3 also incorporates a reduced SST solids retrieval rate (Kirkbride, 1999a). The projected tank needs with only the SST solids retrieved to meet Phase 1B HLW processing needs, fits within available space. With the SST solids retrieval volume added, tank space needs exceed available space starting in FY 2011. Options to reduce the tank space shortage would include adjusting the SST solids retrieval schedule to match available space, increasing the waste processing rates, and/or building additional double-shell tank space.

A comparison of the projected tank space needs required for the three projection cases is depicted in Figure 1. Key assumptions for the three projection cases are summarized in Table 1. Differences in assumptions have been highlighted. Detailed assumptions and space saving alternatives are presented later in this document. A brief summary of the risks associated with these projections is provided in Table 2. Additional information and references for Table 2 can be found later in this document by referring to the section listed under comments. At a minimum, this DST space forecast will be updated annually with the latest information available regarding the estimated volume of waste requiring storage in the DSTs.
Facility waste minimization requirements initiated by the Tank Space Management Board (TSMB) helped to guarantee tank space availability prior to the 242-A Evaporator restart in FY 1994. However, due to the possibility of future tank space shortages, Terminal Clean-out (TCO) and monthly waste generations need to be continually minimized. The DST Waste Inventory Control Group was chartered to control the inventory of the DSTs and meets on a monthly basis to review projected waste generations and waste transfers. Voting members of this group consist of representatives from Operations, Process Engineering, Environmental, and Tank Waste Retrieval. Issues that cannot be resolved by this group will be elevated to the TWRS Waste Modeling Key Assumptions Control Board.

Approximately 6-8 years are required to build additional DSTs. The Case 1 projection with only the SST solids retrieved to meet HLW feed needs, predicts that the available tank space will meet the needs for the RPP planning waste processing assumptions. The Case 1 projection with TPA compliant solids retrieval volumes added will be at or exceed the available space by FY 2004 because the volume of solids retrieved to meet the TPA milestones for SST solids retrieval will grossly exceed the space made available by the waste processing schedule. Building additional tanks alone to meet this excess space requirement does not appear to be a realistic option due to the excessive amount of tanks required—approximately 25 additional tanks by FY 2012 or up to 79 additional tanks by FY 2018. Accelerating the waste processing schedule and rate alone to meet the storage requirements of the TPA compliant SST solids retrieval schedule would require unrealistic high processing rates and expense. Avoiding the projected tank space shortage would require a combination of the following options (see Section 6.0 for a more complete listing):

- Delay retrieval of SST solids
- Accelerate the processing and vitrification of waste
- Establish Phase 2 contract terms for privatization to require rates of retrieval and processing equivalent to TPA rates
- Delay the Single-Shell Tank (SST) interim stabilization effort
- Construct new double-shell tanks

A DST space trade study (Garfield, 1999) has been completed which addresses some of the space saving alternatives mentioned in Section 6 of this document. The DST space trade study states that sufficient DST is available to support waste feed delivery and that no action is necessary at this time to build new double-shell tanks. The study also assumes a reduced retrieval of SST solids.
Figure 1. Comparison of Tank Requirements for 7/99 Projection Cases
### Table 1. Summary of Assumptions For the 1999 Projection Cases (references in Sect. 3)

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<td>----------------------------------------------------</td>
<td>-----------------------------------</td>
<td>-----------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Remaining SWL pumping volume is 6.12 Mgal without flush or dilution</td>
<td>X</td>
<td>Dependent on magnitude of change</td>
<td>X</td>
</tr>
<tr>
<td>CC waste will not solubilize the TRU sludge in Tank 102-SY</td>
<td>X</td>
<td>Dependent on magnitude of change</td>
<td>X</td>
</tr>
<tr>
<td>242-A Evaporator available with one outage in FY 2004</td>
<td>X</td>
<td>Dependent on magnitude of change</td>
<td>X</td>
</tr>
<tr>
<td>Evaporation limit for new DSSF will be SpG of 1.41</td>
<td>X</td>
<td>Dependent on magnitude of change</td>
<td>X</td>
</tr>
<tr>
<td>Facility generations will not exceed TPA Compliant Case levels</td>
<td>X</td>
<td>Dependent on magnitude of change</td>
<td>X</td>
</tr>
<tr>
<td>Facility TCO volumes: 100 Areas &lt;0.7 Mgal</td>
<td>X</td>
<td>Dependent on magnitude of change</td>
<td>X</td>
</tr>
<tr>
<td>No loss of DST space</td>
<td>X</td>
<td>1 mgal/tank</td>
<td>X</td>
</tr>
<tr>
<td>LAW Phase I vitrification starts FY 2007</td>
<td>X</td>
<td>Dependent on magnitude of change</td>
<td>X</td>
</tr>
<tr>
<td>Cross-site transfer lines are available</td>
<td>X</td>
<td>Dependent on magnitude of change</td>
<td>X</td>
</tr>
<tr>
<td>No volume set aside for upsets or new streams</td>
<td>X</td>
<td>Dependent on magnitude of change</td>
<td>X</td>
</tr>
</tbody>
</table>
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2.0 INTRODUCTION

2.1 PURPOSE

The purpose of the OWVP is to present a basis for evaluating future DST needs to meet TPA Milestones M-46-00 and M-46-01. Milestone M-46-00 states that an OWVP report shall be prepared and issued annually evaluating DST needs. Milestone M-46-01 requires RPP, to review and recommend whether or not to build additional DSTs on an annual basis.

This report presents a projected range of tank needs which is 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 projected cases which represent varying degrees of tank space demands. All projected cases incorporate the "privatization" of waste treatment and disposal. The term "privatization" refers to the DOE strategy for phased retrieval and treatment of Hanford tank wastes which would use private contractors to design, permit, build, operate, and deactivate the facilities for waste treatment and immobilization (DOE, 1995). Case 1 is intended to present tank space needs based on all TPA milestones, RPP program planning, and current operational assumptions. Cases 2 is based on the same operational and processing assumptions as Case 1 but incorporates a lower SST solids retrieval schedule. Case 3 presents a different waste processing schedule and SST retrieval schedule than that used in either Case 1 or 2. Operating assumptions for the three cases were established in June 1999. Need dates for new DST construction, tank retrievals, facility schedules, waste generation reductions, conflicts in meeting TPA milestones (WDOE, 1994; WHC, 1996a; WHC, 1996b), and funding priorities can then be reviewed in relation to tank space availability.

2.2 METHODOLOGY

The process followed in preparing an OWVP is shown in Figure 2, below.

![Methodology of Waste Volume Projection Diagram](image)
The process of updating the OWVP begins with the request for updated facility or project "assumptions" from each of the operating facilities and projects that will contribute waste to DST inventory. The term "assumption" in this document refers to engineering inputs or bases supplied by the facilities based on their future operational plans (determined by budget, DOE directive, TPA milestones, etc.). Typical assumptions include operating schedules, waste generation rates, stream compositions, modes of operation, etc. The operating facilities and projects provide estimates of volume, composition, and radionuclide content data for each distinct waste stream exiting the facility. In addition to the projected facility waste generation rates, the processing schedules of each of the plants are factored into the projection. For the Plutonium Finishing Plant (PFP) and 100 Area facilities the projected volumes of waste generated from TCO are estimated and entered. For the 300 Area, 400 Area, and Tank Farms, monthly waste generations are entered from facility inputs and/or actual generation rates. These projected waste generation rates and plant schedules are used to project waste volumes that each plant will be producing per month or year. The composition data is used to calculate Waste Volume Reduction Factors (WVRFs) and to determine waste segregation requirements (due to chemical, radionuclide, or heat content). The WVRF (Riley, 1988) is defined as the percent of water (by volume) that can be removed from a waste stream to achieve a certain interim waste form such as double-shell slurry feed. From the facility assumptions, a matrix of basic assumptions for the three cases to be incorporated into the OWVP projections were prepared and presented to Hanford contractor management and program office for approval. RL has requested that the OWVP document should provide a list of all transfers for the next fiscal year (Kinzer, 1999). Appendix B in this document lists all the gains (GA), losses (LO), and transfers (TR) for projection Cases 1 and 2 through FY 2000.

Once the projection cases have been approved, the database of past waste gains, transfers, and evaporations is updated with data from the most recent months of Tank Farm operations. The early years of the projection are simulated in more detail than the later years. In the first period of the projection, monthly waste volumes are predicted. For the last 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 106-AW) as Double-Shell Slurry Feed (DSSF) which will eventually be disposed of through the Low-Activity Waste (LAW) processing and vitrification facility.

The Neutralized Current Acid Waste (NCAW) and transuranic (TRU) solids will be processed at BNFL and the HLW solids will be immobilized in the High-Level Waste (HLW) vitrification plant into a glass matrix for disposal. It is anticipated that the HLW pretreatment at BNFL would generate a LAW supernate stream that would be stored at BNFL and later sent to LAW vitrification for final disposal.

1 Waste tanks are hereafter referred to in an abbreviated form; for example, Tank 102-AW.
3.0 GENERAL FACILITY DESCRIPTIONS AND ASSUMPTIONS

A brief description of the facilities and projects pertinent to the Case 1 projection are listed in the following section. Facility operating dates, waste generation volumes, WVRFs, flushes, and other pertinent assumptions are also described in this section. Assumptions unique to the Case 2 and Case 3 projections are described in Section 4. This information has been summarized for each of the three cases in Table 9, which is included at the end of this section. The spreadsheet for the Case 1 projection (Section 5.1) lists the waste generations for each year for facilities that presented a range of waste generation rates (e.g., T Plant varied from 1.4 to 2.7 Kgal/month during the period FY 1999-2018). Some waste additions to DSTs require a flush after the transfer has been completed. If a flush is required it is reported in the following sections and in Table 9.

This year, there has been an attempt to totally integrate the OWVP and Disposal Engineering assumptions and the integration is good through the end of Phase 1 (circa FY 2013). Phase 1 processing assumptions, tank usage, and the order of processing were furnished by Disposal Engineering (Kirkbride, 1999a) and are consistent between the two projects. The Case 1 projection uses the waste processing schedule from Disposal Engineering Case 3s3 with a Tri-Party Agreement Compliant SST solids retrieval schedule. The Case 2 projection uses the same assumptions as Case 1 but uses a SST solids retrieval schedule from Disposal Engineering Case 3s3. Case 3 uses waste processing and the SST solids retrieval schedule from Disposal Engineering Case 6b. This year's projections use primarily AN farm tanks for intermediate waste staging. It is assumed BNFL will supply the space necessary for vendor feed staging and that no entrained solids stream or pretreated NCAW supernate stream will be returned to tank farms. The OWVP and Disposal Engineering assumptions will be further integrated in next year's OWVP document.

3.1 B PLANT/WESF

B Plant was constructed in 1945 to recover plutonium by the bismuth phosphate process. The facility was refurbished in 1967 to recover cesium and strontium byproducts from the high level waste tanks (Simmons, 1998). In 1974, the Waste Encapsulation and Storage Facility (WESF), was constructed on the west end of B Plant to support B Plant's mission. B Plant deactivation was completed in FY 1998 and B Plant will not be sending any future waste to tank farms (Lueck, 1999).

WESF's current mission is to receive and store the cesium and strontium capsules that were manufactured at WESF in a safe manner and in compliance with all applicable rules and regulations (Brist, 1999). Waste projection estimates for WESF varied from 0 to 20 Kgal/year. If the integrity of a capsule is lost, up to 90 Kgal could be transferred to tank farms. For all three projection cases, it was assumed that WESF would generate 5 Kgal/year. No flushes were anticipated. The WWRF used to evaporate either B Plant or WESF waste to DSSF is 99% (Sederburg, 1995).
3.2 242-A EVAPORATOR and LERF

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

- This projection model assumed that the 242-A Evaporator would operate in a "Linked Run" process mode (Guthrie, 1993). A "Linked Run" is a continuous operation of the 242-A Evaporator, made possible by simultaneously transferring from the DST's to the Evaporator feed tank (Tank 102-AW).

- A period of four months is required from the time a holding tank is filled with dilute wastes before the waste can be evaporated (Von Bargen, 1995). This period allows time for sampling, analysis per the Evaporator DQO, documentation, and facility preparation (Bloom, 1999).

- All projection cases scheduled evaporator campaigns eight months apart to minimize operational costs and to allow the evaporator and Effluent Treatment Facility to minimize staff requirements. Scheduling campaigns eight months apart required the use of two evaporator staging tanks. If one of the staging tanks is not available, campaigns may have to be scheduled closer together. Several of the projected evaporator campaigns included two tanks of dilute waste for evaporation in a single campaign. Evaporator engineers have recommended that campaigns be limited to a maximum of three dilute tanks per campaign (Bloom, 1999).

- The desired WVR 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 DSSF with a specific gravity of 1.41. Upon reaching the desired concentration level, the concentrated waste is transferred to the evaporator receiver tank (Tank 106-AW). At the end of a campaign or when Tank 106-AW has been filled, DSSF is transferred to another DST holding tank.

- The Liquid Effluent Retention Facility (LERF) has a 7.8 million gallon storage capacity (Basin 42) for evaporator process condensate (Guthrie, 1997a).

- The ratio of process condensate sent to LERF for every gallon of Waste Volume Reduction (WVR) 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 gallon of condensate/gallon of WVR which would lower the value used for future projections. This projection used a value of 1.20 gallon of condensate/gallon of WVR (Bloom, 1999). Since the
Effluent Treatment Facility has a capacity of approximately 50 Mgal/year (Wagner, 1996), it was assumed that LERF capacity would not limit future evaporator operations.

- The maximum monthly WVR during Evaporator operation should be approximately 1500 kgal/month based on a near optimum Campaign 94-2 and 96-1 performance with approximately a 50% initial WVR per pass through the evaporator (Guthrie, 1997b).

- An average evaporation rate of 500 Kgal/month (Bloom, 1999) was used in this simulation taking into consideration:
  - the 242-A Evaporator historical processing rates
  - downtime between campaigns
  - waste characterization
  - staging and tank transfers

- The simulation used in this projection evaporates all dilute wastes 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 WVR limit of the evaporator. Historically, dilute wastes were concentrated to near the aluminate boundary which would produce concentrated wastes with a specific gravity which could range from 1.3 to 1.67. However, it has been noted that all of the DSTs currently on the Flammable Gas Watch List (i.e., tanks with safety concerns related to hydrogen build-up) have specific gravities greater than 1.4 (Reynolds, 1994). To avoid production of future Flammable Gas Watch List tanks, it has been proposed that all future waste concentrations should be limited to a specific gravity of 1.41 unless additional technical evaluation shows flammable gas will not build-up (Fowler, 1999 and Mulkey, 1997).

The waste volume projection model of the 242-A Evaporator operation used in projections thru 1994, typically produced DSSF with a specific gravity of 1.50-1.55. Reducing these wastes to a specific gravity of 1.41 increases waste storage volumes by approximately 22%-35%, depending on the chemical composition of the waste. Although the evaporation limit for concentrated wastes is a specific gravity of 1.41, the first five evaporator campaigns in Table 3 (94-1 thru 97-1) produced concentrated wastes 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 wastes 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 3.

- No evaporator campaigns were completed in FY 1998. A cold run was completed in FY 1998 and added approximately 79 Kgal of water to DSTs.
Table 3. Historical Evaporator Campaigns Since the 1994 Restart

<table>
<thead>
<tr>
<th>Campaign</th>
<th>Start Date</th>
<th>Waste Source</th>
<th>Waste Feed Type</th>
<th>Approximate WVR, Mgal</th>
</tr>
</thead>
<tbody>
<tr>
<td>94-1</td>
<td>4/94</td>
<td>102-AW, 106-AW, &amp; 103-AP</td>
<td>DN</td>
<td>2.42</td>
</tr>
<tr>
<td>96-1</td>
<td>5/96</td>
<td>102-SY, 105-AW, &amp; 102-AY</td>
<td>DN</td>
<td>1.12</td>
</tr>
<tr>
<td>97-1</td>
<td>3/97</td>
<td>101-AN</td>
<td>DN-SWL</td>
<td>0.4</td>
</tr>
<tr>
<td>97-2</td>
<td>9/97</td>
<td>101-AY and 106-AN</td>
<td>DC</td>
<td>0.7</td>
</tr>
<tr>
<td>98</td>
<td>No evaporator campaign in FY 1998 (cold run completed)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- The next evaporator campaign (99-1) was started in July 1999, to evaporate dilute waste from Tanks 102-AY, 106-AP, and 108-AP.

- All projection cases assumed that evaporation capability would be available annually to evaporate all dilute wastes except for the one year outage in FY 2004. The annual evaporation of dilute waste minimizes tank space requirements and allows site cleanup activities to continue unabated. The life of the 242-A Evaporator will be extended through the end of Phase 1 (2018). Evaporator upgrades will be completed by 2005. It is assumed that the Phase 2 waste processing contractor will provide evaporator capability during Phase 2 Operations. (O'Toole, 1998).

- Previous projections assumed that the 242-A Evaporator would require a one year outage for maintenance and or upgrades every ten years based on a 10 year design life of the 242-A Evaporator (Miskho, 1990). All three projection cases assumed a one year outage in FY 2004 (Bloom, 1999).

- Evaporator certification training runs prior to evaporator operation will add approximately 50 Kgal to tank farms and 50 Kgal to the LERF and will occur on a bi-yearly basis (Guthrie, 1997b). The training run in April 1995, added 57 Kgal to DSTs.

- Evaporator flushing after each campaign was previously projected to add 35 Kgal/campaign (Haigh, 1992). Actual flushes for the first three campaigns completed since April 1995 have varied from 27 to 58 kgal/campaign.

- For the years 1999-2004, it was estimated that 1 to 2 campaigns would 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 SWL (complexed and non-complexed) and TCO wastes. The WVR for evaporation of these flushes to DSSF was 99 (Sederburg, 1995).
3.3 GROUT

No additional Grout Vaults are scheduled to be poured at the Hanford site. RPP program planning requires that all tank wastes be separated into low-activity and high-activity fractions and each fraction be immobilized into suitable waste forms for ultimate disposal. Tanks that were originally designated and set aside as grout feed tanks were used for other purposes.

3.4 EFFLUENT TREATMENT FACILITY

The Effluent Treatment Facility (ETF) started operation in November 1995 to process the stored evaporator condensate from the LERF, 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 (SALDS), north of the 200 West Area. This site was chosen to allow tritium to decay away before the groundwater migration reaches the Columbia River. The ETF does not remove tritium because no feasible production-scale tritium removal technology presently exists. The ETF has a capacity to treat 50 Mgal/year. The ETF should not send any streams to DSTs.

3.5 PFP

The Plutonium Finishing Plant (PFP) is a facility in the 200 West Area which houses the processes and supporting operations for (Hirzel, 1999):

1) stabilization of reactive solid residues by muffle furnace calcination (OPERATIONAL);
2) shipping, receiving and storage of special nuclear materials (OPERATIONAL);
3) analytical and development laboratories (OPERATIONAL);
4) treatment and handling of PFP liquid wastes destined for tank farms and the ETF (OPERATIONAL).

An Environmental Impact Statement (EIS) was issued for public comment in November 1995 covering the PFP facility stabilization and clean out. The PFP EIS and Record of Decision (ROD) was published in May 1996. The waste volume projections are based on the preferred alternatives identified in the EIS for facility cleanout and stabilization. The volume of waste anticipated to be produced for the TPA Compliant Case is developed from the existing waste generation rate at PFP (100 untreated gallons/month), and the anticipated use of a direct denitrification vertical calciner coupled with an ion exchange processing system currently planned for FY 2000 startup. The vertical calciner is the most promising technology for plutonium residue stabilization and facility clean out. All projection cases projected that PFP stabilization and clean out would generate a total of 33 Kgal of additional waste from 1999 through 2012 (Hirzel, 1999). The WWRF to evaporate PFP wastes to DSSF is 81% (Sederburg, 1995). Flush volumes for PFP stabilization waste streams is 22% (flushes of waste transfer lines from PFP to 244-TX and from 244-TX to Tank 102-SY).
The percent solids experienced in past PFP waste generations are listed below (Barrington, 1991):

<table>
<thead>
<tr>
<th>% Solids in PRF waste</th>
<th>3.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Solids in RMC waste</td>
<td>4.4%</td>
</tr>
<tr>
<td>% Solids in lab waste</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

3.6 PUREX

The Plutonium Uranium Extraction (PUREX) Facility was used to separate irradiated N Reactor fuel into plutonium nitrate, uranyl nitrate hexahydrate (UNH), 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 deactivation of PUREX 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 #2 Filter catch tank (VII-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 TCO wastes, the WVRF for evaporation of PUREX TCO wastes to DSSF is 99% (Sederburg, 1995). Flush volumes for PUREX TCO waste streams are 10%.

3.7 S PLANT

S Plant (or 222-S Labs) is a dedicated laboratory facility. The Laboratory currently provides analytical chemistry services in support of Hanford processing plants and tank characterization. Emphasis is on waste management processing plants, environmental monitoring programs, Tank Farms, 242-A Evaporator, Waste Encapsulation Storage Facility (WESF), Plutonium Finishing Plant (PFP), research support activities, and essential materials. 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 (Westcott, 1999). Radioactive and radioactive hazardous (mixed) wastes generated by the 222-S Laboratory are discharged to the 219-S Waste Handling Facility. Dilute, non-complexed wastes are currently being transferred via pipeline to Tank 102-SY. Projected S Plant monthly waste generations rates (Westcott, 1999) were approximately 0.83 to 1.0 Kgal/month for FY 1999 through 2028 for all projection cases. Based on the waste composition presented for 222-S Laboratory wastes, the WVRF for evaporation of 222-S miscellaneous wastes to DSSF is 99% (Sederburg, 1995). Flush volumes for 222-S waste streams is 22%.
3.8 SALT WELL LIQUID PUMPING

Salt Well Liquid (SWL) pumping will occur for single-shell tanks (SSTs) which have 50,000 gallons or more of drainable interstitial liquid. Pumping is scheduled to stop when the output rate decreases to 0.05 gallons per minute. SWL pumping assumptions for all three projection cases are listed below:

- A 50 percent saltcake porosity/21 percent sludge porosity were used to estimate the remaining SWL volume, resulting in a remaining volume of ~6.2 million gallons (Schreiber, 1998) without flush and dilution. The pumping schedule (Vladimiroff, 1999) used for all projections is covered later in this section. The WVRF for evaporation of dilute non-complexed (DN) SWL to DSSF is 47% (Sederburg, 1995). The WVRF for evaporation of dilute complexed (DC) SWL to Complexant Concentrate (CC) is 10% (Sederburg, 1995). [Late Note: New estimates being prepared in August 1999 may decrease the amount of remaining SWL by over one million gallons.]

- It was projected that dilution and flushing of the salt well liquid and transfer lines would generate approximately 1.73 Mgal (28%) of water. The WVRF used for this flush is 99% (Sederburg, 1995).

- Approximately 1 Mgal (30%) of the total SWL volume is complexed based on available analytical information.

- Based on the latest SWL pumping project plan, Tanks 101-AN, 106-AP, and 108-AP were used as the 200 East Area receiver tanks.

- Pumping SWL in West Area presents special problems due both to the limited tank space available and due to the transuranic (TRU) heel in Tank 102-SY. Tanks 101-SY and 103-SY contain complexed waste and are also designated as Watch List Tanks. Addition of waste to Watch List tanks is prohibited unless a safer alternative cannot be found.

Therefore, Tank 102-SY was designated as the West Area SWL receiver for both non-complexed and complexed SWL. Tank 102-SY contains approximately 88 Kgal of TRU solids (Table 8) that are not scheduled to be retrieved until after the completion of SWL pumping. Historically, complexed waste and TRU wastes have been segregated to minimize the amount of waste requiring more expensive disposal and to comply with U.S. Department of Energy (DOE) Order 5820.2A. The Hanford Site has implemented this order by segregating waste that was considered complexed (greater than 10 grams/liter total organic carbon) from TRU waste sludge (Reynolds, 1995). The schedule presented in Table 4 would require pumping complexed SWL over the sludge in Tank 102-SY in order to meet TPA milestones for the years 2000-2003. Commingling studies completed in FY 1999 (Kirch, 1999), indicate that no TRU will be solubilized by commingling complexed SWL with the TRU solids in Tank 102-SY. Furthermore, the U. S. Department of Energy, Richland Operations Office (RL) has allowed the commingling of non-complexed and complexed SWL as necessary to allow the stabilization of single-shell tanks (Kinzer, 1998).
In this projection, the complexed wastes are shown being pumped to Tank 102-SY to meet the current TPA schedule.

For all projection cases, it was assumed that all SWL would be pumped from FY 1999 through the end of FY 2004 to meet the Consent Decree milestones. Projected SWL pumping volumes are based on the pumping sequence obtained from the latest SWL project plan (Vladimiroff, 1999). Historical pumping volumes and the projected SWL pumping volumes for all projection cases are presented in Table 4.

Table 4. Salt Well Pumping Schedule for All Projections

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>East Area</th>
<th>West Area</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>55 KGAL</td>
<td>0 KGAL</td>
<td>72 KGAL</td>
</tr>
<tr>
<td>1990</td>
<td>44 KGAL</td>
<td>0 KGAL</td>
<td>44 KGAL</td>
</tr>
<tr>
<td>1991</td>
<td>227 KGAL</td>
<td>0 KGAL</td>
<td>227 KGAL</td>
</tr>
<tr>
<td>1992</td>
<td>121 KGAL</td>
<td>0 KGAL</td>
<td>121 KGAL</td>
</tr>
<tr>
<td>1993</td>
<td>0 KGAL</td>
<td>0 KGAL</td>
<td>0 KGAL</td>
</tr>
<tr>
<td>1994</td>
<td>189 KGAL</td>
<td>0 KGAL</td>
<td>221 KGAL</td>
</tr>
<tr>
<td>1995</td>
<td>194 KGAL</td>
<td>105 KGAL</td>
<td>317 KGAL</td>
</tr>
<tr>
<td>1996</td>
<td>22 KGAL</td>
<td>0 KGAL</td>
<td>218 KGAL</td>
</tr>
<tr>
<td>1997</td>
<td>23 KGAL</td>
<td>0 KGAL</td>
<td>163 KGAL</td>
</tr>
<tr>
<td>1998</td>
<td>0 KGAL</td>
<td>0 KGAL</td>
<td>97 KGAL</td>
</tr>
</tbody>
</table>

Projected SWL Pumping 1999-2000 (without flush)

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>East Area</th>
<th>West Area</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>0 KGAL</td>
<td>0 KGAL</td>
<td>717 KGAL</td>
</tr>
<tr>
<td>2000</td>
<td>184 KGAL</td>
<td>0 KGAL</td>
<td>1227 KGAL</td>
</tr>
<tr>
<td>2001</td>
<td>824 KGAL</td>
<td>0 KGAL</td>
<td>1969 KGAL</td>
</tr>
<tr>
<td>2002</td>
<td>539 KGAL</td>
<td>39 KGAL</td>
<td>1730 KGAL</td>
</tr>
<tr>
<td>2003</td>
<td>107 KGAL</td>
<td>49 KGAL</td>
<td>579 KGAL</td>
</tr>
<tr>
<td>2004</td>
<td>0 KGAL</td>
<td>0 KGAL</td>
<td>0 KGAL</td>
</tr>
<tr>
<td>Total 1999-2000</td>
<td>1654 KGAL</td>
<td>88 KGAL</td>
<td>3475 KGAL</td>
</tr>
</tbody>
</table>
3.9 SINGLE-SHELL TANK SOLIDS RETRIEVAL

This projection assumed that the retrieval of Tank 106-C solids would be started in October 1998 and completed by approximately June 1999 (Kirch, 1997). Initially, approximately 170 Kgal of solids would be retrieved. Retrieval of Tank 106-C solids will require approximately a 3:1 ratio of dilution water to solids (Estey, 1994). Solids retrieved from Tank 106-C will be stored in Tank 102-AY.

Approximately 11.9 Mgal of sludge and 22.9 Mgal of saltcake will be retrieved from SSTs (Hanlon, 1999). Dilution of these solids for retrieval and processing results in a total retrieved volume of approximately 108 Mgal (Penwell, 1998a). Saltcake would be diluted to 5 M Na and sludge will be diluted to 10 weight percent solids (Kirkbride, 1999a). Approximately a 3:1 ratio of dilution water to solids will be required for the retrieval of the remaining SST solids. It is further assumed that all solids will be removed from the SSTs.

For projection Case 1, a TPA compliant SST solids retrieval schedule received from Disposal Engineering (Penwell, 1998a) was incorporated. The TPA compliant SST retrieval schedule would start retrieval in December 2003 (M-45-03-T1) and be completed by the end of FY 2018 (TPA milestone). The as retrieved volume of waste for this case is approximately 2.8 Mgal for FY 2004-2005 and an additional 3.6 Mgal for FY 2006-2007. The as retrieved volumes for the remaining SST solids are shown in the spreadsheet for the TPA Compliant Case (Section 5.1) and are based on retrieval at 5 M Na. Projection Case 2 used the same operational and processing assumptions as Case 1 but incorporated the lower single-shell tank (SST) solids retrieval schedule used in Disposal Engineering Case 3s3. Case 3 used the SST solids retrieval schedule from Disposal Engineering Case 6b.

3.10 T PLANT

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 facilities. The 2706-T Low-Level Decontamination Facility (where low-level equipment decontamination is performed) 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 is currently testing new decontamination techniques (ice blasting and CO₂ decontamination systems) which have reduced liquid waste generations from those reported previously. Dilute, non-complexed wastes collected at T Plant during decontamination, repackaging, or condensate collection, are currently being transported to 204-AR vault via tanker truck. These wastes contain
approximately 5 volume percent solids (McDonald, 1997). Projected T Plant monthly waste generations (McDonald, 1997) were based on a combination of anticipated work loads and actual observed generation rates. The projected volumes supplied by T Plant engineers ranged from 2.1 Kgal/month to 2.7 Kgal/month (Haas, 1999 and McDonald, 1997). The exact waste volume generation projected for each year is shown in the spreadsheet for the Case 1 in Section 5.1. All three projection cases used the same generation rates. The WRPF for evaporation of T Plant miscellaneous wastes to DSSF is 99% (Sederburg, 1995). Flush volumes for T Plant waste streams are 22%.

3.11 TANK FARMS

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

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 wastes (e.g., NCAW wastes or wastes containing high-heat loads due to the presence of 90Sr or 137Cs). The aging waste tanks are equipped with condensers and air-lift circulators. The purpose of the condensers is to handle the vapors from primary tank vent systems when hot liquid is present. Condensates are collected in catch tanks (e.g., 151-AZ) and returned either to an aging waste tank or to a dilute receiver tank. The air-lift circulators aid in suspending NCAW solids and in heat removal. Air-lift circulators require periodic flushing (approximately once/week) to prevent clogging when they are operating. When the air-lift circulators are not operating, flushing is less frequent.

Aging waste tank operation assumptions used in all three projections follow:

- Aging waste tanks can be used for storage of dilute non-aging waste.
- It is assumed that there will be no additional aging waste produced by the Hanford facilities. However, certain wastes containing high 90Sr or 137Cs contents may require storage in aging waste tanks due to their radioactivity. HLW returns to DSTs during Phase 2 processing will be stored in three aging waste tanks (see section 3.18 for more detail).
- Single-shell tank (SST) solids retrieved from Tank 106-C will be stored in an aging DST (Tank 102-AY) due to the high heat content of the solids.
- One million gallons of aging tank space is kept available for receiving the contents of an aging waste tank, in the unlikely event of a tank leak (Department of Energy order 5820.2A).
Tank 102-AY was designated as the 200 East Area dilute receiver for non-complexed wastes through mid FY 1996. Tank 102-AY is currently being used to store the solids retrieved from Tank 106-C. Tank 108-AP is currently receiving direct transfers of wastes from B Plant and tanker truck shipments via 204-AR vault from S Plant, T Plant, 100 Area, 300 Area, and 400 Area. Tank 108-AP and 101-AN are projected to receive non-complexed SWL.

**Double-Shell Tanks for Non-Aging Waste**

The remaining 24 DSTs are called non-aging waste tanks and are used to store wastes that do not contain high-heat loads in accordance with applicable operational and waste segregation policies. Non-aging waste tank operation assumptions are as follows:

- Approximately 66 Kgal of caustic will be added to Tank 107-AN in FY 2001 to mitigate the low caustic condition in the tank for all projection cases (Carothers, 1999).
- Current operational tank usage for this projection are summarized in Table 5. Projected Tank usage will be covered in Section 5.

**Table 5. Current Operational Tanks and Usage**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Designated Tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaporator Feed Tank</td>
<td>Tank 102-AW</td>
</tr>
<tr>
<td>Evaporator Receiver Tank</td>
<td>Tank 106-AW (tank level varies)</td>
</tr>
<tr>
<td>200 East Dilute Receiver Tank</td>
<td>Tank 105-AW (PUREX direct transfers; 100 Area wastes)</td>
</tr>
<tr>
<td>200 West Dilute Receiver Tank</td>
<td>Tank 102-SY (FY 1999-2018)</td>
</tr>
<tr>
<td>200 West SWL Receiver (DN)</td>
<td>Tank 102-SY</td>
</tr>
<tr>
<td>200 West SWL Receiver (DC)</td>
<td>Tank 102-SY</td>
</tr>
<tr>
<td>Private Contractor Feed Tanks</td>
<td>BNFL supplies feed tanks</td>
</tr>
<tr>
<td>Intermediate Staging Tanks</td>
<td>Tanks 101-AN, 106-AN, 104-AN, 105-AN</td>
</tr>
<tr>
<td>Sr/TRU/Entrained Solids Return</td>
<td>BNFL supplies space</td>
</tr>
<tr>
<td>Waste</td>
<td></td>
</tr>
<tr>
<td>Dilute Feed Staging</td>
<td>Tanks 104-AP, 107-AP; Tank 106-AN (FY 2003)</td>
</tr>
<tr>
<td>Spare Tank Space</td>
<td>Distributed space from mid FY 1999 on</td>
</tr>
</tbody>
</table>

- Starting in FY 1999, 0.72 Mgal of operational space in the evaporator Feed and Receipt Tanks (Tanks 102-AW and 106-AW) was used as spare space (Awadalla, 1995) in all three projection cases.
It was assumed that the TRU solids in Tank 102-SY would be retrieved to Tank 105-AW starting in July 2009. The NCRW solids in Tank 105-AW were not combined with the solids in Tank 103-AW 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 a description of each of the facility generations in Section 3.

Tank 108-AP is currently receiving direct transfers of wastes from B Plant and tanker truck shipments via 204-AR vault from S Plant, T Plant, 100 Area, 300 Area, and 400 Area.

Tank 106-AP will be used as the complexed SWL receiver and Tanks 101-AN and 108-AP as the non-complexed SWL receivers in 200 East Area (Vladimiroff, 1999).

Projected waste generations for Tank Farms were based on a combination of previously observed waste generation rates, anticipated operational needs, and chemical additions that are explained below:

Tank Farm water additions to DSTs. Tank Farms waste generation rates and flushing activities generally increase with the restart of the 242-A Evaporator due to the additional waste transfers. The 242-A Evaporator was restarted in April 1994. During the period April 1994 through May 1995, the average monthly waste generation rate for Tank Farms was 10.92 Kgal/month. The average monthly waste generation for Tank Farms during FY 1998 was 3.7 Kgal/month. The target rate set for Tank Farms waste generations 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 WVR for evaporation of these flushes to DSSF was 99% (Sederburg, 1995).

Cross-site Transfers. All projection cases assumed that either the existing cross-site transfer line or the new cross-site transfer line (Project W-058, operational in FY 1998) would be available to allow cross-site transfer of SWL, facility generations, DST solids from Tank 102-SY and/or SST solids. It was assumed that all wastes containing solids would be cross-sited via the new line which has inline pumps to Tank 104-AN. Without operable cross-site lines many of the TPA (and/or Consent Decree) milestones involving West area wastes could not be achieved.

All three projection cases assumed that approximately 35 Kgal of water would be needed to flush after each cross-site transfer. During the period 1999-2003, approximately two to four cross-sites would be needed each year due to the volume of SWL being pumped. Based on the projected cross-site testing and transfers anticipated, 70 Kgal/year was projected for the period FY 1999-2003. All three projection cases used the same volumes for cross-site transfer line tests and flushes. The WVR for evaporation of these flushes to DSSF was 99% (Sederburg, 1995).
Tank Fill Limits (except for special tank fill considerations):
- AY, AZ Tanks: 980 Kgals
- All other DSTs: 1140 Kgals

The special tank fill considerations used to simulate tank transfers in this projection are listed below:

- Tank 102-SY: 1082 Kgal maximum operational fill limit; minimum drawdown level is 358 Kgal until TRU solids have been removed.
- Tank 102-AY: Start transfer at 900 Kgal.
- Dilute receivers are projected to be pumped down to 28 Kgal above solids.

3.12 UO₂ FACILITY

Deactivation of the UO₂ Facility is complete and therefore, no waste will be sent to DSTs.

3.13 WASTE SAMPLING AND CHARACTERIZATION FACILITY (WSCF)

The Waste Sampling and Characterization Facility (WSCF) was started in FY 1994. This projection assumed that WSCF would send its waste to ETF and not to DSTs (Collins, 1996).

3.14 100 AREA

100-N Basin
The 100-N Basin was constructed in 1963 to receive irradiated fuel assemblies discharged from the N Reactor for the purpose of inspection, storage, and preparation for shipment. In 1988 the N Reactor was placed in a "cold standby" status (shutdown but capable of restarting). In 1989 all nuclear fuel was removed from N Basin and transferred to K Basin. In 1991, RL directed Westinghouse to begin deactivation activities. A significant quantity of radioactively contaminated equipment, hardware, debris, and sediment have accumulated in 100-N Basin that will need to be removed. It was assumed that deactivation of the N Basin would not send any wastes to DSTs but wastes would instead be transferred to the Environmental Restoration Disposal Facility (ERDF) (Logan, 1998).

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 K Basin where the fuel handling occurred. Aluminum oxide, iron oxide, concrete grit, and other debris has accumulated and mixed with the fuel corrosion products to form a sludge on the basin floor. Approximately 430 Kgal of water and sediment (approximately 98 Kgal of sediment) will be transferred to DSTs (Rutherford, 1999). New schedules project that these wastes will be transferred to Tank 105-AW in FY 2004 to 2005. The above generations for 100-K Basin cleanout were used in all three projection cases.
105-F & 105-H Basins

Plans to cleanout the 105-F and 105-H Basins are still being reviewed and the date of cleanout is uncertain due to funding. The projected plan is to clean out the 40,000 gallons in 105-F in the year 2001 and the 200,000 gallons from 105-H in the year 2008 (Mihalic, 1997 and Griffin, 1999). These assumptions for 105-F and 105-H Basin cleanout were used for all three projection cases.

The WVRF for evaporation of all 100 Area Basin wastes to DSSF is 99% (Sederburg, 1995). Flush volume for 100 Area wastes is 44%.

3.15 300 AREA

Facilities in the 300 Area are used primarily for research and development activities or for analytical support. Some waste received in FY 1995 was generated by decon of facilities. As of October 1998, radioactive waste from 300 Area facilities will no longer be transferred to the 340 Facility. Liquid wastes collected in 300 Area will be shipped to the 204-AR vault via a tanker truck due to the cessation of rail service at Hanford (Halgren, 1999). In the future, a new facility will be installed for Pacific Northwest National Laboratory to transfer wastes from its 300 Area facilities to the DSTs.

The 320 Facility projected that it would send from 1 to 25 Kgal/year to tank farms during the period 1999 through 2006 (Halgren, 1999). The 324 Facility has estimated it would send 90,000 gallons of waste to tank farms during the period 2000 to 2005 (Hafla, 1999). Facilities in the 300 Area sent 15 Kgal of waste (includes flush) to DSTs (~1.3 Kgal/month) in FY 1998. Based on the facility inputs, all three projection cases projected that 0.11 to 3.4 Kgal/month of miscellaneous waste would be sent from 300 Area Facilities to Tank Farms. See the spreadsheet in Section 5.1 for a listing of the volume of waste projected for each year for 300 Area Facilities. Based on the chemical composition supplied for 300 Area waste streams, the WVRF for evaporation of 300 Area miscellaneous wastes to DSSF is 94% (Sederburg, 1995). Flush volume for 300 Area waste streams is 44%.

3.16 400 AREA

There are three major facilities in the 400 Area (Dillhoff, 1997). These include the Fast Flux Test Facility (FFTF), the Maintenance and Storage Facility (MASF), and the Fuel and Material Examination Facility (FMEF). Radioactive liquid waste is primarily generated in conjunction with the removal of residual sodium from reactor components or with decontamination activities. A phased process was begun in December 1993 to place the FFTF into a radiologically and industrially safe shutdown condition. Shutdown of the FFTF has increased the amount of liquid waste generated by the plant's Sodium Removal System. Approximately 11 Kgal of wastes were received from 400 Area in FY 1994-1995 (~0.5 Kgal/month). With the loss of the railroad system at Hanford, the 400 Area will be sending its radioactive wastes to the Effluent Treatment Facility in 200 Area (Dahl, 1999). All three projection cases projected no wastes would be sent from the 400 Area facilities to tank farms.
3.17 PHASE 1B PRIVATIZATION PROCESSING

Privatization Concept. The revised DOE strategy for treatment of Hanford tank wastes, termed "privatization," would use private contractors to design, permit, build, operate, and decommission the facilities for waste treatment and immobilization (DOE, 1995). Final details of the privatization work will not be developed until later in the process and the assumptions listed below are subject to change. As currently proposed, privatization would be divided into two phases. Phase 1B would include privatization of waste tank supernatant processing, Low-Activity Waste (LAW) immobilization, and High-Level Waste (HLW) immobilization (Washenfelder, 1996b) by a private contractor. The scale of processing during Phase 1B of privatization has been established to demonstrate the technical and commercial capability. Phase 2 of privatization would include additional tank waste retrieval, supernatant processing, sludge/solid processing, LAW immobilization, HLW immobilization, and interim storage of immobilized waste (Washenfelder, 1996a and Kirkbride, 1999a). The schedule and assumptions listed below were used for the Case 1 and 2 projections and were based on Disposal Engineering Case 3s3 (Kirkbride, 1999b and Harmsen, 1999a). Cases 3 used a different waste treatment schedule than the schedule used for Cases 1 and 2. The waste treatment schedule used for Case 3 is presented in Section 4.0 along with the other assumptions unique to this projection case.

Phase 1B Schedule. The facility startup schedule for Phase 1B is summarized below (used for all three projections):

- LAW and HLW Pretreatment start date: October 2005
- HLW vitrification start date: April 2006
- LAW vitrification start date: March 2007

Intermediate Feed Staging Tanks. Tanks 101-AN, 104-AN, 105-AN, and 106-AN were used for intermediate staging of wastes by the Project Hanford Management Contractor (PHMC) (Kirkbride, 1999a).

Privatization Contractor (BNFL) Feed Tanks. Wastes from the intermediate feed staging tanks will be transferred to feed tanks which will be built by BNFL (Taylor, 1999).

HLW Processing and Immobilization. Phase 1B processing of tank waste sludges would involve sludges in Tanks 101-AZ, 102-AZ, 102-AY (includes C-106 solids), 103-AW, 101-AY, and 102-SY. Phase 1B-Prime (extended order) would process sludges from C-104, 104-AW, C-107, and 105-AW (Kirkbride, 1999b). Blends of sludges were processed based on information received from Disposal Engineering (Kirkbride, 1999b). All cases assumed that no in-tank washing of solids would occur.

In Revision 21 of this document, it was assumed that all NCAW solids and the 106-C solids would be combined into one aging waste tank (Tank 102-AZ) and that all NCAW supernates would be concentrated into one aging waste tank (Tank 101-AZ). Since that document was published, studies have been completed which looked at numerous sludge washing/combination options (Powell, 1996a). The alternatives for consolidating high heat sludges have been reviewed by a
decision board comprised of Hanford contractor management, a DOE/RL representative, and a WDOE representative. It was concluded that consolidating all the sludges into a single tank would require modifications to the tank farm safety basis. The preliminary decision reached was not to consolidate all the high heat sludges into a single tank.

**HLW Processing Rate.** The HLW processing rate used for projection Cases 1 and 2 is based on Disposal Engineering Case 3s3 (Kirkbride, 1999b) and is listed below by year:

<table>
<thead>
<tr>
<th>Projection Cases 1 &amp; 2</th>
<th>Canisters/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yr</td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>100</td>
</tr>
<tr>
<td>3-12</td>
<td>120 (100%)</td>
</tr>
<tr>
<td>13on</td>
<td>480 (400%)</td>
</tr>
</tbody>
</table>

**Low-Activity Waste (LAW) Treatment.** The current DOE strategy calls for a demonstration of LAW treatment and immobilization by a private vendor at a rate dependent on the type of waste being processed. Envelope A feed is typically double-shell slurry feed (DSSF), double-shell slurry (DSS), or dilute non-complexed waste (DN). Envelope B feed is untreated NCAW supernate. Envelope C feed is typically complexant concentrate (CC). The processing schedule, sequence of waste processed, and the approximate sodium quantity processed for projection Cases 1 and 2 is listed in Table 6 (Harmsen, 1999a and Kirkbride, 1999b). The LAW processing rate used for Cases 1 and 2 is listed below by year:

<table>
<thead>
<tr>
<th>Projection Cases 1 &amp; 2</th>
<th>units/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yr</td>
<td></td>
</tr>
<tr>
<td>1-3</td>
<td>800 (73%)</td>
</tr>
<tr>
<td>4-11</td>
<td>1100 (100%)</td>
</tr>
<tr>
<td>12on</td>
<td>2200 (200%)</td>
</tr>
</tbody>
</table>

**Storage of Separated TRU and Entrained Solids.** For all projection cases, the entrained solids and transuranic (TRU) elements removed from LAW waste by the private contractor were not returned to tank farms.
Table 6. Projected LAW Processing Schedule for Projection Case 1

<table>
<thead>
<tr>
<th>Tank</th>
<th>Waste Type</th>
<th>Envelope</th>
<th>Volume with solids (Kgal)</th>
<th>Approximate Quantity of Na Delivered (MT Na)</th>
<th>Existing or Future Waste</th>
<th>Transfer Date to Intermediate Staging Tank</th>
<th>Processing Start Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>104-AN</td>
<td>DSSF</td>
<td>A</td>
<td>1052</td>
<td>~1098</td>
<td>Existing</td>
<td>9/2006</td>
<td>2/2008</td>
</tr>
<tr>
<td>105-AN</td>
<td>DSSF</td>
<td>A</td>
<td>1128</td>
<td>~1053</td>
<td>Existing</td>
<td>10/2008</td>
<td>11/2010</td>
</tr>
<tr>
<td>101-SY</td>
<td>CC</td>
<td>A</td>
<td>~2169</td>
<td>~727</td>
<td>Existing</td>
<td>12/2009</td>
<td>7/2011</td>
</tr>
<tr>
<td>103-AN</td>
<td>DSS</td>
<td>A</td>
<td>957</td>
<td>~1249</td>
<td>Existing</td>
<td>3/2011</td>
<td>3/2012</td>
</tr>
<tr>
<td>BNFL</td>
<td>NCAW Supernate</td>
<td>A</td>
<td>~900</td>
<td>~637</td>
<td>Existing</td>
<td>N/A</td>
<td>4/2013</td>
</tr>
</tbody>
</table>

Start of Phase 1B Prime (contract extension)

<table>
<thead>
<tr>
<th>Tank</th>
<th>Waste Type</th>
<th>Envelope</th>
<th>Volume with solids (Kgal)</th>
<th>Approximate Quantity of Na Delivered (MT Na)</th>
<th>Existing or Future Waste</th>
<th>Transfer Date to Intermediate Staging Tank</th>
<th>Processing Start Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>101-AW</td>
<td>DSSF</td>
<td>A</td>
<td>1125</td>
<td>~1031</td>
<td>Existing</td>
<td>10/2011</td>
<td>11/2013</td>
</tr>
<tr>
<td>104-AW</td>
<td>DSSF</td>
<td>A</td>
<td>1119</td>
<td>~475</td>
<td>Future</td>
<td>2/2012</td>
<td>11/2014</td>
</tr>
<tr>
<td>103-SY</td>
<td>CC</td>
<td>C</td>
<td>741</td>
<td>~586</td>
<td>Existing</td>
<td>12/2010</td>
<td>5/2015</td>
</tr>
</tbody>
</table>

3.18 PHASE 2 PRIVATIZATION PROCESSING

The scale of processing during Phase 1B of privatization has been established to demonstrate the technical and commercial capability. Phase 2 of privatization would include the remaining tank waste retrieval, supernatant processing, sludge/solid processing, LAW immobilization, HLW immobilization, disposition of encapsulated Cs/Sr, and interim storage of immobilized waste (Washenfelder, 1996b). The Phase 2 rates are "2X" starting in 2018 (Kirkbride, 1999a).

3.19 WATCH LIST/SAFETY

Due to recent increases in the level in Tank 101-SY, all three projection cases assumed that agitation using a mixer pump would no longer be sufficient for mitigation of the flammable gas buildup in Tank 101-SY. It was assumed that Tank 101-SY would require retrieval and dilution to mitigate the flammable gas buildup. In the Tank 101-SY remediation project plan (Raymond, 1999), it was recommended that a portion of the waste in Tank 101-SY be retrieved with 1:1 dilution to remediate the flammable gas buildup in Tank 101-SY in two stages defined as follows:

a. Minor Dilution. Approximately 100-150 Kgal of waste would be retrieved from Tank 101-SY to 102-SY with 1:1 dilution September 1999. To be conservative, all three projections assumed that 150 Kgal would be retrieved. Tank 101-SY would be refilled with water and the tank would be monitored to see if the flammable gas buildup had been solved—if so, the second stage mentioned below might not be necessary. Waste retrieved in the minor dilution would be cross-sited to AP farm for future evaporation.
**b. Major Dilution.** Assuming that the minor dilution above did not remediate Tank 101-SY, approximately 500 Kgal of waste would be retrieved from Tank 101-SY to Tank 102-SY with 1:1 dilution. This retrieval and dilution would occur in three stages beginning on March 8, 2000; April 26, 2000; and June 15, 2000. The diluted waste (along with commingled DN/DC SWL waste) would be cross-sited from Tank 102-SY to Tank 106-AP and held as Phase 1B feed without being re-evaporated. [Late Note--at the time the document was distributed, the revised plan would transfer the diluted waste to Tank 104-AP]. In all three projections, it was assumed that the minor dilution would be insufficient and that the major dilution would occur as described above.

Tank 103-SY was diluted to approximately 7 M Na and transferred via Tank 104-AN to Tank 106-AN. In projection Case 1, the transfer to Tank 104-AN occurred early in FY 2011.

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

All three cases assume that the authorization basis is amended to support all activities related to Phase 1B activities (for example, LAW feed staging and delivery, HLW feed staging and delivery, etc.

**3.20 SPARE/CONTINGENCY SPACE**

Spare space is space reserved in case of a leak in a double-shell tank per DOE Order 5820.2A. Contingency space has historically been set aside to account for possible inaccuracies in the WVP software when projecting waste generation and/or waste volume reduction factors.

A total of 2.28 million gallons (one aging and one non-aging tank) of spare/contingency space was reserved for all three projection cases. The PHMC has been requested to provide the capability to receive up to one million gallons of BNFL waste returns on an emergency basis within the 2.28 million gallons of total spare space (Taylor, 1999).

From FY 1999 on, 0.72 million gallons of the operational space in Tanks 102-AW and 106-AW was designated as part of the 2.28 million gallons of spare space (Awadalla, 1995) in all three projection cases. The remaining 1.56 million gallons of space was distributed spare space.

**3.21 WASTE SEGREGATION**

Waste segregation and compatibility are requirements of DOE Order 5820.2A (DOE, 1990) and 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 farm operations; to minimize future processing costs; and to comply with DOE Order 5820.2A and WAC 173-303-393. Wastes that are typically segregated include:

- Phosphate Wastes--dilute phosphate (DP) or concentrated phosphate (CP).
- Wastes Containing High Organic Concentrations—dilute complexed (DC) or complexant concentrate (CC).
- TRU containing wastes—Neutralized Cladding Removal Wastes (NCRW solids) or PFP solids (PT).
- Watch list tank wastes to prevent inadvertent commingling with other wastes.
- Pretreated waste streams.
- Washed NCAW solids, etc.
- Concentrated interim waste types—e.g., double-shell slurry feed (DSSF) or double-shell slurry (DSS) need to be separated from dilute wastes to prevent the need to reconcentrate.
- Wastes exhibiting exothermic reactions.

All three projections assume that current waste segregation practices are observed (if possible) with the exception of SWL pumping in 200 West Area as discussed in Section 3.8. Waste segregation practices are summarized in Table 7. For all projection cases, non-complexed and complexed SWL wastes in 200 East Area were mixed for evaporation purposes beginning in FY 2000. RL has allowed the commingling of non-complexed and complexed SWL as necessary to allow the stabilization of single-shell tanks (Kinzer, 1998).

**Table 7. Waste Compatibility Matrix**

<table>
<thead>
<tr>
<th>Receiver Waste Type</th>
<th>DN</th>
<th>DSSF</th>
<th>DC</th>
<th>CC</th>
<th>(PD) NCRW</th>
<th>PT</th>
<th>NCAW</th>
<th>CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>DSSF</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC</td>
<td></td>
<td></td>
<td>X</td>
<td>X*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td></td>
<td></td>
<td>X*</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(PD) NCRW SOLIDS</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(PT) PFP SOLIDS</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCAW</td>
<td></td>
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<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>CP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

(*) 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.
3.22 LOSS OF DST SPACE

Corrosion studies completed to date (Anantatmula and Ohl, 1996) show a 40%-60% chance of a pit corrosion failure occurring in a DST by FY 2028. Some of the corrosion potential could be mitigated by maintaining a corrosion control program for the DSTs. In all three projection cases, it was assumed that none of the DSTs would be removed from service by the end of FY 2018.

3.23 NEW DST CONSTRUCTION

All three projection cases assumed that no new DSTs would be constructed by 2018.

3.24 DST TANK SOLIDS LEVELS

Solids levels in the DSTs are shown in Table 8 (Hanlon, 1999; Estey and Guthrie, 1996; Stauffer, 1997; and Carothers, 1997b). Solids levels have been estimated for the tanks marked with an asterisk (*) based on the previous solids level measurement and the percent solids in facility generations that have been added to the tank since the last solids level measurement. Tanks with no solids level listed have either not been measured or have a minimal solids volume. The total DST solids used for this projection was approximately 4.1 Mgal. The solids level in Tank 102-AY does not reflect the addition of Tank C-106 solids in FY 1999 (total solids as of June 30, 1999 was approximately 137 Kgal).

Table 8. DST Solids Levels (Kgal)

<table>
<thead>
<tr>
<th>TANK</th>
<th>SOLIDS</th>
<th>TANK</th>
<th>SOLIDS</th>
<th>TANK</th>
<th>SOLIDS</th>
<th>TANK</th>
<th>SOLIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>101-AY</td>
<td>108</td>
<td>101-AN</td>
<td>33</td>
<td>101-AP</td>
<td>105-AP</td>
<td>89</td>
<td>101-AW</td>
</tr>
<tr>
<td>102-AY</td>
<td>22</td>
<td>102-AN</td>
<td>89</td>
<td>102-AP</td>
<td>104-AP</td>
<td>449</td>
<td>102-AW</td>
</tr>
<tr>
<td>101-AZ</td>
<td>47</td>
<td>103-AN</td>
<td>410</td>
<td>103-AP</td>
<td>105-AP</td>
<td>489</td>
<td>103-AW*</td>
</tr>
<tr>
<td>102-AZ</td>
<td>104</td>
<td>104-AN</td>
<td>89</td>
<td>104-AP</td>
<td>105-AP</td>
<td>17</td>
<td>104-AW*</td>
</tr>
<tr>
<td>101-SY</td>
<td>41</td>
<td>105-AN</td>
<td>89</td>
<td>105-AP</td>
<td>106-AP</td>
<td>89</td>
<td>105-AW</td>
</tr>
<tr>
<td>102-SY</td>
<td>88</td>
<td>106-AN</td>
<td>17</td>
<td>106-AP</td>
<td>106-AP</td>
<td>280</td>
<td>106-AW</td>
</tr>
<tr>
<td>103-SY</td>
<td>362</td>
<td>107-AN</td>
<td>247</td>
<td>107-AP</td>
<td>107-AP</td>
<td>247</td>
<td>108-AP</td>
</tr>
</tbody>
</table>

3.25 IMUST WASTES

Approximately 500 kilogallons of wastes are projected to be received from Inactive Miscellaneous Underground Storage Tanks (IMUSTs) between FY 2011 and 2015 (Wacek, 1996). This is a new waste type added to these projections.

3.26 ASSUMPTION SUMMARY

Assumptions used for all cases are presented in Table 9. Differences in assumptions between the three cases have been highlighted.
## Table 9. Assumption Matrix
For the 1999 Operational Waste Volume Projection
(All Years are Fiscal Years)

<table>
<thead>
<tr>
<th>Brief Description</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposal Case 3s3 waste processing. TPA Compliant SST solids retrieval. AN Feed Tanks. SWL complete 2004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meets TPA Milestones</td>
<td>Yes (Consent Decree for SWL Pumping)</td>
<td><strong>No</strong></td>
<td><strong>No</strong></td>
</tr>
<tr>
<td>Facility Generations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Limit, Kgal/mo</td>
<td>14.0-17.4</td>
<td>14.0-17.4</td>
<td>14.0-17.4</td>
</tr>
<tr>
<td>PUREX</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yearly Rate, Kgal/yr</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>TCO Scheduled</td>
<td>Completed</td>
<td>Completed</td>
<td>Completed</td>
</tr>
<tr>
<td>TCO Volume, Kgal</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flush for PUREX wastes</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>WVRF for TCO (to DSSF)</td>
<td>99</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>B Plant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yearly Rate, Kgal/yr</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TCO Scheduled</td>
<td>Completed</td>
<td>Completed</td>
<td>Completed</td>
</tr>
<tr>
<td>WESF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Rate, Kgal/mo</td>
<td>0.42</td>
<td>0.42</td>
<td>0.42</td>
</tr>
<tr>
<td>Flush for misc. waste</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>WVRF, misc. waste (to DSSF)</td>
<td>99</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>S Plant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Rate, Kgal/mo</td>
<td>0.83 to 1.0</td>
<td>0.83 to 1.0</td>
<td>0.83 to 1.0</td>
</tr>
<tr>
<td>Flush for misc. waste</td>
<td>22%</td>
<td>22%</td>
<td>22%</td>
</tr>
<tr>
<td>WVRF, misc. waste (to DSSF)</td>
<td>99</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>T Plant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Rate, Kgal/mo</td>
<td>2.1</td>
<td>2.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Flush for misc. waste</td>
<td>22%</td>
<td>22%</td>
<td>22%</td>
</tr>
<tr>
<td>WVRF, misc. waste (to DSSF)</td>
<td>99</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>300 Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Rate, Kgal/mo</td>
<td>0.11 to 3.4</td>
<td>0.11 to 3.4</td>
<td>0.11 to 3.4</td>
</tr>
<tr>
<td>Flush for misc. waste</td>
<td>44%</td>
<td>44%</td>
<td>44%</td>
</tr>
<tr>
<td>WVRF, misc. waste (to DSSF)</td>
<td>94</td>
<td>94</td>
<td>94</td>
</tr>
<tr>
<td>400 Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Rate, Kgal/mo</td>
<td>0 (to ETF)</td>
<td>0 (to ETF)</td>
<td>0 (to ETF)</td>
</tr>
<tr>
<td>Flush for misc. waste</td>
<td>44%</td>
<td>44%</td>
<td>44%</td>
</tr>
<tr>
<td>WVRF, misc. waste (to DSSF)</td>
<td>94</td>
<td>94</td>
<td>94</td>
</tr>
</tbody>
</table>

**WSCF**

| Monthly Rate, Kgal/mo | 0 (to ETF) | 0 (to ETF) | 0 (to ETF) |
Table 9. Assumption Matrix
For the 1999 Operational Waste Volume Projection
(continued)

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tank Farms</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monthly Rate, Kgal/mo</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>WVRF, flushes (to DSSF)</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td><strong>IMUST Wastes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tot. Volume, Kgal (2011-15)</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td><strong>100 Area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100-N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCO Scheduled</td>
<td>Completed</td>
<td>Completed</td>
</tr>
<tr>
<td>TCO Waste Received</td>
<td>N/A-send to ERDF</td>
<td>N/A-send to ERDF</td>
</tr>
<tr>
<td>TCO Volume, Kgal</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>100-K Basin Cleanout</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCO Total Volume, Kgal</td>
<td>430</td>
<td>430</td>
</tr>
<tr>
<td>Volume of Solids included</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td><strong>105-F &amp; 105-H Basin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCO waste in 2001, Kgal</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>TCO waste in 2008, Kgal</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td><strong>Flush, ALL 100 Area Waste</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44%</td>
<td>44%</td>
<td>44%</td>
</tr>
<tr>
<td>WVRF, ALL TCO waste (to DSSF)</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td><strong>Tank 107-AN Caustic Addition</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Addition in FY 2001 (Kgal)</td>
<td>66</td>
<td>66</td>
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<tr>
<td><strong>Salt Well Liquid Pumping</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume remaining (Mgal)</td>
<td>6.18</td>
<td>6.18</td>
</tr>
<tr>
<td>Pumping estimate for 1999</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>West Area Receiver</td>
<td>Tank 102-SY</td>
<td>Tank 102-SY</td>
</tr>
<tr>
<td>Pumping Completion, FY</td>
<td>2004</td>
<td>2004</td>
</tr>
<tr>
<td>Dilute Complexed SWL (Mgal)</td>
<td>&quot;1&quot;</td>
<td>&quot;1&quot;</td>
</tr>
<tr>
<td>Porosity saltcake/sludge</td>
<td>50%/21%</td>
<td>50%/21%</td>
</tr>
<tr>
<td>Flush for SWL Pumping</td>
<td>28%</td>
<td>28%</td>
</tr>
<tr>
<td>WVRF, non-complexed (to DSSF)</td>
<td>47</td>
<td>47</td>
</tr>
<tr>
<td>WVRF, complexed (to DSSF)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>Single-Shell Tank (SST) Solids</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start Remaining SST Retvl</td>
<td>2004</td>
<td>2004</td>
</tr>
<tr>
<td>Complete SST Retrieval</td>
<td>2018</td>
<td>2018</td>
</tr>
<tr>
<td>Approximate Dilution Ratio</td>
<td>3:1</td>
<td>3:1</td>
</tr>
<tr>
<td>Retrieved Vol 2004-2005 (Mgal)</td>
<td>2.8</td>
<td>0</td>
</tr>
<tr>
<td>Retrieved Vol 2006-2007 (Mgal)</td>
<td>3.6</td>
<td>0</td>
</tr>
<tr>
<td>Meets TPA Milestones</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>No. SSTs Retrieved</td>
<td>149</td>
<td>149</td>
</tr>
<tr>
<td>Sludge Retrieved (Mgal)</td>
<td>12.2</td>
<td>12.2</td>
</tr>
<tr>
<td>Saltcake Retrieved (Mgal)</td>
<td>23.4</td>
<td>23.4</td>
</tr>
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</table>
Table 9. Assumption Matrix
For the 1999 Operational Waste Volume Projection
(continued)

<table>
<thead>
<tr>
<th></th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PFP Stabilization</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume, Kgal</td>
<td>33</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Flush</td>
<td>22%</td>
<td>22%</td>
<td>22%</td>
</tr>
<tr>
<td>WVRF</td>
<td>81</td>
<td>81</td>
<td>81</td>
</tr>
<tr>
<td><strong>Evaporator</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>242-A Shutdown</td>
<td>~2011</td>
<td>~2011</td>
<td>~2011</td>
</tr>
<tr>
<td>New Evaporator Available</td>
<td>Phase 2</td>
<td>Phase 2</td>
<td>Phase 2</td>
</tr>
<tr>
<td>Next Outage Date</td>
<td>2004 (1 Yr)</td>
<td>2004 (1 Yr)</td>
<td>2004 (1 Yr)</td>
</tr>
<tr>
<td>Training Vol. (bi-yearly)</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Ave. Evap Rate, Kgal/mo</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Evaporation Product</td>
<td>dilute DSSF</td>
<td>dilute DSSF</td>
<td>dilute DSSF</td>
</tr>
<tr>
<td>Evaporation Limit (g/ml)</td>
<td>1.41</td>
<td>1.41</td>
<td>1.41</td>
</tr>
<tr>
<td>LERF capacity (Mgal)</td>
<td>13</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Gal. condensate/gal. WVR</td>
<td>1.20</td>
<td>1.20</td>
<td>1.20</td>
</tr>
<tr>
<td>Interval between campaigns(mos)</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Yearly evaporation of DN</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>(except for scheduled outage)</td>
<td></td>
<td></td>
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<tr>
<td><strong>Effluent Treatment Facility</strong></td>
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<td></td>
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</tr>
<tr>
<td>Rate (Mgal/year)</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td><strong>Watch List/Safety</strong></td>
<td></td>
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<tr>
<td><strong>Spare/Contingency Space</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Spare Space, Mgal</td>
<td>2.28</td>
<td>2.28</td>
<td>2.28</td>
</tr>
<tr>
<td>Use 0.72 Mgal of Operational space in 106-AW as part of spare space from 1999 on</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Contingency space, Mgal</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>-date</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Waste Segregation/DST Solids</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Total DST solids (Mgal)</td>
<td>~4</td>
<td>~4</td>
<td>~4</td>
</tr>
<tr>
<td>Store DSSF on NCRW solids</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Store DSSF on NCAW solids</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Segregate Complexed wastes</td>
<td>If Possible</td>
<td>If Possible</td>
<td>If Possible</td>
</tr>
<tr>
<td><strong>Loss of DST Space</strong></td>
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<tr>
<td>Number Tanks Removed from Service</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td><strong>New DST Construction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date Constructed</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>New Cross-Site Transfer Line</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>New line operational</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Old line operational</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</table>
Table 9. Assumption Matrix
For the 1999 Operational Waste Volume Projection
(continued)

<table>
<thead>
<tr>
<th>DST Retrieval</th>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidation of NCRW solids in 103-AW &amp; 105-AW</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waste Processing</th>
<th>Disposal Case 3s</th>
<th>Disposal Case 3s</th>
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</tr>
</thead>
<tbody>
<tr>
<td>LAW Phase 1B Processing by Year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yr</td>
<td>units/yr</td>
<td>Yr</td>
<td>units/yr</td>
</tr>
<tr>
<td>-----</td>
<td>---------</td>
<td>-----</td>
<td>---------</td>
</tr>
<tr>
<td>1-3</td>
<td>800 (73%)</td>
<td>1-3</td>
<td>800 (73%)</td>
</tr>
<tr>
<td>4-11</td>
<td>1100 (100%)</td>
<td>4-11</td>
<td>1100 (100%)</td>
</tr>
<tr>
<td>12+</td>
<td>2200 (200%)</td>
<td>12+</td>
<td>2200 (200%)</td>
</tr>
<tr>
<td>5</td>
<td>60 (200%)</td>
<td>6+</td>
<td>120 (400%)</td>
</tr>
<tr>
<td>LAW Phase 2 Processing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase 1B minimum contract quantity processed by:</td>
<td>~ 2013</td>
<td>~ 2013</td>
<td>~ 2012</td>
</tr>
<tr>
<td>Total Processed Quantities:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Envelope A (MT Na)</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Envelope B (MT Na)</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Envelope C (MT Na)</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>Staging/Characterization time per tank</td>
<td>100 days</td>
<td>100 days</td>
<td>100 days</td>
</tr>
<tr>
<td>Approximate Concentration of retrieved DSSF, CC</td>
<td>7 M, Na</td>
<td>7 M, Na</td>
<td>7 M, Na</td>
</tr>
<tr>
<td>LAW Retrieval Schedule (not processing dates)—First five waste sources:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source 4</td>
<td>105-AN(10/2008)</td>
<td>105-AN(10/2008)</td>
<td>102-AN(10/2009)</td>
</tr>
<tr>
<td>Interim Feed Staging Tanks (1AN,6AN,4AN,5AN)</td>
<td>(1AN,6AN,4AN,5AN)</td>
<td>(1AN,6AN,4AN,5AN)</td>
<td>(1AN,6AN,4AN,5AN)</td>
</tr>
<tr>
<td>Vendor Feed Tanks</td>
<td>BNFL Space</td>
<td>BNFL Space</td>
<td>BNFL Space</td>
</tr>
<tr>
<td>Pretreated NCAW Receipt Tank</td>
<td>BNFL Space</td>
<td>BNFL Space</td>
<td>BNFL Space</td>
</tr>
<tr>
<td>Entr. Solid Receipt Tanks</td>
<td>BNFL Space</td>
<td>BNFL Space</td>
<td>BNFL Space</td>
</tr>
<tr>
<td>HLW Phase 1 Processing by year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yr</td>
<td>Canisters/yr</td>
<td>Yr</td>
<td>Canisters/yr</td>
</tr>
<tr>
<td>-----</td>
<td>-------------</td>
<td>-----</td>
<td>-------------</td>
</tr>
<tr>
<td>1-2</td>
<td>100</td>
<td>1-2</td>
<td>100</td>
</tr>
<tr>
<td>3-12</td>
<td>120 (100%)</td>
<td>3-12</td>
<td>120 (100%)</td>
</tr>
<tr>
<td>13+</td>
<td>480 (400%)</td>
<td>13+</td>
<td>480 (400%)</td>
</tr>
<tr>
<td>6</td>
<td>6. (400%)</td>
<td>7+</td>
<td>12. (800%)</td>
</tr>
<tr>
<td>HLW Phase 2 Processing</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.0 ASSUMPTIONS FOR PROJECTION CASES 2 AND 3

Case 1 (TPA Compliant) is meant to project DST needs based on established TPA milestones (Consent Decree milestones for SWL pumping), RPP program planning, and the most realistic operational assumptions (described in Section 3). Case 1 used waste processing assumptions from Disposal Engineering's Case 3s3 (Kirkbride, 1999b) but added in a TPA Compliant SST solids retrieval schedule received from Disposal Engineering (Penwell, 1998). Case 1 presents a basis for evaluating future DST space needs for the TPA Compliant case through the end of FY 2018. The TPA compliant SST solids retrieval schedule would start retrieval in December 2003 (M-45-03-T1) and be completed by the end of FY 2018 (TPA milestone).

The Case 2 and Case 3 projections present a range of operational assumptions meant to determine the impact of changes in the SST solids retrieval schedule and processing schedule on DST needs. The Case 2 and Case 3 projections do not present a lower or an upper limit on double-shell tank needs which could vary significantly depending on the assumption changes. The following section will describe assumptions specific to the Case 2 and Case 3 projections. These assumptions are also summarized in Table 9.

Projection Case 2 presents projected DST space needs based on the same processing schedule used for Projection Case 1 with the SST solids retrieval schedule used in Disposal Engineering's Case 3s3. Projection Case 3 uses the processing schedule and SST solids retrieval schedule from Disposal Engineering's Case 6b. Projection Cases 2 and 3 project tank space needs with two different reduced SST solids retrieval schedules. Additional details of the assumptions for these projection cases are included in the following sections.

4.1 PROJECTION CASE 2 ASSUMPTIONS

Assumptions for projection Case 2 are the same as those for the projection Case 1 except for the use of the reduced SST solids retrieval schedule from Disposal Engineering Case 3s3 (Penwell, 1999). This SST solids retrieval schedule would begin retrieving additional solids (solids beyond those needed as HLW feed in Phase 1B) in FY 2004 at a reduced rate as compared to the TPA Compliant schedule used in projection Case 1. The retrieved volume of waste for Case 2 is approximately 0.2 Mgal for FY 2004-2005 and an additional 0.2 Mgal for FY 2006-2007. The as retrieved volumes for the remaining SST solids are shown in the spreadsheet for the Case 2 projection (Section 5.2) and are based on retrieval at 5 M Na.
4.2 PROJECTION CASE 3 ASSUMPTIONS

Assumptions for the Case 3 projection are the same as those for Case 1 except for the use of different waste processing schedules and SST solids retrieval schedule from Disposal Engineering Case 6b (Harmsen, 1999b and Kirkbride, 1999a).

LAW Processing

The LAW processing for Case 3 also begins in March 2007 but at a lower processing schedule as compared to the schedule used in Case 1 but ramps up to a higher processing rate from year six on as shown below:

LAW Phase 1B processing by year

<table>
<thead>
<tr>
<th>Projection Cases 1 &amp; 2</th>
<th>Projection Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yr</strong></td>
<td>units/yr</td>
</tr>
<tr>
<td>1-3</td>
<td>800 (73%)</td>
</tr>
<tr>
<td>4-11</td>
<td>1100 (100%)</td>
</tr>
<tr>
<td>12on</td>
<td>2200 (200%)</td>
</tr>
<tr>
<td>5</td>
<td>60 (200%)</td>
</tr>
</tbody>
</table>

LAW Phase 2 Processing

The schedule used for the first ten LAW waste sources is summarized in Table 10.

Table 10. Projected Processing Schedule for Case 3

<table>
<thead>
<tr>
<th>Tank Type</th>
<th>Waste Type</th>
<th>Envelope</th>
<th>Volume with solids (Kgal)</th>
<th>Approximate Quantity of Na Delivered (MT Na)</th>
<th>Existing or Future Waste</th>
<th>Transfer Date to Intermediate Staging Tank</th>
<th>Processing Start Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNFL</td>
<td>NCAW</td>
<td>A</td>
<td>~900</td>
<td>~637</td>
<td>Existing</td>
<td>N/A</td>
<td>3/2007</td>
</tr>
<tr>
<td>107-AN</td>
<td>CC</td>
<td>C</td>
<td>1044</td>
<td>~652</td>
<td>Existing</td>
<td>5/2005</td>
<td>12/2008</td>
</tr>
<tr>
<td>104-AN</td>
<td>DSSF</td>
<td>A</td>
<td>1052</td>
<td>~1098</td>
<td>Existing</td>
<td>8/2007</td>
<td>9/2009</td>
</tr>
<tr>
<td>102-AN</td>
<td>CC</td>
<td>C</td>
<td>1060</td>
<td>~1080</td>
<td>Existing</td>
<td>10/2009</td>
<td>12/2010</td>
</tr>
<tr>
<td>105-AN</td>
<td>DSSF</td>
<td>A</td>
<td>1128</td>
<td>~1053</td>
<td>Existing</td>
<td>4/2010</td>
<td>8/2011</td>
</tr>
<tr>
<td>101-SY</td>
<td>CC</td>
<td>A</td>
<td>~2169</td>
<td>~727</td>
<td>Existing</td>
<td>6/2011</td>
<td>3/2012</td>
</tr>
<tr>
<td>103-AN</td>
<td>DSS</td>
<td>A</td>
<td>957</td>
<td>~1249</td>
<td>Existing</td>
<td>8/2011</td>
<td>6/2012</td>
</tr>
<tr>
<td>101-AW</td>
<td>DSSF</td>
<td>A</td>
<td>1125</td>
<td>~1031</td>
<td>Existing</td>
<td>3/2012</td>
<td>10/2012</td>
</tr>
<tr>
<td>103-SY</td>
<td>CC</td>
<td>C</td>
<td>741</td>
<td>~586</td>
<td>Existing</td>
<td>6/2012</td>
<td>2/2013</td>
</tr>
<tr>
<td>101-AY</td>
<td>DSSF</td>
<td>A</td>
<td>~844</td>
<td>~699</td>
<td>Future</td>
<td>9/2012</td>
<td>4/2013</td>
</tr>
</tbody>
</table>
**HLW Processing**

The HLW processing for Case 3 also begins in April 2006 but at a lower processing schedule as compared to the schedule used in Case 1 but again ramps up to a higher rate from year six on as shown below:

**HLW Phase 1 Processing by year**

<table>
<thead>
<tr>
<th>Yr</th>
<th>Canisters/yr</th>
<th>Yr</th>
<th>MT IHLW/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>100</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>3-12</td>
<td>120 (100%)</td>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>13on</td>
<td>480 (400%)</td>
<td>3-5</td>
<td>1.5 (100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>6. (400%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7+on</td>
<td>12. (800%)</td>
</tr>
</tbody>
</table>

**SST Solids Retrieval Schedule**

The SST solids retrieval schedule used for Projection Case 3 was based on the schedule used for for Disposal Engineering Case 6b (Penwell, 1999) which would start retrieval in FY 2009 and completed retrieval by the end of FY 2026. The retrieved volume of waste for this case is approximately 0.8 Mgal for FY 2009-2010 and an additional 6 Mgal for FY 2011-2012. The as retrieved volumes for the remaining SST solids are shown in the spreadsheet for the Case 3 projection (Section 5.3) and are based on retrieval at 5 M Na.
5.0 PROJECTION RESULTS

The results of a waste volume projection can be used to forecast tank space needs versus time, forecast evaporator operation, forecast needed LAW processing and disposal rates, HLW processing and storage, analyze tank space issues for aging and non-aging waste tanks, predict tank usage, or to 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 as compared to the available space. Generations and evaporation for the near term (thru 2001) 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 DSSF in the year they are produced, provided an evaporator is operational and the WVR limit of the evaporator has not been exceeded. In later parts of the projections when tank space becomes tight due to processing needs and/or the amount of SST solids being retrieved, the evaporator is assumed to operate yearly even if volumes are small in order to minimize waste storage needs.

Long range projection graphics for the three projection cases are presented in Sections 5.1, 5.2, and 5.3. A tank space requirement graphic and a spreadsheet showing inputs/outputs have been included for all three projections. Short range graphics, tank usage graphics, evaporator WVR data, and a spreadsheet showing inputs/outputs have been included for the projection Cases 1 and 2 only.

This year's projection cases incorporate several space saving assumptions. These space saving alternatives reduce the need to build additional DSTs but add additional risks to the RPP program. These actions and some of the risks are listed below:

- Waste generation rates and TCO volumes have been reduced compared to those used in Rev. 24.
- In Revision 21 of this document, it was assumed that all NCRW and PFP solids could be consolidated into one DST (Awadalla, 1995). In Revs. 22 and 23 of this document, it was assumed that the solids in Tanks 103-AW and 105-AW would not be combined. However, the PFP solids from Tank 102-SY and the solids from the 100 Area TCO activities were combined into Tank 105-AW. To further minimize the impact of this non-consolidation of solids compared to Revision 21, the projections in Revs. 24 and 25 assumed that slurry feed (DSSF) could be stored on top of the solids in Tanks 103-AW and 104-AW. The acceptability of this assumption is still being reviewed.
- Spare space is space reserved in case of a leak in a double-shell tank per DOE Order 5820.2A. 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. A total of 2.28 million gallons (one aging and one non-aging tank) of spare/contingency space was reserved for all three projection cases. This space is distributed space from FY 1999 on. Operational space in Tanks 102-AW and 106-AW was used to provide 0.72 Mgal of the required 2.28 Mgal of spare/contingency space from FY 1999 on (Awadalla, 1995). This assumption change reduces operational space which may create
operational/space problems during the period when SST solids are being retrieved.

- These projections assumed that dilute non-complexed waste could be evaporated to a specific gravity (SpG) of 1.41 rather than the previous 1.35 limit used in the 1995 projection, L9503A (Awadalla, 1995). Analysis has shown that as long as the SpG remains at 1.41 or less that there will not be a buildup of flammable gas in the DSTs (Fowler, 1999). Evaporating the waste to a SpG of 1.41 would save approximately 2/3 of a tank by the end of the projection as compared to the 1995 projection, L9503A.

- Some double-shell tanks are nearing their design life. None of this year's projections provide for the loss of any DST space through 2018. The volume of this impact would be approximately one million gallons if one DST is lost. Spare space would be used if a loss of a double-shell tank should occur.

- All three projections assumed that evaporator capacity would be available on an annual basis from FY 1999-2018 except for a one year outage in FY 2004. A reduction in evaporation capacity during years when space is tight or when waste receipts are high could result in a tank space shortage.

- The PHMC team will need to use Tanks 101-AN, 106-AN, 104-AN, and 105-AN for waste management during the same time frame that Project W-211 is preparing them for use as intermediate feed staging tanks.

- All three projection cases assume that timely permission is obtained to remove waste from watch-list tanks used as LAW feed sources and to remove the watch-list designation from that tank immediately after retrieval/dilution. This means that emptied tanks are immediately available for unrestricted use.

The space savings actions listed above reduce the need for construction of new DST space that was recommended based on a previous projection (Rev. 20) but introduce additional uncertainties and risks into the overall RPP program. If many of these items are not possible or if waste generations exceed those used in this projection, it may be necessary to either delay site cleanup activities, delay TPA milestones (e.g., SWL pumping and/or SST solids retrieval), increase the waste processing rate, or build additional tank space in order to avoid exceeding the available DST space. A special trade study was completed in FY 1999 to assess the space savings, costs, and risks associated with many of the space saving alternatives mentioned above (Garfield, 1999). This study states that sufficient DST is available to support waste feed delivery and that no action is necessary at this time to build new double-shell tanks. This assumes a reduced retrieval of SST solids.
5.1 PROJECTION CASE 1 RESULTS

Assumptions for the Case 1 projection represent the current planning basis for RPP programs to meet TPA commitments (Consent Decree milestones for SWL pumping). The LAW and HLW waste processing schedules used in Case 1 are based on the project planning baseline guidance provided by the Office of River Protection (ORP) in April 1999 (Taylor, 1999) coupled with a Tri-Party Agreement compliant SST solids retrieval schedule (Penwell, 1998). The projected tank space needs for the Case 1 projection, both with and without SST solids retrieval, are shown in Figure 3. "Without SST solids retrieval" refers to no additional SST retrieval beyond those solids scheduled to be retrieved for HLW vitrification feed for Phase 1B. The required tank space for the Case 1 projection without additional SST solids retrieval is near the available space for the period FY 2001-2005 due to the number of tanks required for SWL pumping and storage. Three tanks (Tanks 101-AN, 106-AN, and 108-AP) are projected to be used for SWL pumping in the 200 East Area while only one tank (tank 102-SY) is used for SWL pumping in the 200 West Area. Decreasing the number of tanks used for SWL pumping in the 200 East area could be used to decrease the required tanks space for Case 1 during the period FY 2000-2003 should the need arise.

The required tank space for the Case 1 projection with the TPA compliant SST solids retrieval schedule exceeds available space by one tank in FY 2004, by up to three tanks in FY 2005-2006, by up to ten tanks by FY 2010, and by up to twenty-five tanks by the end of FY 2012. The tank space shortage during the period FY 2004-2018 is the result of the delay in the start of waste processing and the reduced waste processing rates compared to the waste processing assumptions that were used when the TPA milestones were initially negotiated. The waste processing schedule used in Case 1 will not free up DST space fast enough to support the TPA compliant SST solids retrieval schedule. Furthermore, acceleration of the waste processing rate alone to meet the storage requirements for the TPA compliant SST solids retrieval schedule would require unrealistically high processing rates. If the waste processing rates used in Case 1 were held constant, building additional tanks to meet the storage requirements for the TPA compliant SST solids retrieval schedule would require building an excessive amount of tanks. Avoiding or meeting the projected tank space shortage would require a combination of the following options (see Section 6.0 for a more complete listing):

- Reduce the amount of SST solids waste retrieval volume during FY 2004-2018 by renegotiating the TPA milestones.
- Increase Phase 1B and/or Phase 2 processing rates to free up additional tank space.
- Optimize the use of existing DST space--this includes actions such as utilizing DST headspace, etc. (Garfield, 1999).
- Delay SWL pumping to reduce tank space (delays TPA milestones).
- Build additional double-shell tanks.

The required tank space for the Case 1 projection without additional SST solids retrieval beyond those needed to supply feed for HLW vitrification indicates that ample DST space exists to support waste processing but tank space is critical in the FY 2001-2005 timeframe. Space saving options (Garfield, 1999) will continue to be reviewed.
A spreadsheet summarizing the waste generations, evaporator WVR, and processing requirements for the Case 1 projection has been added to this document and is included as Table 11. This spreadsheet is included to present a global view of how the various inputs and outputs affect tank space. This spreadsheet is useful to review waste inventories and waste receipts but cannot accurately predict the dynamics of tank usage or the full impact of partially filled tanks on tank space needs.

RL has requested that the OWVP document should provide a list of all transfers for the next fiscal year (Kinzer, 1999). Appendix B in this document lists all the gains (GA), losses (LO), and transfers (TR) for projection Cases 1 and 2 through FY 2000. For convenience--this listing has been broken into two parts--part 1 includes inventory records, historical transactions for FY 1998, and projected transfers for 1999. Part 2 includes all transfers projected for FY 2000.
Figure 3. Double-Shell Tank Requirements for Case 1 -- TPA Compliant
<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
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<td>18598</td>
<td>18543</td>
<td>21743</td>
<td>23456</td>
<td>24821</td>
<td>23926</td>
<td>20065</td>
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<td>25172</td>
<td>28144</td>
<td>29666</td>
<td>29054</td>
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</tr>
<tr>
<td>Priority/Operational Space</td>
<td>2843</td>
<td>4195</td>
<td>3209</td>
<td>3295</td>
<td>3481</td>
<td>4502</td>
<td>3174</td>
<td>2486</td>
<td>4374</td>
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<td>TOTAL WASTE BEFORE EVAP</td>
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<td>25867</td>
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<td>32980</td>
<td>42945</td>
<td>54678</td>
<td>68017</td>
<td>63792</td>
<td>94765</td>
<td>105743</td>
<td>115460</td>
</tr>
<tr>
<td>Loss due to (B att, Linac, Evap, Surf Chp, Instr, etc.)</td>
<td>-137</td>
<td>0</td>
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<td>Low activity waste</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>High Level Waste Contractor</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NET INVENTORY CHANGE</td>
<td>245</td>
<td>840</td>
<td>2309</td>
<td>1713</td>
<td>1385</td>
<td>-895</td>
<td>2129</td>
<td>718</td>
<td>-1399</td>
<td>2973</td>
<td>1545</td>
<td>92</td>
<td>1716</td>
<td>6540</td>
<td>11545</td>
<td>15978</td>
<td>14271</td>
<td>10299</td>
<td>11077</td>
<td>9269</td>
</tr>
<tr>
<td>END OF YEAR INVENTORY</td>
<td>18598</td>
<td>19438</td>
<td>21743</td>
<td>23456</td>
<td>24821</td>
<td>23926</td>
<td>20065</td>
<td>26771</td>
<td>25172</td>
<td>28144</td>
<td>29666</td>
<td>29054</td>
<td>32598</td>
<td>39777</td>
<td>51122</td>
<td>67099</td>
<td>81571</td>
<td>91829</td>
<td>102724</td>
<td>112103</td>
</tr>
<tr>
<td>TOTAL CAPACITY</td>
<td>26895</td>
<td>27321</td>
<td>29860</td>
<td>30293</td>
<td>31924</td>
<td>32570</td>
<td>32871</td>
<td>33740</td>
<td>34103</td>
<td>35584</td>
<td>36250</td>
<td>40157</td>
<td>4782</td>
<td>42301</td>
<td>4807</td>
<td>59028</td>
<td>73588</td>
<td>90490</td>
<td>96002</td>
<td>100810</td>
</tr>
</tbody>
</table>

Table 11. Spreadsheet of Waste Additions and Reductions for Case 1 with SST Solids Retrieval
Interpretation of Short Range Projection Results

This section provides an interpretation of detailed short range projection results. The OCVF 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 axis represent thousands of gallons of waste generated. An example of this type of graphic is the facility waste generation graphic. The volume generated per month for each facility is depicted on a facility waste generation graph. An example of the facility waste generation graph for PUREX waste is shown below (Figure 4).

![Figure 4. Facility Waste Generation Graphic](image)

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 a specific tank is filled with waste. Usually when a receiver tank is full, waste is transferred to a holding tank. This waste is either evaporated or stored for future disposal. For every transfer out of a tank, there is a corresponding receipt of the same volume into another tank or facility. For every evaporation out of a tank there is a corresponding receipt of the more concentrated waste in the receiving tank and an increase in the condensate from the 242-A Evaporator being sent to the LERF.

An example of this type of graph (a tank fill graphic) for Tank 105-AW is shown below (Figure 5).

![Figure 5. Tank Fill Graphic](image)
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 Sections 3 and 4.

- 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 streams volumes are projected based on historical data and/or facility supplied operating schedules. Section 5.4 includes a comparison of actual waste receipts to the facility waste generation targets for the last fiscal year (October 1997 to September 30, 1998).

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

The graphics depicted on the next few pages summarize the short range projection results for Projection Case 1. Figure 6 shows the role of each tank for a period of four years. It should be noted that if a tank has several transfers in or out of the 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 any changes that occur during the month are not shown. The simplified routing schematic shown in Figure 7 depicts the assumptions that are made about the routing of waste from the plants to the tanks and from tanks to the facilities. The projected tank inventories and tank space usage for the Case 1 and 2 projections as of September 2001 are included in Table 12.
Figure 6. Tank Levels During the Short Range Projection
Figure 7. Simplified Schematic of Current and Planned Routings
Table 12. Projected Tank Usage on 9/2001 for the Case 1 and 2 Projections

<table>
<thead>
<tr>
<th>Tank</th>
<th>Liquid (Kg)</th>
<th>Solids (Kg)</th>
<th>Total (Kg)</th>
<th>Comment/Projected Usage for Tank as of 9/2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>101-AY</td>
<td>513</td>
<td>108</td>
<td>621</td>
<td>Due to space shortage, started storing concentrated wastes in 1AY in late 2000</td>
</tr>
<tr>
<td>102-AY</td>
<td>555</td>
<td>154</td>
<td>709</td>
<td>Received C-106 solids starting 10/1999; third HLW feed tank in all projection cases</td>
</tr>
<tr>
<td>101-AZ</td>
<td>798</td>
<td>47</td>
<td>845</td>
<td>NCAM/SL; first HLW feed tank in all projection cases</td>
</tr>
<tr>
<td>102-AZ</td>
<td>785</td>
<td>104</td>
<td>889</td>
<td>NCAM/SL; second HLW feed tank in all projection cases</td>
</tr>
<tr>
<td>101-SY</td>
<td>1115</td>
<td>5</td>
<td>1120</td>
<td>CC/SL inventory; minor retrieval/dilution 9/1999; major retrieval/dil. 3/2000</td>
</tr>
<tr>
<td>102-SY</td>
<td>287</td>
<td>88</td>
<td>375</td>
<td>DN/PT inventory; 200 West Area SWL and dilute receiver</td>
</tr>
<tr>
<td>103-SY</td>
<td>384</td>
<td>362</td>
<td>746</td>
<td>CC/SL inventory; WL tank</td>
</tr>
<tr>
<td>101-AW</td>
<td>819</td>
<td>306</td>
<td>1125</td>
<td>DSSF/SL inventory; WL tank; third tank to be processed in Case 1 &amp; 2 projections</td>
</tr>
<tr>
<td>102-AW</td>
<td>865</td>
<td>40</td>
<td>905</td>
<td>Evaporator feed tank</td>
</tr>
<tr>
<td>103-AW</td>
<td>164</td>
<td>348</td>
<td>512</td>
<td>DN/PD solids; DSSF projected addition in FY 2002</td>
</tr>
<tr>
<td>104-AW</td>
<td>86</td>
<td>231</td>
<td>317</td>
<td>DN/SL; DN evaporated in 9/2001; projected refill w/ DSSF in FY 2002</td>
</tr>
<tr>
<td>105-AW</td>
<td>429</td>
<td>280</td>
<td>709</td>
<td>DN heel/PD solids; receives all 100 Area wastes &amp; solids starting in 2001; dilute receiver starting in FY 2001</td>
</tr>
<tr>
<td>106-AW</td>
<td>594</td>
<td>228</td>
<td>822</td>
<td>Evaporator slurry receiver tank</td>
</tr>
<tr>
<td>101-AN</td>
<td>150</td>
<td>33</td>
<td>117</td>
<td>SWL receiver; transfer approx. full tank to 106-AN in late FY 2001; cleaned out for use as an intermediate staging tank in FY 2005</td>
</tr>
<tr>
<td>102-AN</td>
<td>984</td>
<td>89</td>
<td>1073</td>
<td>CC (TRU) inventory</td>
</tr>
<tr>
<td>103-AN</td>
<td>549</td>
<td>410</td>
<td>959</td>
<td>DSSF inventory; WL tank</td>
</tr>
<tr>
<td>104-AN</td>
<td>606</td>
<td>449</td>
<td>1055</td>
<td>DSSF inventory; WL tank; second tank to be processed in Case 1 &amp; 2 projections</td>
</tr>
<tr>
<td>105-AN</td>
<td>639</td>
<td>489</td>
<td>1128</td>
<td>DSSF inventory; WL tank;</td>
</tr>
<tr>
<td>106-AN</td>
<td>1097</td>
<td>17</td>
<td>1114</td>
<td>DN/SL; received SWL from Tank 101-AN in late FY 2001; used to stage dilute waste for evaporation in FY 2001-5; cleaned out for use as an intermediate staging tank in FY 2005</td>
</tr>
<tr>
<td>107-AN</td>
<td>867</td>
<td>247</td>
<td>1114</td>
<td>CC (TRU)/SL inventory; first tank to be processed in Case 1 &amp; 2 projections</td>
</tr>
<tr>
<td>101-AP</td>
<td>1115</td>
<td></td>
<td>1115</td>
<td>DSSF</td>
</tr>
<tr>
<td>102-AP</td>
<td>1094</td>
<td></td>
<td>1094</td>
<td>CP inventory; Late Note may be transferred to another AP tank in FY 2000-2001 if 102-AP is needed to serve as a backup feed/staging tank</td>
</tr>
<tr>
<td>103-AP</td>
<td>1139</td>
<td>1</td>
<td>1140</td>
<td>CC/SL; received concentrated waste 2/1999 on</td>
</tr>
<tr>
<td>104-AP</td>
<td>51</td>
<td></td>
<td>51</td>
<td>DN/DC; used to receive cross-sited waste from 102-SY and to stage dilute for evaporation</td>
</tr>
<tr>
<td>105-AP</td>
<td>986</td>
<td>89</td>
<td>1140</td>
<td>Filled w/ DSSF by 9/2000;</td>
</tr>
<tr>
<td>106-AP</td>
<td>1119</td>
<td></td>
<td>1119</td>
<td>In projections 1 &amp; 2, used to store retrieved/diluted waste from 101-SY in FY 2000</td>
</tr>
<tr>
<td>107-AP</td>
<td>905</td>
<td></td>
<td>905</td>
<td>DN/DC; used to receive cross-sited waste from 102-SY and to stage dilute for evaporation; started filling with concentrated waste in FY 2003</td>
</tr>
<tr>
<td>108-AP</td>
<td>748</td>
<td>8</td>
<td>756</td>
<td>Dilute receiver in E. Area until FY 2004; started filling with concentrated waste in FY 2004</td>
</tr>
</tbody>
</table>
Evaporator WVR and LERF Condensate

Schedule and operational considerations presented in Section 3 result in the following Evaporator Waste Volume Reduction (WVR) and LERF Condensate production volumes for the Case 1 projection. The ratio of process condensate sent to LERF for every gallon of Waste Volume Reduction (WVR) 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 gallon of condensate/gallon of WVR which would lower the value used for future projections. This projection used a value of 1.20 gallon of condensate/gallon of WVR (Bloom, 1999) to project future condensate production recorded in Table 13. The waste sources, campaign schedule, and concentrated waste receiver tanks used in this projection are summarized Table 14. Table 14 shows evaporator campaigns through the start of FY 2005 only. Cross-site transfers through FY 2003 are shown in Table 15.

Table 13. Evaporator WVR and LERF Additions for Case 1 Projection

<table>
<thead>
<tr>
<th>FISCAL YEAR</th>
<th>EVAPORATOR WVR (KGAL)</th>
<th>CONDENSATE TO LERF (KGAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>900</td>
<td>1080</td>
</tr>
<tr>
<td>2000</td>
<td>620</td>
<td>740</td>
</tr>
<tr>
<td>2001</td>
<td>1160</td>
<td>1390</td>
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<td>2002</td>
<td>1220</td>
<td>1460</td>
</tr>
<tr>
<td>2003</td>
<td>1940</td>
<td>2330</td>
</tr>
<tr>
<td>2004</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2005</td>
<td>1830</td>
<td>2200</td>
</tr>
<tr>
<td>2006</td>
<td>810</td>
<td>970</td>
</tr>
<tr>
<td>2007</td>
<td>640</td>
<td>770</td>
</tr>
<tr>
<td>2008</td>
<td>300</td>
<td>360</td>
</tr>
<tr>
<td>2009</td>
<td>660</td>
<td>790</td>
</tr>
<tr>
<td>2010</td>
<td>520</td>
<td>620</td>
</tr>
<tr>
<td>2011</td>
<td>570</td>
<td>680</td>
</tr>
<tr>
<td>2012</td>
<td>320</td>
<td>380</td>
</tr>
<tr>
<td>2013</td>
<td>610</td>
<td>730</td>
</tr>
<tr>
<td>2014</td>
<td>350</td>
<td>420</td>
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<tr>
<td>2015</td>
<td>640</td>
<td>770</td>
</tr>
<tr>
<td>2016</td>
<td>440</td>
<td>530</td>
</tr>
<tr>
<td>2017</td>
<td>450</td>
<td>540</td>
</tr>
<tr>
<td>2018</td>
<td>440</td>
<td>530</td>
</tr>
<tr>
<td>Campaign</td>
<td>Start Date</td>
<td>Staging Tank(s)</td>
</tr>
<tr>
<td>----------</td>
<td>------------</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
| 99-1     | 7/99       | Direct to 102-AW | 102-AY to 102-AW-- 7/98  
108-AP to 102-AW-- 1/99 | DN | ~1000 | 105-AP |
| 00-1     | 3/00       | 107-AP          | 102-SY to 107-AP-- 4/99 & 8/99 | DN | ~1000 | 105-AP & 101-AY |
| 01-1     | 11/00      | 104-AP          | 102-SY to 104-AP-- 8/99 & 12/99  
DN-SWL & DN DC from 101-SY | DN-SWL & DN DC from 101-SY | ~1000 | 103-AP |
| 01-2     | 7/01       | 107-AP          | 102-SY to 107-AP-- 6/00 & 9/00  
105-AW to 107-AP-- 10/01 | DN-SWL & DN DC from 101-SY | ~1000 | 103-AP & 101-AY |
| 02-1     | 3/02       | Direct to 102-AW | 104-AW to 102-AW-- 9/01 | DN | ~800 | 101-AP |
|          | 4/02       | 107-AP          | 102-SY to 107-AP-- 9/01  
105-AW to 107-AP-- 10/01 | DN-SWL | ~1000 | 101-AP |
| 03-1     | 11/02      | 104-AP          | 102-SY to 104-AP-- 3/02  
108-AP to 104-AP-- 4/02  
105-AW to 104-AP-- 8/02 | DN-SWL & DN | ~1000 | 101-AP & 104-AW |
|          | 12/02      | Direct to 102-AW | 106-AN to 102-AW-- 12/02 | DN-SWL | ~1000 | 104-AW & 107-AP |
| 03-2     | 7/03       | 104-AP          | 102-SY to 104-AP-- 8/02  
105-AW to 104-AP-- 8/02 | DN-SWL & DN | ~900 | 107-AP |
|          | 8/03       | 106-AN          | 102-SY to 106-AN-- 4/03  
108-AP to 106-AN-- 4/03 | DN-SWL & DN | ~1000 | 107-AP & 108-AP |
| FY-04    | Evaporator outage is scheduled for FY 2004 | | | | |
| 05-1     | 10/04      | 106-AN          | 101-AN to 106-AN-- 8/03  
105-AW to 106-AN-- 9/03 | DN-SWL & DN | ~1000 | 108-AP |
|          | 11/04      | 104-AP          | 108-AP to 104-AP-- 12/03  
105-AW to 104-AP-- 7/04 | DN-SWL & DN | ~1000 | 108-AP |
Table 15. Cross-site Transfer Schedule for Projection Case 1 and 2

<table>
<thead>
<tr>
<th>Date for Cross-site</th>
<th>Receiver Tank</th>
<th>Volume (Kgal)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/99</td>
<td>107-AP</td>
<td>680</td>
<td>DN-SWL &amp; DN</td>
</tr>
<tr>
<td>8/99</td>
<td>107-AP &amp; 104-AP</td>
<td>680</td>
<td>DN-SWL &amp; DN</td>
</tr>
<tr>
<td>12/99</td>
<td>104-AP</td>
<td>680</td>
<td>Includes minor dilution from 101-SY transferred to 102-SY plus commingled DN/DC-SWL &amp; DN.</td>
</tr>
<tr>
<td>3/00</td>
<td>106-AP</td>
<td>680</td>
<td>Includes waste from the major dilution of 101-SY that is stored in 106-AP and is not scheduled to be evaporated.</td>
</tr>
<tr>
<td>6/00</td>
<td>106-AP &amp; 107-AP</td>
<td>660</td>
<td>Includes waste from the major dilution of 101-SY plus commingled DN/DC-SWL &amp; DN. Waste transferred to 106-AP is not scheduled to be evaporated.</td>
</tr>
<tr>
<td>9/00</td>
<td>107-AP &amp; 104-AP</td>
<td>680</td>
<td>DN/DC-SWL &amp; DN</td>
</tr>
<tr>
<td>3/01</td>
<td>104-AP</td>
<td>680</td>
<td>DN/DC-SWL &amp; DN</td>
</tr>
<tr>
<td>9/01</td>
<td>107-AP</td>
<td>680</td>
<td>DN/DC-SWL &amp; DN</td>
</tr>
<tr>
<td>3/02</td>
<td>104-AP</td>
<td>680</td>
<td>DN/DC-SWL &amp; DN</td>
</tr>
<tr>
<td>8/02</td>
<td>104-AP</td>
<td>680</td>
<td>DN-SWL &amp; DN</td>
</tr>
<tr>
<td>4/03</td>
<td>106-AN</td>
<td>650</td>
<td>DN-SWL &amp; DN</td>
</tr>
</tbody>
</table>

Additional Notes for Table 14 and 15:

1. Tank 101-AP is currently filled with DSSF waste. Tank 101-AP is characterized and once the contents are found to be suitable, the DSSF contents are stored on top of the solids in Tanks 103-AW and 104-AW in early FY 2000. This allows Tank 101-AP to be refilled later in FY 2000. This method should allow topping off Tanks 103-AW and 104-AW with DSSF with less likelihood of producing another watch list tank than direct transfers from Tank 106-AW.

2. Evaporator campaigns were scheduled to start every eight months. Campaigns 00-1 and 01-1 could be combined and completed on some date after 4/00 without an adverse space impact.

3. The evaporator campaign and cross-site schedules are the same for projection Cases 1 and 2.

See Figure 8 for dilute receiver tanks, evaporator WVR, and the 242-A Evaporator operating schedules for the Case 1 and 2 projections.
Based on the 50 Mgal/year treatment capacity for the ETF, the ETF should have no problem processing the projected evaporator condensates thru 2018. There should be sufficient LERF and DST space for storage of Hanford facilities generated waste and condensates between FY 1999 and the end of 2018, provided:

- the 242-A Evaporator schedule is achieved
- the amount of condensate sent to LERF does not grossly exceed the 1.2 gallon condensate/gallon WVR factor
- facilities stay within their respective generation limits
- no unexpected waste receipts are received in the DSTs
Figure 8. Dilute Receiver Tanks and 242-A Evaporator Operations
NON-AGING TANK SPACE

In later parts of the projections when tank space becomes tight due to processing needs and/or the amount of SST solids being retrieved, the evaporator is assumed to operate yearly to minimize waste storage needs and to decrease the volume of retrieved SST solids waste. Tank space pinches occurring between FY 2000 and FY 2018 (Figure 3) are caused by a combination of factors, including:

- SWL pumping (SST stabilization) volumes pumped by the end of FY 2000 and the use of three tanks in 200 East Area to pump SWL
- Four intermediate staging tanks are used to stage wastes for Phase 1B processing--Tanks 101-AN, 104-AN, 105-AN and 106-AN
- The large volume of SST solids retrieved beginning in FY 2004
- The decision not to operate the Grout Facility has eliminated an early means of freeing up DST space
- The decision not to consolidate NCAW solids has increased the DST space needs from 2001 on

Figures 9 through 12 show the detailed operation of all the DST waste tanks for the Case 1 and 2 projections during the near term.
Figure 9. West Area Waste Generations and Tank Levels
Figure 10. AN Tank Farm Levels
Figure 11. AP Tank Farm Levels
Figure 12. AW Tank Farm Levels
AGING WASTE TANK SPACE

Since PUREX has been decommissioned, only two aging waste tanks (Tanks 101-AZ and 102-AZ) are required to store existing aging waste.

One additional aging waste tank will be required to retrieve and store the contents of Tank 106-C (a SST containing high heat waste). Waste from Tank 106-C has been retrieved to Tank 102-AY from October 1998 thru June 1999. Tank 102-AY is also used to retrieve the SST solids from Tank 104-C in FY 2010-11.

In Revision 21 of this document, it was assumed that all NCAW solids and the 106-C solids would be combined into one aging waste tank (Tank 102-AZ) and that all NCAW supernates would be concentrated into one aging waste tank (Tank 101-AZ). Since that document was published, studies have been completed which looked at numerous sludge washing/combination options (Powell, 1996a). The alternatives for consolidating high heat sludges have been reviewed by a decision board comprised of Hanford contractor management, a RL representative, and a WDOE representative. It was concluded that consolidating all the sludges into a single tank would require modifications to the tank farm safety basis. The preliminary decision reached was not to consolidate all the high heat sludges into a single tank. The current HLW strategy will send all NCAW wastes to BNFL for pretreatment and sludge washing within their facility. No streams will be returned to DSTs from the HLW processing.

A graph of aging waste tank space requirements as a function of time is presented in Figure 13. The uses of each individual aging waste tank for the Case 1 projection are shown in Figure 14.

Figure 13. Aging Tank Requirements
Figure 14. Aging Waste Tank Usage
5.2 PROJECTION CASE 2 RESULTS

Tank space needs for the Case 2 projection, both with and without SST solids retrieval, are shown in Figure 15. "Without SST solids retrieval" refers to no additional SST retrieval beyond those solids scheduled to be retrieved for HLW vitrification feed for Phase 1B. The required tank space needs without additional SST solids retrieval is identical to Case 1 since both cases use the same processing schedule for Phase 1B.

The required tank space for the Case 2 projection with the Disposal Engineering Case 3s3 solids retrieval schedule (Penwell, 1999), exceeds available space one tank in FY 2011 and by one tank in FY 2014 in Figure 15. The tank space shortage in FY 2011 and 2014 could be easily eliminated by shifting some of the retrieval volume in these two years to the period FY 2012-2013 when excess tank space is available.

A spreadsheet summarizing the waste generations, evaporator WVR, and processing requirements for the Case 2 projection is included in Table 16. The tank usage, evaporator, and cross-site transfer information for Case 2 are identical to those presented for Case 1 and were shown previously in Tables 12-15.

Figure 16 shows the waste additions and available space for Case 2 in a bar graph format to allow the user to more easily visualize the tank space usage. Numbered comments have been added to the bar graph explaining the inventory changes. These comments follow the figure. During the period when SST solids are being retrieved and processed, some of the tanks could be filled and processed within the same fiscal year. These tanks will show up as "empty" in the graphic because they have been filled and processed within the same fiscal year and their inventory at the end of the year has been reduced to a heel. Thus, the bar graph misleads the user into believing that most of the space dedicated to SST solids retrieval is not needed. The space is actually needed to allow staging and processing of the SST solids wastes. Retrieval and processing rates are high enough in FY 2011-2018 that it is difficult to retrieve the wastes, allow the 100 days assumed for characterization, and process the waste at the specified rate.
Figure 15. Double-Shell Tank Requirements for Case 2
### Table 16. Spreadsheet of Waste Additions and Reductions for Case 2 with SST Solids Retrieval

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Starting Inventory</strong></td>
<td>18353</td>
<td>18796</td>
<td>19438</td>
<td>1743</td>
<td>23436</td>
<td>24231</td>
<td>23589</td>
</tr>
<tr>
<td><strong>Space Utilization</strong></td>
<td>2280</td>
<td>2280</td>
<td>2280</td>
<td>2280</td>
<td>2280</td>
<td>2280</td>
<td>2280</td>
</tr>
<tr>
<td><strong>Waste Reduction</strong></td>
<td>618</td>
<td>609</td>
<td>709</td>
<td>709</td>
<td>709</td>
<td>709</td>
<td>1218</td>
</tr>
<tr>
<td><strong>Compacted Space</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Restricted Space</strong></td>
<td>2950</td>
<td>719</td>
<td>719</td>
<td>633</td>
<td>653</td>
<td>653</td>
<td>1492</td>
</tr>
<tr>
<td><strong>Purity/Operational Space</strong></td>
<td>2483</td>
<td>4195</td>
<td>3209</td>
<td>3265</td>
<td>3458</td>
<td>4502</td>
<td>3566</td>
</tr>
<tr>
<td><strong>NEW WASTE ADDITIONS</strong></td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>Beam Wastefl</strong></td>
<td>7</td>
<td>12</td>
<td>11</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td><strong>Plant Wastefl</strong></td>
<td>0</td>
<td>25</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td><strong>Tritium</strong></td>
<td>15</td>
<td>2</td>
<td>20</td>
<td>40</td>
<td>18</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td><strong>300 Area</strong></td>
<td>37</td>
<td>5</td>
<td>5</td>
<td>45</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>Fluxes</strong></td>
<td>128</td>
<td>288</td>
<td>521</td>
<td>615</td>
<td>369</td>
<td>219</td>
<td>111</td>
</tr>
<tr>
<td><strong>SNL Pumping</strong></td>
<td>89</td>
<td>715</td>
<td>1238</td>
<td>1871</td>
<td>1736</td>
<td>574</td>
<td>0</td>
</tr>
<tr>
<td><strong>Tank Farms</strong></td>
<td>56</td>
<td>123</td>
<td>120</td>
<td>150</td>
<td>203</td>
<td>180</td>
<td>170</td>
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<tr>
<td><strong>SST Retrieval</strong></td>
<td>0</td>
<td>250</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>71</td>
<td>94</td>
</tr>
<tr>
<td><strong>PP</strong></td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>0</td>
<td>0</td>
<td>90</td>
<td>90</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Non-Vacuum</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Everything Else</strong></td>
<td>50</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Pretreatment Dilution</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>In Tank Washing</strong></td>
<td>382</td>
<td>1735</td>
<td>2931</td>
<td>2871</td>
<td>2580</td>
<td>1984</td>
<td>1187</td>
</tr>
<tr>
<td><strong>NEW WASTE ADDITIONS TOTAL</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL WASTE BEFORE EVAP</strong></td>
<td>18734</td>
<td>20333</td>
<td>22550</td>
<td>24514</td>
<td>26536</td>
<td>25595</td>
<td>23558</td>
</tr>
<tr>
<td><strong>EVAPORATOR WAR</strong></td>
<td>0</td>
<td>809</td>
<td>151</td>
<td>2879</td>
<td>3482</td>
<td>6700</td>
<td>5596</td>
</tr>
<tr>
<td><strong>CUM EVAPORATOR WAR</strong></td>
<td>0</td>
<td>809</td>
<td>151</td>
<td>2879</td>
<td>3482</td>
<td>6700</td>
<td>5596</td>
</tr>
<tr>
<td><strong>Lost due to (Linc, Lecce Evap, Surf Chp, Infl, etc.)</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Loss due to waste</strong></td>
<td>157</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td><strong>High Level Waste Contractor</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>EVAP AND OUTFLOW TOTAL</strong></td>
<td>157</td>
<td>809</td>
<td>151</td>
<td>2879</td>
<td>3482</td>
<td>6700</td>
<td>5596</td>
</tr>
<tr>
<td><strong>NET INVENTORY CHANGE</strong></td>
<td>245</td>
<td>840</td>
<td>2309</td>
<td>1713</td>
<td>1395</td>
<td>489</td>
<td>933</td>
</tr>
<tr>
<td><strong>END OF YEAR INVENTORY</strong></td>
<td>18586</td>
<td>19438</td>
<td>23436</td>
<td>24231</td>
<td>23589</td>
<td>24231</td>
<td>23589</td>
</tr>
<tr>
<td><strong>TOTAL CAPACITY</strong></td>
<td>29900</td>
<td>27321</td>
<td>28660</td>
<td>30383</td>
<td>31924</td>
<td>22070</td>
<td>30787</td>
</tr>
</tbody>
</table>

**Notes:**
- "WAR" stands for Waste Account Record.
- The values represent additions and reductions of waste for each fiscal year.
- The inventory change is calculated by subtracting the previous year's inventory from the current year's inventory.
- The total capacity represents the maximum amount of waste that can be handled in the facility.
Figure 16. Double-Shell Tank Inventory and Space for the Case 2 Projection
Comments for Figure 16--Double-Shell Tank Inventory and Space for the Case 2 Projection

This bar chart graphic is meant to show the increase and decrease in the various waste categories or waste types for this year's Case 2 projection. Spare and processing receipt tanks are not shown. Beginning in 1999, a portion of the evaporator operational space maintained in Tanks 102-AW and 106-AW (abbreviated 2AW and 6AW on Figure 4) will also be considered as spare space to decrease tank space needs. Levels of Dilute Non-complexed waste (DN) in the dilute receiver and evaporator tanks will vary with time. The bar for each year depicts the tank space needs for the end of that fiscal year and may not show tank space changes occurring during the fiscal year, especially if the tank inventory has been removed prior to the end of the fiscal year.

Numbered Comments for "Tank Inventory and Space" Graphic

1. "Watch List" (WL) tank inventories are constant from 1997-2000. In late FY 2006, half of the contents of Tank 104-AN are staged to Tank 101-AN for Phase 1B processing causing a decrease in WL inventory. By FY 2007, the WL inventory has increased to its original total due to dilution of the remaining half of the waste in Tank 104-AN. The remainder of Tank 104-AN is processed in FY 2009, causing a decrease in inventory and tank count in the WL category. All WL tanks have been processed by FY 2013 causing this category to disappear from the graphic. Once the wastes are removed from the Watch List tank, the watch list designation is removed from the tank and it is reused for storage of other wastes.

2. Space above Neutralized Cladding Removal Waste (NCRW) solids is routinely used to store Dilute Non-complexed (DN) waste. For clarity, the graph shows this DN inventory in with the other DN inventory toward the top of the graph. (i.e, to ascertain "free" space, add the space shown in the NCRW group to that shown in the DN group).

3. Space above PFP Tru (PT) solids is used to store DN waste, (see note 2). It is assumed that complexed salt well liquid pumping in 200 West Area would be added to Tank 102-SY before the PT (PFP TRU) solids are retrieved.

4. Increase in the DC category in FY 1999 was the result of the "minor" dilution of Tank 101-SY (150 Kgal was retrieved, diluted 1:1, and combined with SWL waste in Tank 102-SY). The waste in Tank 102-SY was cross-sited to AP farm for evaporation.

5. Appearance of the SSTS (single-shell tank solids) inventory in FY 1999 was caused by the retrieval of Tank C-106 solids to Tank 102-AW.

6. The increase in the CC volume and tank count in FY 2000 was caused by the "major" dilution of Tank 101-SY (500 Kgal was retrieved, diluted 1:1, and transferred to Tank 102-SY). In this projection it was assumed that the retrieved and diluted waste would be cross-sited to Tank 106-AP to be held as feed for BNFL.

7. Increases and decreases in the DC category during the period FY 2000-2003 are due to the pumping of dilute complexed SWL wastes and their re-evaporation to CC.

8. Decrease in Watch List (WL) tank count in FY 2001 was caused by the retrieval and 1:1 dilution of waste from Tank 101-SY mentioned above in note 6. It was assumed that this remediation would result in Tank 101-SY being removed from the Watch List in FY 2001 thus decreasing the WL.
category by one tank. The diluted waste in Tank 101-SY was held as feed for BNFL.

9. The increase in the CC category in FY 2001 was due both to the evaporation of dilute complexed SWL wastes and 1:1 dilution of waste from Tank 101-SY (see notes 6 and 9).

10. The increase in the DSSF category in FY 2001 and beyond was due to the evaporation of dilute non-complexed miscellaneous and SWL wastes.

11. The gradual increase in the SSTS category beginning in FY 2004 and the increase in headspace is due to the beginning of SST solids retrieval. The gradual decrease in the SSTS category in FY 2008-9 is due to the HLW processing occurring from Tank 102-AY (Tank C-106 solids are being processed). By FY 2010, the yearly retrieval of other SST solids to DSTs causes the SSTS category to increase significantly. This category continues to increase through the end of FY 2018.

12. The NCAW category disappears by the end of FY 2006 because the solids in Tanks 101-AZ and 102-AZ have been sent to HLW vitrification.

13. The decrease in the CC category in FY 2006 was caused by the staging of CC waste for LAW processing. Subsequent increases in the inventory and tank count FY 2007-8 were caused by the dilution of CC waste for processing and the higher number of feed tanks occupied by the diluted waste. Beginning in FY 2009, the CC inventory decreases steadily due to LAW waste processing.

14. The decrease in Watch List category in FY 2009 was caused by staging of wastes from Watch List tanks for LAW processing--see note 1 for greater detail.
5.3 PROJECTION CASE 3 RESULTS

Projected tank space needs for the Case 3 projection, both with and without additional SST solids retrieval, are shown in Figure 17. The Case 3 projection incorporates waste processing schedules from Disposal Engineering Case 6b (Kirkbride, 1999a). The LAW processing rate is initially one third slower but ramps up to a rate twice as fast as the rate used for OWVP projection Cases 1 and 2 (see Table 9 for processing rate comparison). The SST solids retrieval schedule for Case 3 is a reduced retrieval schedule that does not meet most of the TPA milestones. By the end of FY 2012, Case 3 would predict a tank space need three tanks higher than that predicted for Cases 1 and 2 due to the slower initial processing rate for Case 3. By the end of FY 2013, Case 3 would predict a tank space need one tank higher than Cases 1 and 2. By the end of FY 2014, Case 3 would predict a tank space need eight tanks lower than Cases 1 and 2 due to the faster ramp-up in the LAW processing rate for Case 3. Therefore, additional space has been freed up for SST solids retrieval from FY 2014 and beyond.

The required tank space for the Case 3 projection with SST solids retrieval incorporates the SST solids retrieval schedule from Disposal Engineering's Case 6b (Kirkbride, 1999a and Penwell, 1999). The projected tank space need with SST solids retrieval exceeds available space during the periods FY 2011-2015 and 2017-2018. The SST solids retrieval schedule used for Case 3 scales up the SST solids retrieval faster than waste processing has emptied tanks.

A spreadsheet summarizing the waste generations, evaporator WVR, and processing requirements for the Case 3 is included in Table 17.
Figure 17. Double-Shell Tank Requirements for Case 3
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>STARTING INVENTORY</td>
<td>18553</td>
<td>18593</td>
<td>19438</td>
<td>21743</td>
<td>23456</td>
<td>24221</td>
<td>22925</td>
<td>24605</td>
<td>24605</td>
<td>22290</td>
<td>22453</td>
<td>23115</td>
<td>2014</td>
<td>21970</td>
<td>21251</td>
<td>21094</td>
<td>24464</td>
<td>20863</td>
<td>25080</td>
<td></td>
</tr>
</tbody>
</table>

| SPACE UTILIZATION | 2290 | 2290 | 2290 | 2290 | 2290 | 2290 | 2290 | 2290 | 2290 | 2290 | 2290 | 2290 | 2290 | 2290 | 2290 | 2290 | 2290 |
| Webbed Space | 678 | 669 | 709 | 709 | 709 | 709 | 709 | 709 | 826 | 828 | 828 | 828 | 1088 | 1137 | 0 | 0 | 0 | 0 |
| Contingency Space | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Normalized Space | 2956 | 719 | 719 | 853 | 853 | 853 | 853 | 853 | 853 | 1492 | 1036 | 336 | 582 | 313 | 1227 | 440 | 449 | 1825 | 2873 | 2873 | 2873 |
| Priority/Operational Space | 1903 | 3209 | 3253 | 3461 | 4502 | 1525 | 2813 | 3250 | 2674 | 2624 | 6873 | 4315 | 3299 | 4041 | 5527 | 9115 | 8021 | 7024 | 1460 |

| NEW WASTE ADDITIONS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B Plan2WESF | 7 | 12 | 14 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| T Plant | 0 | 25 | 24 | 24 | 24 | 25 | 25 | 25 | 25 | 26 | 26 | 26 | 26 | 26 | 26 | 27 | 27 | 27 | 27 | 27 |
| 300 Area | 15 | 23 | 23 | 23 | 16 | 16 | 16 | 16 | 16 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| TCO | 37 | 5 | 5 | 45 | 6 | 5 | 223 | 217 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Flashes | 128 | 288 | 521 | 615 | 569 | 219 | 111 | 547 | 248 | 106 | 106 | 104 | 288 | 358 | 948 | 808 | 248 | 108 | 108 | 110 |
| SWL Pumping | 136 | 715 | 1228 | 1871 | 1736 | 574 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tank Farm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SST Retrieval | 0 | 250 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| P2P | 0 | 6 | 2 | 5 | 8 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Inventory | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Waste Before Evap | 487 | 1963 | 22359 | 21614 | 218036 | 25887 | 24688 | 353300 | 24706 | 23543 | 23597 | 23457 | 26604 | 2050 | 27473 | 25335 | 23754 | 31249 | 35993 |
| EVAPORATOR WWR | 0 | 895 | 816 | 1158 | 1211 | 1941 | 0 | 1825 | 812 | 683 | 795 | 659 | 525 | 589 | 558 | 526 | 592 | 528 | 648 | 538 |
| CUM EVAPORATOR WWR | 0 | 895 | 1511 | 2869 | 3364 | 5825 | 5825 | 7650 | 6842 | 9124 | 8419 | 9655 | 10900 | 11096 | 11682 | 12582 | 13327 | 14026 | 14648 |
| Low activity waste | -157 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EVAP AND OUTFLOWS TOTAL | -157 | 895 | 816 | 1158 | 1211 | 1941 | 0 | 1825 | 812 | 683 | 795 | 659 | 525 | 589 | 558 | 526 | 592 | 528 | 648 | 538 |

| NET INVENTORY CHANGE | 250 | 840 | 23205 | 1713 | 1303 | -955 | 502 | -483 | -1730 | 196 | 410 | -2361 | 1455 | 1183 | 832 | -840 | -1172 | -693 | 215 | 5097 |

| END OF YEAR INVENTORY | 18096 | 19438 | 21743 | 23456 | 24281 | 23028 | 24488 | 24005 | 22956 | 22485 | 23975 | 20514 | 21969 | 23333 | 23963 | 21524 | 21540 | 20649 | 20963 |

| TOTAL CAPACITY | 26985 | 77221 | 29860 | 30363 | 31924 | 30700 | 29855 | 31369 | 20542 | 27881 | 28047 | 30082 | 30880 | 30839 | 30723 | 32037 | 32037 | 32817 | 32040 | 39223 | 39030 |

| 24 | 25 | 26 | 27 | 28 | 29 | 27 | 26 | 25 | 26 | 27 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
5.4 ACTUAL WASTE GENERATION COMPARED TO MANAGEMENT LIMITS

During the Tank Space Management Board (TSMB) meeting on August 7, 1991, the need to establish new facility waste generation limits was discussed with the Hanford facility representatives based on additional delays in the 242-A Evaporator restart. A new total monthly waste generation rate of 64 Kgal/month was adopted based on: discussions with facility representatives, the average monthly waste generation rate for each facility during FY 1991, and the need to provide contingency space for potential delays in the 242-A Evaporator restart.

Facility generation limits were not established for high priority waste generations, which were assigned to "Priority Space". These generations included the PFP stabilization campaign (safety), SWL pumping (TPA milestone), and the 242-A Evaporator (space necessary for the mini-run and restart).

New average monthly waste generation targets have been established for this projection with waste generations being reduced by the facilities (references and discussion in Section 3). Table 18 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 (Kgal/month) for the period October 1997 through September 30, 1998. Terminal cleanout (TCO) was completed at B Plant in 1998 and no additional waste will be received from this facility. TCO at the PUREX facility was completed but the facility will be sending ~5 Kgal/year of collected condensate to Tank Farms.

Table 18. Comparison of Average Monthly Waste Generation Rates (Kgal/month)

<table>
<thead>
<tr>
<th>FACILITY</th>
<th>64 KGAL/MONTH MANAGEMENT LIMIT FROM OWWP REV. 20</th>
<th>FACILITY TARGET FOR REV. 25</th>
<th>AVERAGE MONTHLY FACILITY GENERATIONS (10/97 - 9/98)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TANK FARMS</td>
<td>10.0</td>
<td>10.0</td>
<td>3.7</td>
</tr>
<tr>
<td>B PLANT</td>
<td>23.0</td>
<td>N/A-TCO MODE</td>
<td>N/A-TCO MODE</td>
</tr>
<tr>
<td>WESF</td>
<td>N/A</td>
<td>0.5</td>
<td>0.0</td>
</tr>
<tr>
<td>PUREX</td>
<td>N/A</td>
<td>0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>PFP</td>
<td>N/A</td>
<td>0.4</td>
<td>0.0</td>
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<tr>
<td>T PLANT</td>
<td>6.0</td>
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</tr>
<tr>
<td>S PLANT</td>
<td>5.0</td>
<td>1.7</td>
<td>0.9</td>
</tr>
<tr>
<td>300 AREA</td>
<td>5.0</td>
<td>2.3</td>
<td>1.3</td>
</tr>
<tr>
<td>400 AREA</td>
<td>0.0</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>64.0</td>
<td>16.0</td>
<td>5.9</td>
</tr>
</tbody>
</table>

# Monthly Totals do not Include Terminal Clean-out Volumes or SWL Pumping
Due to the commendable efforts by the Hanford facilities, all waste generators are at or below their new waste generation target for the period October 1997 through September 30, 1998. A comparison of the volumes of waste entering the DST tank space for that time period is compared graphically to the various targets or projected generations in Figures 18-21.
**NOTE** THIS GRAPHIC DEPICTS CONTRIBUTIONS FROM FACILITY GENERATIONS; TERMINAL CLEAN-OUT AND SWL PUMPING IS NOT SHOWN
* B-PLANT LISTED UNDER TERMINAL CLEAN-OUT FROM 10/96.

**Figure 18. Comparison of Facility Generations to "TARGET"**
Comparison of the Average Monthly Waste Generation Rate (Kgal/month) To their Respective Target Rate for the Period October 1, 1997 through September 30, 1998

Figure 19. Comparison of Monthly Average Waste Generation To Target Rate
Figure 20. Contributions From Salt Well Liquid Pumping
CONTRIBUTIONS FROM FACILITY TERMINAL CLEAN-OUT (TCO), JUNE 30, 1999

TOTAL ALLOTTED TCO VOLUME
(CLEAN-OUT WASTE PLUS FLUSH)

TCO COMPLETED

220 KGAL
WITH FLUSH

TCO COMPLETED

0.0 KGAL

Figure 21. Contributions From TCO (June 30, 1999)
6.0 SPACE SAVING ALTERNATIVES

In the near term, space saving alternatives include waste minimization, continued availability of the 242-A Evaporator, LERF availability, and the operation of the ETF. These alternatives must be considered because new inputs to the system may develop (e.g., unexpected new waste streams or a leaking SST or DST).

Should a tank space shortage develop in the period 1999 through 2018, response to the shortage for the TPA Compliant Case must be in one of three areas. The inflows to the system must be reduced, the outflows to the system must be increased (or started earlier), or the available tank space increased. Inflows to the system include miscellaneous facility waste generations, TCO wastes, dilution of Tanks 101-SY and 103-SY (for processing), processing, SWL pumping, and SST solids retrieval. Outflows include the 242-A Evaporator and waste disposal (processing and vitrification). Increasing the tank space available could be done by building more tanks (a six to eight year task), mixing segregated waste types (which would gain about half a million gallons of space), or operating without reserved spare tank space.

In addition to minimizing waste generations, other actions could be pursued. The list below includes many actions which can result in tank space savings or economization, and can serve as a starting point in a tank space optimization program. A special trade study was completed in FY 1999 to assess the space savings, costs, and risks associated with some of the space saving alternatives mentioned below (Garfield, 1999). The special trade study stated that sufficient DST is available to support waste feed delivery and that no action is necessary at this time to build new double-shell tanks. The special trade study assumed a reduced retrieval of SST solids.

**PUREX Facility**
- TCO of PUREX was completed in FY 1997. Therefore, waste reductions for PUREX will not be a viable option.

**B Plant**
- Continue to reduce waste being generated at B Plant
- Reduce or eliminate flush volumes following low-level waste transfers to DSTs

**Plutonium Finishing Plant**
- Continue to reduce waste being generated at PFP (only 33 Kgal of total waste are scheduled to be generated from FY 1999-2006
6.0 SPACE SAVING ALTERNATIVES (CONTINUED)

Tank Farms

- Continue to reduce waste being added to DSTs
- Continue waste accountability and minimization controls
- Develop a total waste cutoff plan
- Increase the 5 M Na limitation on aging waste tanks
- Use dilute waste for retrieval, air lift circulator flushes, line flushes, etc.
- Increase the WVR of the 242-A Evaporator
- Accelerate plans to consolidate solids from Tanks 102-SY into Tank 105-AW
- Delay SWL pumping
- Build new tanks
- Accept loss of waste segregation (used as a last resort)
- Store facility generated waste in designated "spare tank space" (used in an extreme emergency)
- Improve efficiency of the 242-A Evaporator
- Solidify treated waste and dispose of as low level waste in burial grounds
- Consolidate NCAW and Tank 106-C solids in one aging tank with one additional aging tank being used to combine NCAW supernates (requires modification of safety basis).
- Increase the heat limit on non-aging DSTs to allow either the Tank 106-C wastes or the supernate from Tank 101-AZ to be stored in a non-aging DSTs
- Concentrate DSSF to Double-Shell Slurry (DSS). Experience with Tank 101-SY makes this alternative highly unlikely.
- Store waste in single-shell tanks (used in an extreme emergency; would require approval by DOE, EPA, and Ecology)
- Store waste in facility storage tanks or portable tanks such as railcars (used in an extreme emergency; total space available is small compared to the contents of a DST)
- Upgrade single-shell tanks by adding a liner to allow storage of waste

Grout

- Reinstate the Grout Disposal Program (unlikely to occur; considered an emergency option only) to grout the existing waste in Tanks 102-AP and 101-AW
7.0 CONCLUSIONS

Last year's OWVP (Rev. 24) stated in the risk assessment table (Table 2) that if the LAW Phase 1 waste processing did not start in FY 2002 and process 2.2 Mgal per year or if Phase 2 processing did not start in FY 2011 and process 24.1 Mgal/yr, that the SST solids retrieval schedule would have to be delayed (due to lack of space). Recent schedule slippages in the privatization contract start date and decreases in the waste processing rate in the RPP project planning guidance received in April 1999 (Taylor, 1999) have impacted the amount of space in DSTs that will be available for SST solids retrieval. The delay in the start of LAW processing to March 2007 and the lower waste processing rates have decreased the space available for SST solids retrieval. Tank space is not available to meet the space requirements for the TPA compliant SST solids retrieval milestones beginning in FY 2004. A review of the space needs with and without SST solids retrieval follows:

Projected Tank Needs Without SST Solids Retrieval

Without SST solids retrieval refers to no additional solids retrieval beyond those solids scheduled to be retrieved for Phase 1B HLW processing feed. Cases 1 and 2 would retrieve solids from Tank C-106 during Phase 1B and the solids from Tanks C-104 and C-107 during Phase 1B prime. A review of the three projections completed in this document indicate that tank space is available to meet the needs of waste feed delivery for Phase 1B and for the retrieval of those SST solids necessary to supply Phase 1B HLW processing feed. In other words, no new tanks are required if SST retrieval is reduced to those tanks mentioned above.

Projected Tank Needs With TPA Compliant SST Solids Retrieval (Projection Case 1)

With the TPA compliant SST solids retrieval schedule added, Case 1 projects that tank space requirements will significantly exceed available space:

- by one tank by the end of FY 2004
- three tanks by the end of FY 2006
- twenty five tanks by the end of FY 2012
- seventy nine tanks by the end of FY 2018

In projection Cases 1 and 2, the Phase 1B prime (extended) waste processing will be processing DST waste until approximately 2018-2019 and very little SST solids retrieval wastes could be processed which accounts for the large number of additional tanks that would be required. Clearly, if the TPA compliant SST solids retrieval schedule is to be met and the waste processing schedule cannot be increased, an excessively high number of DSTs will have to be built. Furthermore, since it requires 6-8 years to build additional DSTs, it is doubtful that additional tank space could be built fast enough to meet the early TPA milestones for SST solids retrieval by FY 2004. A DST space trade study (Garfield, 1999) has been completed which addresses some of the space saving alternatives mentioned in Section 6 of this document.
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8.0 BIBLIOGRAPHY (CONTINUED)

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APPENDICES
### APPENDIX A. Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tr>
<td>ASD</td>
<td>ammonia scrubber distillate from</td>
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<tr>
<td>ASF</td>
<td>ammonia scrubber feed from</td>
</tr>
<tr>
<td>AW</td>
<td>aging waste, also called NCAW</td>
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<tr>
<td>BCP</td>
<td>B Plant process condensate</td>
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<td>CC</td>
<td>complexant concentrate waste</td>
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<td>CP</td>
<td>concentrated phosphate waste</td>
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<td>DC</td>
<td>dilute complexed waste</td>
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<tr>
<td>DCRT</td>
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<td>DN</td>
<td>dilute non-complexed waste</td>
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<td>DOE</td>
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<tr>
<td>DP</td>
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<tr>
<td>DSS</td>
<td>double-shell slurry (most concentrated double-shell tank waste)</td>
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<td>DSSF</td>
<td>double-shell slurry feed</td>
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<tr>
<td>DST</td>
<td>double-shell tank</td>
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<tr>
<td>EIS</td>
<td>Environmental Impact Study</td>
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<td>FFTF</td>
<td>Fast Flux Test Facility</td>
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<tr>
<td>FSAR</td>
<td>Facility Safety Analysis Report</td>
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<tr>
<td>FY</td>
<td>fiscal year</td>
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<tr>
<td>GTF</td>
<td>Grout Treatment Facility</td>
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<tr>
<td>HFW</td>
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<td>High Level Waste</td>
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<td>IPM</td>
<td>Initial Pretreatment Module</td>
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<tr>
<td>IX</td>
<td>ion-exchange</td>
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<tr>
<td>KGAL</td>
<td>kilogallon (1000 gallons)</td>
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<td>LERF</td>
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<td>LAW</td>
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<td>Non-volatile oxide less sodium and silicon</td>
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<td>Waste Sampling and Characterization Facility</td>
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<td>WVR</td>
<td>waste volume reduction</td>
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APPENDIX B. Transfers for Projections in FY 1998-2000
Appendix B-1: Transactions for projection Case 1 through Fiscal Year 1999 - Page 1 of 4

Transactions through 9/30/1998 are historical records.
Transactions from 10/01/1998 through 9/30/1999 are projected.

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Appendix B-1: Transactions for projection Case 1 through Fiscal Year 1999 - Page 2 of 4

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### Appendix B-1: Transactions for projection Case 1 through Fiscal Year 1999 - Page 3 of 4

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B-4
### Appendix B-1: Transactions for project Case 1 through Fiscal Year 1999 - Page 4 of 4

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ZNL87  COMBINED PFP WASTE STREAM (NO TRUEX)
ZTL87  COMBINED PFP WASTE STREAM (TRUEX)
ZNS87  COMBINED PFP SOLIDS
ZTS87  COMBINED PFP SOLIDS
PAW88  PUREX NCAW FROM THE PROCESSING OF NPR FUEL
PDL89  PUREX DECLADDING WASTE STREAM (FY 1989 ON)
PDS89  PUREX DECLADDING SOLIDS (FY 1989 ON - NON-TRU SOLIDS)
PML89  PUREX SPENT METHATHESIS WASTE (FY 1989 ON)
PMS89  PUREX SPENT METHATHESIS SOLIDS (FY 1989 ON - TRU SOLIDS)
PMW88  PUREX MISC. WASTE FROM PROCESSING OF NPR FUEL
PASF  PUREX AMMONIUM SCRUBBER FEED
PXTCO  PUREX TCO WASTES
AWSC  AGING WASTE STEAM CONDENSATE
AWPC  AGING WASTE PROCESS CONDENSATE
SPN87  S PLANT DILUTE NON-COMPLEXED
WNE88  SALT WELL LIQUID DILUTE, NON-COMPLEXED
WCE88  SALT WELL LIQUID COMPLEXED
WNW88  SALT WELL LIQUID DILUTE, NON-COMPLEXED
WCW88  SALT WELL LIQUID COMPLEXED
TAL88  T PLANT SUPERNATE (AS IS MODE)
TNS88  T PLANT SOLIDS (NO TRUEX - TRU SOLIDS)
1FL96  105-F, 105-H, & 100-N LIQUID TCO WASTE
1KL96  100-K LIQUID TCO WASTE
1NS96  100-AREA SOLID TCO WASTE
34L87  300/400 AREA LAB WASTE
PWAT  PRETREATMENT DILN. ENTERED AS SF
EVAPF  EVAPORATOR FLUSH AND TANK FARMWATER
ERD31  ENVR. RESTOR. DISP. FAC. TRENCH 31 LEACHATE
BPN89  B PLANT MISCELLANEOUS WASTE
BPTCO  B PLANT TCO WASTE
BVC87  B PLANT VESSEL CLEANOUT
BCD87  B PLANT CELL DRAINAGE
BPT89  B PLANT CATCH TANK WASTE
BPDCV  B PLANT DILUTE COMPLEXED VESSEL CLEANOUT
BNS7  B PLANT AGING WASTE FROM NCAW PROCESSING ALL TANKS
BNL7  B PLANT SUPERNATE FROM NCAW PROCESSING
PCWAT  PRETREATMENT DILN. COMPLEXED ENTERED AS CC
BCIS7  B PLANT SOLID STREAM FROM PROCESSING OF CC WASTE
BPL88  B PLANT LIQUID STREAM FROM PFP PROCESSING (COMBINED)
BPS88  B PLANT SOLIDS STREAM FROM PFP PROCESSING
BPCU7  B PLANT SOLID STREAM SUPERNATE
HWV87  HWVP WASTE
CCSL  CONCENTRATED COMPLEXANT SOLIDS
WATER  FLUSH WATER
XSWAT  CROSS-SITE TRANSFER WATER
RWAT  RETRIEVAL WATER FOR DST WASTE
SWAT  RETRIEVAL WATER FOR SST SOLIDS RETRIEVAL
SSTSL  SST SLUDGE
SSTSC  SST SALTCAKE
WSSTL  WASHED SST LIQUID
WSSTS  WASHED SST SOLID
PSSTL  PRETREATED SST LIQUID
PSSTS  PRETREATED SST SOLID
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3SYCC 103SY INVENTORY
HCFIN HIGH CONCENTRATION FACTOR INVENTORY
LCFIN LOW CONCENTRATION FACTOR INVENTORY
DSSF DOUBLE-SHELL SLURRY FEED
TCO ESTIMATED WWRF FOR TCO WASTES
7ANDN 7AN CAUSTIC
INTWA IN TANK WASHING SOLNS.
IMUST INDEP. MISC UNDERGR. STORAGE TANKWASTE
SRRTN Sr Return Stream/Entrained Solids/TRU from Pretreatment
WESF WESF WASTES
UNKN CHANGE DUE TO GAS, SURFACE CHG.,INSTRUMENT,ETC
NAOH CONCENTRATED NAOH
INST CHANGE DUE TO INSTRUMENT
ADJUS ADJUST WASTE MAKEUP USUALLY DUE TO NEW SOLIDS MEAS.
AWSOL AGING WASTE OR HIGH HEAT SOLIDS
CAUST Caustic Wash
# DISTRIBUTION SHEET

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| 08/23/99 |

**EDT No.**

| N/A |

**ECN No.**

| ECN-644164 |

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**Page 2 of 3**

**Date:** 08/23/99

**Project Title/Work Order:**

HNF-SD-WM-ER-029, Rev. 25, "Operational Waste Volume Projection"

**EDT No.:** N/A

**ECN No.:** ECN-644164

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