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High Level Waste Management Division

High-Level Waste System Plan Revision 7 (U)

October 1996

INFORMATION ONLY

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

MASTER

Prepared for the U. S. Department of Energy under contract no. DE-AC09-96SR18500

Westinghouse
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HLW-OVP-96-0083

Mr. A. L. Watkins, Assistant Manager
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Dear Mr. Watkins:

HIGH LEVEL WASTE SYSTEM PLAN, REVISION 7 (U)

Attached is the final version of the HLW System Plan, Revision 7. This revision aligns the System Plan with the FY96 Ten Year Plan, under which the site's 24 old-style tanks will be emptied by 2006 and all existing high level waste will be vitrified by 2018. Several improvements are incorporated in this Plan as compared to Revision 6. Additional improvements are already in progress for Revision 8. It is anticipated that this Plan will be revised and issued again as Revision 8 in Spring 1997.

Questions or requests for additional information regarding this Plan should be directed to S. S. Cathey at 5-3052, or N. R. Davis at 5-1246, or M. N. Wells at 5-4797 of my staff.

Sincerely,

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MNW:mnw/jbm

Att.

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High-Level Waste Management Division

High-Level Waste System Plan Revision 7

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Executive Summary

Introduction

This revision of the High Level Waste (HLW) System Plan aligns SRS HLW program planning with the DOE Savannah River (DOE-SR) Ten Year Plan (QC-96-0005, Draft 8/6), which was issued in July 1996. The objective of the Ten Year Plan is to complete cleanup at most nuclear sites within the next ten years. The two key principles of the Ten Year Plan are to accelerate the reduction of the most urgent risks to human health and the environment and to reduce mortgage costs. Accordingly, this System Plan describes the HLW program that will remove HLW from all 24 old-style tanks, and close 20 of those tanks, by 2006 with vitrification of all HLW by 2018. To achieve these goals, the DWPF canister production rate is projected to climb to 300 canisters per year starting in FY06, and remain at that rate through the end of the program in FY18. (Compare that to past System Plans, in which DWPF production peaked at 200 canisters per year, and the program did not complete until 2026.) An additional $247M (FY98 dollars) must be made available as requested over the ten year planning period, including a one-time $10M to enhance Late Wash attainment. If appropriate resources are made available, facility attainment issues are resolved and regulatory support is sufficient, then completion of the HLW program in 2018 would achieve a <u>$3.3 billion cost savings</u> for DOE, versus the cost of completing the program in 2026.

Facility status information is current as of October 31, 1996.

State of the HLW System

In FY96, the 2F Evaporator achieved 457 Kgal of its 1,000 Kgal space gain goal, largely because less feed was transferred from H-Area to F-Area than was projected.

The 2H Evaporator far surpassed its FY96 space gain goal of 1,000 Kgal when it achieved a total space gain of 1,648 Kgal, because the feed that was intended for F-Area was retained in H-Area. The FY96 combined (2F + 2H) space gain of 2,105 Kgal exceeded the combined goal of 2,000 Kgal.

Design and construction of the Replacement High Level Waste Evaporator (RHLWE) continues. The evaporator vessel has been installed. Radioactive startup is scheduled for 11/30/98.

In-Tank Precipitation (ITP) completed concentration of Batch #1. However, benzene generation rates greatly exceeded expectations. Production was suspended and a phased process verification test (PVT) program was initiated, but that, too, was temporarily suspended upon the issuance of Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 96-1, which recommended against adding significant amounts of new waste or sodium tetraphenylborate to Tank 48 until benzene generation, retention and release rates are better understood and specific safety issues are resolved. Dedicated teams are currently evaluating ITP chemistry, flowsheet changes, and authorization basis;

safety basis upgrades are in progress. The date by which precipitate can be ready for transfer to Late Wash is still under evaluation. For planning purposes only, this Plan assumes ITP will resume processing at the start of FY98.

Late Wash Facility startup testing continues toward a planned 2/28/97 Ready for Radioactive Operations date, contingent upon no upgrades being required to resolve potential benzene issues.

Extended Sludge Processing (ESP) continues to provide washed sludge as required to support Defense Waste Processing Facility (DWPF) canister production. Slurry pump seal leakage is within specifications.

The Waste Removal project scope was redirected to focus on outfitting tanks with waste removal equipment and demonstrating cost effective alternatives to salt removal with slurry pumps. Design and construction of Waste Removal facilities on Tanks 21, 22, 23, 24, 25, 28 and 29 is progressing. Salt removal demonstrations on Tank 41 were successfully begun, but were suspended because of tank space concerns. A salt removal demonstration for Tank 25 is planned. The high pressure water jet which was intended to demonstrate hard heel sludge removal in Tank 19 has been procured and will be delivered to the site in FY97. The Advanced Design Slurry Pump (joint project with Hanford) continues, as do tests with a variety of commercially-available pumps and samplers developed by AEA Technologies.

DWPF started radioactive operations 3/12/96. In FY96, DWPF produced 64 radioactive canisters (versus a goal of 60 canisters), with 52 canisters welded and transferred to the Glass Waste Storage Building. This represents completion of approximately 1% of the total number of canisters to be produced over the life of the facility.

The Saltstone Facility has reduced its waste processing rates commensurate with ITP's outage and subsequent reduced waste volumes. Saltstone has processed a total of 3.3 million gallons of salt solution from Tank 50, disposing 5.3 million gallons of saltstone, since startup in June 1990.

The Effluent Treatment Facility continues to operate as planned.

Working Inventory ("space available") in the Tank Farms continues to be managed carefully. A HLW Water Management Team has been convened to oversee tank space concerns, and to plan tank farm operations accordingly. Approximately 1,133 Kgal of space are available at the time of this Plan.

The HLWMD has begun efforts to close the Tank 17-20 cluster in F-Area. An Environmental Assessment identified bulk waste removal, water washing and backfilling with grout as the preferred alternative for tank closure. A grout formulation has been specifically developed and tested for tank closure, and procurement of a vendor contract to supply the grout was initiated. A Tank Farm Closure Plan was approved by the South Carolina Department of Health and Environmental Control (SCDHEC) and the Environmental Protection Agency

(EPA) in July 1996, contingent upon the Nuclear Regulatory Commission's (NRC) classification of the residual waste as "incidental." Discussions with the NRC are ongoing. The Tank 20 Closure Module was submitted to SCDHEC in September 1996 for approval. In accordance with the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6), tank closures could begin as early as FY97.

System Planning Improvement Opportunities

The HLW System Plan is continuously improved in terms of planning tools, administrative controls and scheduling. While there is a strong basis for this Plan, additional effort is needed in the future to assess the impact of the following actions:

- continued refinements to the various production planning models;
- process optimization to reduce the number of canisters produced;
- incorporation of operating data to refine cycle times for new facilities;
- continued refinement of waste characterization via the Waste Composition Database, particularly in the area of cesium, potassium and insoluble solids concentrations in the salt tanks and characterization of aluminum compounds in sludge;
- resource loaded schedules at the Department and Division level;
- return of empty Type III salt tanks to salt receipt service, particularly Tank 41;
- cooling coil replacement for Tanks 29-31; and
- tank closure criteria and Performance Evaluations.

1.0 Introduction to the HLW System Plan

This Plan describes the strategy for the integrated startup and operation of the HLW System based on the efficient allocation of available and projected resources. This Plan is developed in conjunction with the budget planning process. This revision supports the objectives of the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6).

The HLW System planning bases are described in Sections 1-6. Key issues and assumptions are described in Section 7. The production plan is described in detail in Section 8, and supporting tables and figures are included in the Appendices. Appendix A provides a list of acronyms, and Appendices H and I show simplified process flowsheets. These appendices should be particularly useful to those who are not familiar with this Plan.

One of the goals of the planning process is to continuously improve the HLW System Plan to better serve the needs of the stakeholders. Revision 7 of this Plan incorporates several improvements since Revision 6:

- ProdMod, an integrated linear programming computer simulation of the HLW System using Aspen Speedup(R) software, is now used in lieu of the previous personal computer-based spreadsheets for all parts of this Plan;
- salt batching for ITP now extends to the end of the program versus only for the first 40 batches;

- the Saltstone operation is planned through the end of the program versus the first three vaults; and
- planned sludge washing and aluminum dissolution for each Sludge Batch has been optimized, versus the previous assumption of washing all batches to 10 wt % Na and removing 75 wt % of the aluminum.

Several process alternative studies and demonstrations were in progress at the time of this Plan with the goal of cost reduction. ITP flowsheet modifications are also under evaluation. The FY97 Annual Operating Plan (AOP) is also being developed at this time. Revision 7 reflects the scope of the FY97 Annual Operating Plan, except for some activities where minor differences exist. The most significant of these are Tank Closure and Waste Removal activities supporting Tank Closure. Revision 8 of this Plan will evaluate the results and incorporate cost reductions into the planning process, with other changes as appropriate. In this way, more funding can be allocated to canister production, removal of waste from tanks, maintenance of those facilities for which there is a long term mission, and tank closure.

2.0 Mission

The mission of the High Level Waste System is to:

- safely store the existing inventory of DOE high level waste;
- support critical Site production and cleanup missions by providing tank space to receive new waste;
- volume reduce and thereby stabilize high level waste by evaporation;
- pretreat high level waste for subsequent treatment and disposal;
- immobilize the low level liquid waste resulting from HLW pre-treatment and dispose onsite as Saltstone grout;
- immobilize the high level liquid waste as vitrified glass, and store the glass canisters onsite until a Federal Repository is available;
- close HLW tanks per regulatory-approved approach;
- ensure that risks to the environment and to human health and safety posed by high level waste operations are either eliminated or reduced to acceptable levels.

That part of the HLW Mission that supports other Site Missions remains a high priority. The Defense Nuclear Facilities Safety Board (DNFSB) 94-1 document contains nine distinct recommendations, the first of which is:

> "That an integrated program plan be formulated on a high priority basis, to convert within two to three years the materials addressed in the specific recommendations below, to forms or conditions suitable for interim storage."

The Savannah River Site (SRS) plan to address this recommendation is the Integrated Nuclear Materials Management (INMM) Plan, which is briefly described in Section 8.2. The high level waste resulting from executing the INMM Plan is shown in Appendix G.

In addition, the mission of the HLW System has been expanded from previous System Plans to include tank closure, in accordance with the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6). The F/H Area HLW Tank Closure Plan, which describes the methodology SRS will use to close HLW tanks, was approved by DOE-SR and SCDHEC in July 1996. Specific closure plans for individual tanks will be written as separate Modules. Each Module will be separately reviewed and approved by DOE-SR and SCDHEC. Near-term tank closure activities are described in Section 8.14. The Federal Facilities Agreement (FFA) Tank Waste Removal and Closure schedule is shown in Appendix E.

3.0 Purpose

The purpose of this HLW System Plan is to document currently planned HLW operations from the receipt of fresh waste through the operation of the DWPF and Saltstone until all HLW has been vitrified and the HLW tanks have been closed. This document is a summary of the key planning bases, assumptions, limitations, strategy and schedules for facility operations as described in the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6.) This System Plan will also be used as a base document for developing future budget plans, for adjusting individual project baselines to match projected funding, and to project the Site's ability to support the Federal Facilities Agreement (FFA) Waste Removal Plan and Schedule.

4.0 High Level Waste System Description

Key facilities of the HLW System are listed below. The HLW System includes Tank Farm receipt of fresh waste and DWPF recycle, storage of existing waste inventories, waste removal, pretreatment and transfer facilities required to deliver feed to DWPF, and the operation of DWPF and Saltstone. The Consolidated Incineration Facility (CIF) is included because of the supporting role it will play by treating the DWPF's benzene waste stream. Other supporting operations and projects are also listed.

High Level Waste

- F-Area Tank Farm
- 2F Evaporator
- H-Area Tank Farm
- 2H Evaporator
- Replacement High Level Waste Evaporator project
- Waste Removal projects
- F/H Inter-Area Line
- In-Tank Precipitation
- Extended Sludge Processing
- F/H Effluent Treatment Facility
- Tank Farm Services Upgrade (H-Area) project
- Tank Farm Services Upgrade (F-Area) project
- Tank Farm Storm Water System Upgrade project
- Tank closure projects

Defense Waste
- Defense Waste Processing Facility
- Late Wash
- Replacement Melter projects
- Failed Equipment Storage Vaults projects
- Glass Waste Storage Building #1
- Glass Waste Storage Building #2 project
- Saltstone Facility
- Saltstone Vaults #1 and #4
- Saltstone Vault projects

Solid Waste
- Consolidated Incineration Facility project

The inter-relationship of the above facilities and projects is shown in Appendix H, Simplified HLW Flowsheet Diagram. Appendix I shows the same facilities with more detail on the individual waste tank contents and tank functions.

5.0 Planning Constraints

Operation of the HLW System facilities is subject to a variety of programmatic, regulatory and process constraints as described below.

5.1 Planning Methodology and Approvals

Some uncertainty is inherent in this Plan. Lack of actual operating experience in the new processes, as well as emergent budget issues, changes to Canyon production plans, evolution of Site Decontamination & Decommissioning initiatives, and other factors preclude execution of a "fixed" plan. Therefore, DOE Headquarters (DOE-HQ), DOE Savannah River (DOE-SR) and Westinghouse Savannah River Company (WSRC) personnel are continuously evaluating the uncertainties in the Plan and incorporating changes to improve planning and scheduling confidence. WSRC refines and updates this Plan in conjunction with facility operations planning and budget planning.

The **HLW Steering Committee** provides the highest level of oversight of the HLW System. This Committee consists of members from DOE-HQ, DOE-SR, and the WSRC HLW Division. The Committee meets periodically to formally review the status and operational plan for the HLW System. The HLW System Plan is approved by DOE-HQ, DOE-SR, and WSRC HLW.

The **HLW Program Board** is a WSRC committee that provides oversight and approval of the HLW System Plan and the schedules contained therein which form the schedule and cost "baseline" for the overall program. Maintenance of the baseline is controlled via a formal change control process.

The **Technical Oversight Steering Team (TOST)** provides the oversight for resolution of technical issues within the HLW System. The TOST is comprised of representatives from HLW Engineering, the Savannah River Technology Center (SRTC) and HLW Program Management.

The **HLW System Integration Management Plan (SIMP)** describes the production planning methodology and tools applied at the division and facility levels. The SIMP provides administrative controls regarding the roles and responsibilities of organizations and for the planning, modeling, and evaluation tools that are used.

The **High Level Waste Management Technology Program Plan (TPP)** describes the integrated technology program plan for the SRS HLW System. the program is based upon the specific needs of the HLW System and is organized following system engineering functions. Specific tasks, funding, deliverables, and milestones are presented for each fiscal year; the plan is updated and issued annually.

The **Process Interface Description (PID)** specifically describes the interfaces between HLW facilities and discusses the control of the interfaces. Changes to facility technical baselines are reviewed to determine if they could impact the interfaces described in the PID before the changes are implemented.

Waste Acceptance Criteria are in place for all waste transferred to the Tank Farms for interim storage. Influent waste streams must be compatible with existing equipment and processes, must remain within the safety envelope, and must meet downstream process requirements.

The **Citizens Advisory Board (CAB),** a non-partisan, independent group of citizens, provides informed and timely recommendations to the Site on environmental cleanup and waste management issues. The CAB is formally chartered and meets on a regular basis.

Public Meetings are held periodically to increase opportunities for information exchange between SRS officials and members of the public. Meeting locations are varied in order to reach as many communities as possible.

5.2 Modeling Tools

WSRC uses a family of computer simulations to model the operation of the HLW System. Each model is designed to address different aspects of long range production planning. WSRC uses these models interactively to guide long-range production planning.

The **Waste Composition Database** consists of 38 chemical species and radionuclides, plus 23 other waste characteristics, describing all 51 HLW Tanks. The data contained in this database is derived from a multitude of monthly reports, waste sampling results, and canyon process records. This database represents the best compilation of SRS HLW characterization to date, and provides a sound basis for production planning analyses.

The **Chemical Process Evaluation System (CPES)** is a steady-state model that was originally developed as a design document for DWPF. The strength of this model is the size of the database it can mange. The current version of CPES tracks 180 chemical compounds in 1,300 process streams connecting over 600 unit operations. Its output consists of a complete tabular material balance for all chemical compounds in each process stream. CPES models waste processing operations for the entire 22 year HLW program in a single, steady-state simulation. It assumes that all of the current and future waste inventories are present and well-mixed in one large batch. The drawback to this model is that since all waste is assumed blended in one large batch, any extreme conditions associated with an individual waste tank tend to be averaged over the whole batch. This may lead to indications that all processing requirements have been satisfied, when in fact some requirements may not be met some of the time. In FY97, the CPES model will be modified to use the Waste Composition Database as its source for waste data.

The **Product Composition Control System (PCCS)** verifies that the tank farm waste blends proposed by CPES will produce acceptable glass in DWPF. (For additional information on DWPF glass acceptability, refer to section 8.9). PCCS is also used within the DWPF process to plan cold chemical additions.

The **HLW Integrated Flowsheet Model (HLWIFM)** is a non-linear, dynamic simulation in Speedup^R software that addresses daily variability over a shorter planning period, typically 3 years. HLWIFM can model transient waste processing conditions (such as tank levels, temperatures or curie content) against known processing constraints (such as safety parameters, source term limits, operations limits, and regulatory permit requirements). However, running a three year simulation of the complete HLW system takes several hours.

To expedite modeling of different production planning scenarios, the individual facility modules of the HLWIFM can be run independently. The results of these facility-specific runs are available in seconds, not hours, and will be used to optimize facility operations. They are also useful as "real-time" predictive and diagnostic tools while the facility is operating. Facility-specific models have been developed for ITP, ESP, the evaporators and DWPF. A Late Wash Facility model is being developed. HLWIFM is already using the Waste Composition Database as its source of waste data.

The **Production Model (ProdMod)** is a linear equation model that uses the same Speedup^R software as HLWIFM. ProdMod tracks three key waste constituents: 1) sodium, because it drives the sludge washing operation in ESP; 2) potassium, because it determines the amount of precipitate produced at ITP; and 3) cesium, because many source term limits are based on cesium concentrations. The linear equations used in ProdMod enable it to calculate in monthly and annual increments to the end of the program, with a run time of about one minute. This enables planners to quickly evaluate different operating scenarios while still tracking key parameters. In FY97, ProdMod will be modified to automatically access the Waste Composition Database.

All of these models were used to generate the production planning data contained in the appendices of this Plan.

5.3 Regulatory Constraints

There are numerous Regulatory laws, constraints and commitments that impact HLW System planning. The most important are briefly described below.

5.3.1 Federal Facility Agreement (FFA)

The FFA was executed January 15, 1993 by DOE, the Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC) and became effective August 16, 1993. The FFA provides standards for secondary containment, requirements for responding to leaks, and provisions for the removal from service of leaking or unsuitable HLW storage tanks. Tanks that do not meet the standards set by the FFA may be used for the continued storage of their current waste inventories, but these tanks are required to be placed on a schedule for removal from service. The "F/H Area High Level Waste Removal Plan and Schedule," submitted to Regulators on November 10, 1993, shows specific start and end dates for the removal from service of each non-compliant tank, and commits SRS to remove the last non-compliant tank from service no later than FY28. (In support of the DOE-EM Ten Year Plan, the current waste removal program schedule shows removal of waste from all 24 non-compliant tanks by FY06.) SRS anticipates that SCDHEC will approve the F/H Area High Level Waste Removal Plan and Schedule when it is submitted as part of the "HLW Tank Systems Closure Program Plan," which is due to SCDHEC in December 1996.

5.3.2 National Environmental Policy Act (NEPA) Activities

NEPA requires federal agencies to assess the potential environmental impacts of constructing and operating new facilities or modifying existing facilities. DOE has completed four NEPA documents that directly affect the HLW System and support the operating scenario described in this Plan:

- DWPF Supplemental Environmental Impact Statement;
- Waste Management Environmental Impact Statement;
- Interim Management of Nuclear Materials (IMNM) Environmental Impact Statement;
- Environmental Assessment (EA) for the Closure of the High Level Waste Tanks in F- & H-Areas at the Savannah River Site.

The first three of these documents have been described in detail in previous revisions of the System Plan. The most recently completed document was the EA, which was issued in July 1996. The preferred alternative, which included bulk waste removal, tank cleaning, and filling the tanks with a pumpable backfill material, was selected as the best method for tank closure. The EA describes a typical tank closure configuration from the bottom of the tank upward, as follows: residual waste, followed by a layer of reducing grout (or "smart" grout) specifically formulated to reduce the mobility of residual waste contaminants; followed by a layer of Controlled Low-Strength Material (CLSM), which will provide adequate strength to prevent subsidence of the tank, but could be excavated in the future; topped by a layer of "strong" grout, which will fill small void spaces at the top of the tank and discourage intruders from accidentally accessing the residual wastes if institutional control is lost. A Finding of No

Significant Impact (FONSI) was issued on July 31, 1996; therefore, an EIS is not required for tank closure to proceed.

5.3.3 Industrial Wastewater Closure Plan for F- and H-Area High-Level Waste Tank Systems

The "Industrial Wastewater Closure Plan for F- and H-Area High-Level Waste Tank Systems" establishes the general protocol by which SRS will close the F-Area and H-Area HLW tank systems. Tank closure will occur under the tanks' industrial wastewater permits, and will be consistent with RCRA and CERCLA requirements. Prior to initiating the closure process for a tank, the bulk waste will be removed and the tank will be water-washed. Any waste remaining in the tank after water washing will be considered residual waste. For each tank, the residual waste will be characterized. A method for stabilizing the residual contaminants will be proposed, and the closure configuration will be subjected to fate and transport modeling to evaluate compliance with overall performance objectives as determined by applicable environmental regulations. Contributions from other nearby tanks and non-tank sources will also be included in the calculations. The portion of the performance objectives remaining after subtracting non-tank sources will be apportioned among the tanks to determine individual, tank-specific performance objectives. Detailed tank-specific closure modules will be prepared for each tank and submitted to SCDHEC for approval.

DOE has assumed that the residual waste in the tanks will not be classified as high level waste, and can be classified as "incidental waste" under NRC criteria. At the time of this plan, discussions between DOE and the NRC are in progress. The NRC has indicated to DOE they expect SRS to meet the same criteria for incidental wastes as were identified in the NRC's March 2, 1993 letter regarding Hanford, which states:

> "The Commission...would regard the residual fraction as "incidental" waste, based on the Commission's understanding that DOE will assure that the waste:
> (1) has been processed (or will be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical;
> (2) will be incorporated in a solid physical form at a concentration that does not exceed the applicable concentration limits for Class C low-level waste as set out in 10 CFR Part 61; and
> (3) will be managed, pursuant to the Atomic Energy Act, so that safety requirements comparable to the performance objectives set out in 10 CFR Part 61 are satisfied."

SRS will continue to work with the NRC to reach consensus on classification of the tanks' residual wastes.

At the time of this Plan, the Tank 20 Closure Model had been drafted and submitted to SCDHEC for their approval, pending resolution of the incidental waste position with the NRC, and work on the Tank 17 Module had begun. After

SCDHEC has approved a closure module, stabilization of that tank's residual wastes will begin. Following completion of closure activities, each tank will be turned over to the Environmental Restoration Division to be managed as part of the overall remediation of the Tank Farms under RCRA/CERCLA requirements.

For additional information on closure of these and other tanks, please refer to Section 8.14 and Appendix E.

5.3.4 Site Treatment Plan (STP)

The Site Treatment Plan for SRS describes the development of treatment capacities and technologies for mixed wastes. This will allow DOE, Regulatory Agencies, the States and other stakeholders to efficiently plan mixed waste treatment and disposal by considering waste volumes and treatment capacities on a national scale. The STP identifies vitrification in DWPF as the preferred treatment option for treating SRS liquid high level waste, and it identifies incineration followed by stabilization in the CIF as the preferred treatment option for many mixed wastes.

The STP includes the following commitments for DWPF:

1) *"Operations shall commence by 3Q federal FY97. Commencing operation shall mean initial transfer of high-level waste to the DWPF vitrification building."*

   This commitment was met when HLWMD transferred dilute sludge from ESP to DWPF's Sludge Receipt and Adjustment Tank on March 7, 1996.

2) *"Provide schedule for processing backlogged and currently generated mixed waste within 120 days after commencing operations."*

   This commitment was met when SRS prepared and submitted a waste processing schedule to SCDHEC on May 16, 1996. The schedule stated that:

   "... After the startup period is complete and DWPF begins full operation, the maintenance of an average of 200 canisters of processed glass per year will be required in order to meet the schedule for removal of backlogged and currently generated waste inventory by the year 2028..."

   The current production plan, as described in this System Plan, meets or exceeds that requirement.

The STP includes the following commitments for CIF:

1) *"Initiate testing 4th quarter federal FY95. Testing shall mean the period following completion of CIF construction when the facility performs integrated testing such as test burns using simulated or actual waste to determine readiness to conduct a trial burn before the receipt of waste for incineration."*

Systems testing has begun and is currently in progress.

2) *"Operations shall commence no later than February 2, 1996. Commence operations shall mean the introduction of waste into the CIF rotary kiln or secondary combustion chamber for treatment."*

In a letter dated December 4, 1995, SRS formally requested that SCDHEC grant an extension to the CIF operations date from February 2, 1996 to June 30, 1996. SRS cited design problems with the kiln seals and the decision to proceed with DOE readiness reviews prior to the trial burn as reasons for the requested extension. In a verbal response, SCDHEC gave the Site an opportunity to re-evaluate the CIF startup schedule and request additional time, if needed. Given emergent concerns regarding operator training and experience and several design issues, the Site sent a second letter, dated February 1, 1996, requesting that the startup date be extended to June 30, 1997. There has been no formal SCDHEC response to that letter.

3) *"Submit an LDR waste processing rate at the CIF within 180 days after commencing operations, including the time necessary to prepare or repackage certain mixed waste streams."*

This requirement will be addressed after CIF starts Radioactive Operations.

5.4 Operating Constraints

Waste processing is also subject to a variety of operating constraints as described below.

Waste Removal from Type I, II and IV Tanks: Four different designs, or "Types," of carbon steel waste tanks are used to store liquid HLW at SRS, but only the Type III Tanks meet current requirements for leak detection and double containment as defined in the FFA. The Type I and Type II Tanks have inadequate secondary containment and leak detection capabilities, and the Type IV Tanks have no secondary containment at all. Although eleven of the non-compliant HLW tanks have leaked in the past, the HLWMD's formal tank integrity monitoring program indicates that none of the known leak sites are currently active. Still, risk to the environment will be greatly reduced by removing the waste from these tanks and immobilizing it in a solid borosilicate glass or stabilizing it in a saltstone waste form.

Waste Removal Sequencing Considerations: The following generalized priorities are used to determine the current sequencing of waste removal from the HLW tanks:

1) Maintain emergency tank space per the Tank Farm Safety Analysis Report (SAR);

2) Control tank chemistry, including radionuclide and fissile material inventory;
3) Enable continued operation of the evaporators;
4) Ensure blending of processed waste to meet ITP, Late Wash, DWPF, and Saltstone feed criteria;
5) Remove waste from tanks with a leakage history;
6) Remove waste from tanks which do not meet secondary containment and leak detection requirements;
7) Provide continuous radioactive waste feed to DWPF;
8) Maintain an acceptable precipitate balance within ITP;
9) Support the startup and continued operation of the RHLWE; and,
10) Remove waste from the remaining tanks.

The principal goal of the Regulatory drivers is to remove waste from the old-style tanks, and under the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6), waste will be removed from all of the old-style tanks by 2006. However, salt waste must concurrently be removed from some of the Type III Tanks to support the cleanup of the older tanks. Salt removal from new tanks is required to maintain the evaporator systems on-line and to provide receipt space for large transfers of ESP decants and DWPF recycle. Removal of salt from Type III Tanks 38, 41, 25, 29, and 31 must receive priority to support the key volume reduction mission of the 2H, 2F and RHLWE Evaporator systems. The complex interdependency of the safety and process requirements of the various HLW facilities drives the sequencing of waste removal from tanks.

Tank Space Availability: Ensuring the availability of sufficient operating space in specific tanks at specific need dates is a key consideration in the development of an operating strategy. In addition to providing safe storage of waste, additional tank space must be generated to serve as surge capacity. This recovered tank space results almost entirely from the operation of ITP. (Processing dilute HLW supernate through the evaporator systems reduces the amount of space required to store waste, but does not constitute "recovered space," per se.) This space gain is extremely important for the following reasons:

- to support critical site production and cleanup missions by providing tank space to receive new waste;
- to maintain the evaporator systems on-line;
- to provide space to receive the large volume, low-level radioactivity waste transfers which are a by-product of ESP, Waste Removal and DWPF operations; and,
- to ensure flexibility to handle unanticipated problems (such as a leaking tank, or sudden increase in canyon effluents) that could require additional tank space.

At this time, the volume of available tank space is only 1,133 Kgal, so a significant portion of this Plan is dedicated to planning in this area. Refer also to Sections 7 and 8 and Appendix G.

6.0 Planning Bases

6.1 Ten Year Plan and Reference Date

Schedules, budget, milestones, cost estimates, and operational planning for this System Plan are aligned with the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6), issued in July 1996. If actual budget resources are allocated differently in the SRS FY97 AOP, work scope and schedules will be adjusted accordingly. Facility status information is current as of October 31, 1996.

6.2 Funding

The funding required to support the HLW System Plan through FY06 is shown in Appendix C.1 by individual Activity Data Sheet (ADS) and is based on the following assumptions and requirements:

- Target funding for the entire SRS DOE-EM Program (including High Level Waste, Waste Management/Site Treatment Plan, Environmental Restoration, Nuclear Materials Stabilization, and Spent Nuclear Fuel) is $1,250 million per year beginning in FY98, and assumes constant buying power (FY98 constant dollars). The HLW portion of that funding during the ten year planning period, in FY98 constant year dollars, is as follows:

FY97 (BO)	98	99	00	01
$467M	$470M	$475M	$461M	$477M
FY02	**03**	**04**	**05**	**06**
$476M	$530M	$515M	$500M	$485M

  The Nuclear Materials Stabilization and Processing (NMSP) Division is projected to complete its stabilization mission in FY02; starting in FY03, that portion of funding previously allocated to NMSP for stabilization will instead be allocated to the HLWMD to accelerate waste processing and tank closure.

- SRS privatization proposals (i.e., Spent Nuclear Fuel transfer and storage, from which the site expects to derive cost savings that could benefit HLW) will be supported and implemented.

- Program flexibility exists for minor year-to-year scope sequencing to align resource needs with available funding.

- Planned productivity improvements, many of which challenge current business practices, can be successfully implemented.

- The nationally-managed Office of Science and Technology Program will support technology needs, in areas including: reverse addition of solutions at ITP, smaller replacement melters for DWPF, ESP just-in-time counter current decantation, optimized waste loading in DWPF glass, alternative salt removal techniques, and new approaches to saltstone grout disposal. Deployment of innovative technologies will be successful.

- Regulators (EPA, SCDHEC and NRC) will have the capacity to support program acceleration, particularly with respect to Tank Closures, and their decisions will be supportive of program acceleration.

- A Federal Repository will be available to accept approximately 500 canisters per year beginning in FY15. The SRS cost for shipment of each canister is assumed to be $100K, in FY96 dollars.

6.3 HLW System Plan Cost Model

The Cost Model is based on fixed and variable costs. Fixed costs are those costs required to keep a facility in a "hot standby" mode, in which the facility is fully manned with a trained workforce ready to resume production immediately. Variable costs are those costs that vary with production, including: raw materials, repetitive projects such as outfitting tanks with waste removal equipment, replacement glass melters, Failed Equipment Storage Vaults, Saltstone Vaults, some Capital Equipment, etc. Variable costs go to zero if production is zero.

To determine the cost impacts of accelerating the HLW production schedule to meet the goals of the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6), the Cost Model was used to compare a "200 Canisters Per Year" Case against the Ten Year Plan Case. The key differences between the two cases are canister production and tank closure.

In the 200-Can Case, DWPF canister production reaches 200 canisters per year in FY98 and remains at that level through program completion in FY26; tank closure would not begin until FY07. In the Ten Year Plan case, DWPF canister production increases to 200 canisters per year starting in FY98, 250 canisters per year in FY04 and FY05, then 300 canisters per year from FY06-FY18. Vitrification of all existing high level wastes is completed in FY18. Closure of 20 of the 24 high risk tanks would begin in FY97 and complete by FY06. The fixed costs and variable costs of both cases were compared.

The only known increase in fixed costs for the Ten Year Plan case will be the addition of a second shift to the Saltstone Facility in FY04, when production will increase to 250 canisters per year. As operating experience is acquired, other step changes in fixed costs may be identified to increase production.

The additional funding required to support the Ten Year Plan case is therefore mostly variable. The HLW Cost Model indicates that the cost of the 200-Can Case, from FY97-FY26, is $13.6 billion (FY98 dollars). However, given an additional $247 million (FY98 dollars) in variable costs over the ten year planning period, including a one-time $10 million cost to enhance Late Wash attainment and other funding to support DWPF attainment upgrades, waste removal projects will necessarily be accelerated, and 20 of the 24 high-risk tanks can be closed by FY06. (The other four high-risk tanks will remain in use for storage of very dilute wash water, which presents no significant environmental risk.) This will lead to closure of large portions of the Tank Farms in FY07, thereby reducing continuing surveillance and maintenance costs beginning in FY08. Vitrification of existing HLW inventories and closure of all 51 tanks could be completed by FY18, at a cost of $10.3 billion (FY98 dollars). Therefore, implementing the Ten Year Plan could realize a savings of $3.3 billion (FY98 dollars). For additional details, refer to Appendix C.2

6.4 Key Milestones and Integrated Schedule

Key milestones relate to the processes required to safely remove radioactive waste from storage and process it into canisters of glass or vaults of saltstone. New milestones have been added for closure of HLW tanks. The key milestones shown below are supported by the budget as described in Section 6.2 and the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6). If actual budget resources are allocated otherwise in the SRS FY97 AOP, work scope and schedules will be adjusted accordingly. For planning purposes only, this Plan assumes that ITP will resume PVT processing at the start of FY98. Dates shown in italics are actual dates.

Key Milestone	rev. 4	rev. 5	rev. 6	rev. 7
• Start up In-Tank Precipitation	3/95	7/95	*9/95*	*9/95*
• Start up New Waste Transfer Facility	11/95	11/95	*11/95*	*11/95*
• DWPF Radioactive Operations	12/95	12/95	12/95	*3/96*
• Complete closure of Tank 20				12/96
• Late Wash Ready for Rad Ops	6/96	6/96	6/96	2/97
• Consolidated Incineration Facility Rad Ops	2/96	2/96	5/96	3/97
• Complete closure of Tank 17				9/97
• Complete closure of Tank 19				9/97
• Resume ITP Rad Ops (PVT-2a)				10/97
• Precipitate ready to feed Late Wash				3/98
• Complete closure of Tank 16				9/98
• Complete closure of Tank 18				9/98
• Tank 8 ready for sludge removal (Batch#2a)	2/01	2/01	2/00	10/98
• Tank 25 ready for salt removal (2nd ITP)	6/96	3/97	3/97	11/98
• Start up RHLWE	5/01	4/99	11/98	11/98
• Tank 29 ready for salt removal (3rd ITP)	9/98	7/99	12/99	10/00
• Tank 28 ready for salt removal (4th ITP)	5/00	5/04	9/01	9/01
• Tank 11 ready for sludge removal (Batch#2b)	11/02	9/05	9/02	3/01
• Tank 38 ready for salt removal (5th ITP)	5/01	8/06	9/02	9/02
• Waste removed from 24 old-style tanks				FY06
• Closure complete on 20 old-style tanks				FY06
• Shut down old F-Area Control Room				FY06
• Closure complete on all 24 old-style tanks				FY09
• Shut down old H-Area Control Room				FY09
• Closure complete on all F-Area tanks				FY13
• Waste removal complete from all tanks				FY18

7.0 Key Issues and Assumptions

Key issues affecting the HLW system are described below. Each issue is based on certain assumptions. Potential contingency actions are described, should the assumptions prove to be incorrect.

7.1 DOE-SR Ten Year Plan and Schedule

Issue: SRS's ability to meet the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6) and schedules for waste processing and tank closure is uncertain. Success will require a combination of additional funding, technology improvements, and stakeholder support.

Background: The objective of the Ten Year Plan is to reduce risk and mortgage costs complex-wide by accelerating site cleanup schedules and reallocating funding. SRS has established aggressive goals to remove waste from all 24 old-style tanks, and close 20 of those tanks, by 2006. The HLW program could be complete (all HLW vitrified) by 2018, an 8 year improvement over the HLW program baseline completion date of 2026.

To accelerate the waste processing schedule, funding requirements must be met as specified in the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6). This includes an additional $247M which is required over the ten year planning period (FY97-06) to accelerate waste removal projects, purchase additional cold chemicals, and fund supporting facilities (like saltstone vaults) to increase production to 300 canisters per year. Additional funding also has been allocated under New Facility Planning to improve attainment at Late Wash and DWPF.

Closing the first 20 old-style waste tanks will also require sufficient regulatory support.

Assumptions: A combination of increased funding at appropriate times, regulatory agency and stakeholder support, system attainment improvements, more cost-effective waste removal technologies, and successful tank closure demonstrations can be achieved to support this very aggressive schedule. Additional cost reductions via re-engineering at the Site level will also reduce the cost of the HLW mission.

Contingency: If resources are not available as needed or if technology improvements prove not to be feasible, program work scope and schedule will be adjusted accordingly.

7.2 Age of the HLW Facilities

Issue: The materiel condition of many HLW facilities constructed from the early 1950's to the late 1970's is deteriorating.

Background: The following are examples: The transfer line encasement in F-Area has failed in one place and is leaking in several others. Groundwater intrusion into Tanks 19 and 20 has been observed. Routine repairs to service systems in the F and H-Area Tank Farms have escalated into weeks of unplanned downtime due to the poor condition of the service piping and obsolete instrumentation. In many cases, waste cannot be transferred out of tanks unless temporary services are installed or emergency measures are taken. Aging facilities cause excessive unplanned downtime, addition of unplanned scope to existing projects or the need for new Line Item projects to ensure that the Tank Farm infrastructure will be able to support the HLW Program. It should be noted that the Tank Farm can't be "shut down" as it contains 34 million gallons of highly radioactive waste; much of which is in a mobile form.

Assumption: The H-Area encasement will not fail and the H-Area Type IV Tanks will not leak or fail. Sufficient funding will be allocated to maintenance of the Tank Farms, and planned Line Item projects in FY96 (Tank Farm Services Upgrades), FY98 (Tank Farm Storm Water Upgrades) and FY99 (Tank Farm Support Services, Phase II) will remain on schedule to help refurbish and preserve the Tank Farm infrastructure.

Contingency: Remove sludge from old-style tanks earlier by consolidating it in new-style tanks without feeding it to DWPF; accept a slowdown of the HLW Program and increased life cycle costs to reallocate funding to the Tank Farm infrastructure; accept increased environmental risks as tank systems age; or obtain additional funding.

7.3 Plans to Avoid Saltbound Condition in Evaporator Systems

Issue: The 2H Evaporator System is nearly saltbound.

Background: All three evaporator systems are approaching saltbound conditions:

- The 2F Evaporator has only ~315 Kgal space available in one receipt tank (Tank 46); the other six (Tanks 25, 27, 28, 44, 45 and 47) are full.
- Of the 2H Evaporator's two salt receipt tanks, Tank 41 is full and Tank 38 has only ~200 Kgal space available.
- The RHLWE will have one salt receipt tank (Tank 30) when it starts up.

The 2H Evaporator system is of greatest concern because of the small amount of salt space remaining and because the 2H Evaporator is needed to evaporate the H-Canyon Low Heat Waste stream and the DWPF recycle stream.

Approximately 44 Kgal of existing supernate and interstitial liquid were transferred from Tank 41 to Tank 40 in August 1996 in preparation for starting the Modified Density Gradient Test in Tank 41(for more information, refer to Section 8.7.)

Assumptions: ITP will resume Radioactive Operations no later than October 1997. The Canyon's influent waste stream volumes will be less than or equal to the forecast. The 2H and 2F Evaporators will continue operating, with no emergent technical concerns or other events that could shut them down. The RHLWE will start up as planned in November 1998.

Contingency: Continued operation of the 2H evaporator at under-saturated salt conditions dissolve existing saltcake. Periodically, this liquor will be transferred to Tanks 30 and 39 to enable the evaporator to continue operating. This will extend the life of Tank 38 to accommodate the delays in ITP operations and therefore in emptying Tank 41.

Alternative salt removal techniques to assist in emptying salt tanks at a lower cost will be successfully demonstrated and implemented (see Section 8.7). One salt tank in each evaporator system will be equipped with slurry pumps to ensure that one tank can be emptied quickly if needed. HLW system attainment could be decreased to achieve near term cost reductions, or planned Canyon programs could be slowed until the Tank Farm is in a better position to support them.

7.4 Analytical Laboratory Requirements

Issue: Laboratory turnaround times limit the production capacity of several HLW facilities.

Background: The startup of ITP, ESP, Waste Removal, DWPF and Late Wash will increase the analytical burden on the Site laboratories. The attainment of each facility in the HLW System is partly dependent upon the timely turnaround of sample results. Analytical results are required to confirm that some processing steps have been satisfactorily completed before proceeding to the next step.

Assumption: Minimum analytical needs can be identified, appropriately scheduled and accommodated by onsite facilities such that HLW System attainment will not be adversely impacted.

Contingency: Alternative analytical methods which can decrease turnaround time are being evaluated as substitutions for previously planned methods. Projected analytical needs are being compared to current Site capabilities to facilitate changes in sample schedules or recommend improvements in Site resources as appropriate. Analytical Laboratory facility upgrades may be required to support higher attainment rates, or HLW System attainment may be slowed commensurate with analytical laboratory capabilities.

7.5 ITP Flowsheet and Resumption of Operations

Issue: Composite Lower Flammability Limit (CLFL) concerns have driven ITP to suspend precipitate processing until the factors influencing the decomposition of the tetraphenylborate ion are understood and bounded, safety basis upgrades are installed, and processing parameters can be adjusted to meet Authorization Basis criteria. ITP processing is the only source of true space gain in the Tank Farms.

Background: In-Tank Precipitation (ITP) completed concentration of Batch #1. However, benzene generation rates greatly exceeded expectations. Production was suspended and a phased process verification test program was initiated, but it too was suspended upon the issuance of DNFSB Recommendation 96-1, which recommended against further processing until benzene generation, retention and release rates are better understood and specific safety issues are resolved. Two key decisions have been made to date:

1) The nitrogen systems will be upgraded such that oxygen control would be the primary means of mitigating benzene deflagration, with fuel control used primarily for defense-in-depth administrative controls.

2) Tank 22 (a Type IV tank) has been eliminated from the ITP flowsheet.

Dedicated teams are currently evaluating ITP chemistry, flowsheet changes, and the SAR, and safety basis upgrades are in progress. Other modifications may be made as determined by the outcome of the PVT tests.

Assumptions: Facility modifications will be installed, safety basis upgrades will be completed, laboratory test results will be favorable, and a phased Process Verification Test will be successfully implemented such that ITP will be able to resume operations and process at rates supportive of this Plan as projected in Appendix G.1.

Contingency: 2H evaporator feeds and processing are being closely controlled to achieve space gain while minimizing the amount of salt produced, in order to maintain the operability of the 2H system while ITP is down.

7.6 HLW System Attainment Uncertainty

Issue: Process batch and cycle times of individual facilities are uncertain, thus the production capacity of the HLW System is uncertain.

Background: The RHLWE is still under construction. ESP and DWPF are first-of-a-kind facilities just beginning to operate. The ITP/Late Wash flowsheet is being revised. Late Wash is close-coupled to DWPF, with no "wide spot" to accumulate late washed precipitate; as a result, Late Wash becomes the rate-limiting process in the HLW System. Current projectionss are that Late Wash's maximum production rate will support 130-200 canisters per year, depending on flowsheet variables. While there is confidence that each process will work, the interaction of the individual flowsheets and actual batch durations have yet to be established.

Assumptions: Until more information is available, this Plan assumes that Late Wash can support 200 canisters per year. ITP and Late Wash attainment improvements can be achieved using funding already set aside in ADS 25-LI, DWPF New Facility Planning, in FY98-99. Facilities will be started up, experience will be gained, and production batch durations can be defined, meshed and altered as necessary to achieve a HLW System production rate consistent with the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6).

Contingency: Process parameters can be modified as necessary to increase process attainment rates. Such parameters may include refining the sample schedule and optimizing analyses, thereby possibly reducing laboratory turn-around time. Volumetric waste transfer rates may be increased. Some operations may be conducted in parallel versus in series, etc.

7.7 Technical Safety Requirements (TSR) Implementation

Issue: Bringing the F- and H-Area Tank Farms into compliance with DOE Order 5480.22 will require significant manpower resources, and may require capital upgrades to facilities.

Implementation of a revised Authorization Basis (AB) program has begun, but some issues must be resolved: additional information is required to implement some TSRs, many administrative controls need further definition, and the equipment functional classification and backfit analyses are expected to result in TSR changes and equipment upgrades.

Background: In the past, the Tank Farms' Authorization Basis relied heavily on administrative programs. The new methodology requires significantly more safety related systems and programs to provide adequate protection. Achieving compliance with the new AB documents will require implementing a comprehensive program addressing Limiting Conditions of Operation (LCOs), surveillance requirements, administrative controls, mode change check lists, integrated operating procedures, training and compliance verification.

Dedicated, interdisciplinary teams representing Engineering, Operations, Procedures, Maintenance and Training are working to address the four major functional areas of the Tank Farm SAR: storage, evaporation, waste transfers, and administrative programs. Implementation is planned in three phases. In Phase I, procedures, training and surveillances will be upgraded and implemented. Phase I is in progress and will be complete by September 30, 1997. In Phase II, the functional classification (i.e., Safety Class or Safety Significant, SC/SS) of the components in each system will be defined, and equipment backfit analyses and commercial grade dedication evaluations will be conducted to determine where capital upgrades will be required. Cost/benefit analyses will be performed to evaluate the cost of the equipment upgrades versus risk. Exemptions will be requested where deemed appropriate by WSRC. Work on Phase II has already begun, and a resource-loaded schedule for completion of Phase II will be prepared. The resulting upgrades, which may include control rooms and transfer lines, will be implemented in Phase III. Full compliance with the requirements of 5480.22 will be achieved at the end of Phase III.

Assumptions: Adequate manpower and funding resources can be applied to support the program. Some exemptions will be requested and granted based on the outcome of the Phase II backfit analysis.

Contingency: A Basis for Interim Operations is in place as one of the Tank Farms' AB documents to specify compensatory measures until the upgrades are completed.

8.0 Integrated Production Plan

8.1 General

Under the assumptions stated in the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6) , the overall HLW System attainment will be 47% with program completion in FY18. All of the FFA Waste Removal Plan and Schedule commitments will be met. The funding required to achieve this is shown in Appendices C.1 and C.2.

Section 8.2 describes the effect of each influent and effluent stream in the Tank Farms, and it's impact on Tank Farm operations, as illustrated in Appendices G.3 and G.4. Sections 8.3 through 8.14 describe the requirements of each HLW facility to support this Plan.

8.2 HLW System Material Balance

The Tank Farm Material Balance shown in Appendix G.3 is the key tool used to develop this Plan. The balance between influents to the Tank Farm and effluents to DWPF, Saltstone and the Effluent Treatment Facility is critical during the next ten years due to the current low working inventory of tank space in the Tank Farm. The lack of tank space impacts the ability to receive influents from Separations and DWPF and to store salt concentrate from the evaporators. A review of the forecasted influents and effluents and their impact on the HLW System is provided below.

Working Inventory of Tank Space

Influents and effluents are listed only as they impact the Type III Tanks that are used to store and evaporate HLW, herein referred to as the "Working Inventory" of tank space. The old-style tanks are not considered part of the Working Inventory because the Tank Farm Wastewater Operating Permit does not generally allow waste to be added to old-style tanks. ITP Tanks 48-50 and ESP Tanks 40 and 51 are also not part of the near term Working Inventory because there is no plan to use these tanks for anything other than the pre-treatment of HLW. Also, each Tank Farm is required to maintain 1,271 Kgal of space in Type III Tanks as emergency spare. The "Working Inventory" column in Appendix G.3 is the total available tank space in the Type III Tanks after deducting 2,542 Kgal for emergency spare space and after deducting the processing tanks listed above. The Tank Farm currently has about 1,133 Kgal of Working Inventory.

Influents - F-Area Low Heat Waste (LHW) and High Heat Waste (HHW)

This Plan assumes that both Canyons are operating. The F-Area Canyon will process Mk-16/22 fuel and blend to 1% low enriched uranium. Np-237 and Am/Cm solutions will be vitrified in F-Canyon. Pu-239 solution from F-Canyon will be converted to metal in FB-Line. Influent volumes to the F-Area Tank Farm range from 32-38 Kgal per month while the F-Area Canyon is operating. All waste volumes after FY02 are shutdown flows.

Influents - H-Area Low Heat Waste (LHW) and High Heat Waste (HHW)

This Plan assumes that both Canyons are operating. Restart of the H-Canyon H- Modified (HM) process has been moved from 7/98 to 9/98. Processing of Mk-16/22 fuel will commence at that time with highly enriched uranium solutions blended to 5% U-235 with existing depleted uranium solutions for eventual sale to the Tennessee Valley Authority (TVA). HB-Line will process Pu-242 and will then be converted for dissolution of Pu-239 and mixed residues. Pu-239 and Np-237 solutions will be transferred to F-Canyon for stabilization. All of these campaigns will be completed by FY03. Influent volumes to the H-Area Tank Farm range up to 53 Kgal per month, of which 15 Kgal is from the Outside Facilities General Purpose Evaporator.

Influents - DWPF Recycle

DWPF recycle is based on planned production of 150 canisters (28%) in FY97, 200 canisters per year in FY98-03 (37%), 250 canisters per year in FY04-05, (46%) and 300 canisters per year (56%) thereafter. The recycle volume will range from 1,398 to 2,954 Kgal per year as attainment increases. The recycle algorithm is explained in Section 8.9.

Influents - Tank Washwater

The waste tank interiors of all tanks to be removed from service are water washed as part of the waste removal program. The annulus of each tank with a leakage history is also water washed. The volume of the tank interior wash is planned to be 140 Kgal, which is a level of about 40 inches in most tanks. The annulus wash is assumed to be two 25 Kgal washes, which is a level of about 24 inches in the annulus for each wash. This Plan assumes that all tanks are water washed.

Influents - ESP

The ESP washwater values are based on ProdMod modeling for each of the remaining sludge batches. All of the washwater is assumed to be evaporated. The washwater for each batch is generated during the 24 month period immediately before the batch is fed to the DWPF. No differentiation is made between the water used to slurry and transport the sludge to the ESP tanks, aluminum dissolution waste, and sludge washwater. For more details on ESP, refer to Section 8.4.

Other Influents

Influents from the 100-Areas were listed in previous revisions of this Plan but are now planned to be zero. There are no plans to support the Reactor Basin water quality programs using HLW tanks. Also, the ETF evaporator bottoms that are transferred to Tank 50 do not impact the Tank Farm inventory as Tank 50 is not used to store and evaporate HLW. The Receiving Basin for Offsite Fuel (RBOF) impact on the Working Inventory is projected to be zero because the RBOF waste will be stored in Tank 23, and when Tank 23 fills, that waste will be used to dissolve salt.

Effluents - 2F Evaporator

The 2F Evaporator space gain is based on the forecasted Canyon waste generation and evaporation of the remaining backlog of F-Area HHW. Space gain is based on the projected volume of the waste streams allocated to the 2F Evaporator as described in Section 8.5.3. In general, these streams are F-Area and H-Area HHW, F-Area LHW, sludge washwater from pre-washing F-Area sludge in F-Area prior to transfer to the ESP tanks, and tank washwater for the F-Area tanks. The 2F Evaporator is assumed to go down for one six-month outage in FY99 for a vessel replacement.

Effluents - 2H Evaporator

The 2H Evaporator space gain is based on the projected volume of waste streams allocated to the 2H Evaporator as described in Section 8.5.2. In general, these streams are H-Area LHW, ESP washwater and the DWPF recycle (until RHLWE starts up). This evaporator has two salt receipt tanks (Tanks 38 and 41). The evaporator vessel has been replaced with a new vessel outfitted with a hastelloy tube bundle and warming coil. This unit is expected to last until the end of the HLW Program.

Effluents - RHLWE

The RHLWE is planned to start up 11/30/98. Space gain is based on the projected volume of waste streams allocated to the RHLWE as described in Section 8.5.4. In general, these streams are the DWPF recycle, ESP washwater generated from H-Area sludge pre-treatment, and tank washwater generated from H-Area waste tank retirement.

Effluents - In-Tank Precipitation

ITP space gain occurs when concentrated supernate is fed directly to ITP or when a salt tank is emptied and returned to salt receipt service. The space gained with each batch of dissolved salt removed from a salt tank is not shown because the plan is to empty the tank completely. A 1,271 Kgal space gain is generally shown at the completion of salt removal from each tank. ITP space gain is based on executing the ITP Production Plan shown in Appendix G. For more details on ITP, refer to Section 8.3.

Salt Space

As each evaporator gains space, saltcake and a caustic-rich concentrated supernate are formed in the salt receipt tank. When the saltcake level reaches 1.0 million gallons, the tank is considered full. The remaining space typically contains concentrated supernate. At that time, another salt receipt tank is required or the evaporator will become saltbound and shut down.

Pages 3 and 4 of Appendix G.3 show the salt formation in each of the three evaporator systems. The 2H Evaporator has two salt receipt tanks: 38 and 41. Tank 38 is currently filling as indicated by the ascending salt inventory values. This Plan assumes that some Tank 38 liquor will be transferred out of the 2H Evaporator system in January 1998, when the Tank 38 inventory reaches one million gallons. Plans to empty Tank 41 via several alternative salt removal technology demonstrations were suspended as a result of ITP's current outage and resulting concerns about tank space to store the dissolved salt solutions.

The 2F Evaporator and RHLWE salt inventory is also shown. The RHLWE tanks fill more quickly than 2F or 2H as this is a higher capacity evaporator.

8.3 In-Tank Precipitation

ITP Cycle 1 Batch 1

Processing of the first batch has been completed. 130 Kgal of concentrated salt supernate from Tank 38 and 37.3 Kgal of sodium tetraphenylborate were added to the 252 Kgal heel of precipitate left in Tank 48 from the 1983 demonstration. This material was filtered and concentrated down to 154 Kgal (about 3 wt % solids) thus producing 383 Kgal of filtrate. The filter performance, stripper performance and Cs-137 decontamination factor met acceptance criteria.

During Batch 1 processing, the benzene release into the Tank 48 vapor space was greater than expected. The expectation was based on an inadequate understanding of the decomposition of soluble and solid tetraphenylborate. Radiolytic decomposition was presumed to be the dominant decomposition mechanism during the filtration and concentration steps of the ITP process. Evaluation of data gathered during Batch 1 indicates that chemical catalysts caused the rapid decomposition of the soluble tetraphenylborate thus generating more benzene than expected. Other significant factors appear to be temperature and the nitrogen atmosphere in Tank 48.

Benzene releases during Batch 1 were observed to be low when the slurry pumps were not operating. After the pumps were down for several days or weeks and then restarted, the benzene release rate increased by 2-3 orders of magnitude thus indicating that some sort of benzene retention phenomenon was occurring. This also was not expected.

Laboratory testing since Batch 1 has helped improve the scientific understanding of benzene generation, retention and release although this work is not nearly complete. One of the tests apparently resulted in rapid decomposition of the tetraphenylborate solids. This was not observed in Tank 48 and has not been duplicated in the lab. This anomalous experiment is the subject of ongoing study.

The ITP flowsheet and plant configuration during Batch 1 relied on fuel control to reduce the calculated frequency of benzene deflagration to an acceptable level. Given the unexpected benzene generation, retention and release results of Batch 1, a decision was made to upgrade the nitrogen inerting and associated control systems such that oxygen control would be the primary means of preventing benzene deflagration with fuel control used for defense-in-depth administrative controls. A decision was also made to eliminate Tank 22 from the plant configuration (refer also to the "ITP Flowsheet/Plant Configuration section below) as it was presumed that the ongoing accident analysis would indicate that Tank 22 could not withstand design basis accidents without excessive consequence. Work was initiated on hardware improvements to the nitrogen system. A revision to the ITP accident analyses and Safety Analysis Report was also initiated to include all ITP unit operations.

DNFSB Recommendation 96-1

The DNFSB issued Recommendation 96-1 on August 14, 1996. The recommendation was confined to safety issues at the ITP facility. It contained two specific recommendations:

1. Conduct of the planned test PVT-2 should not proceed without improved understanding of the mechanisms of formation of the benzene that it will generate, and the amount and rate of release that may be encountered for that benzene.

2. The additional investigative effort should include further work to (a) uncover the reason for the apparent decomposition of precipitated TPB in the anomalous experiment, (b) identify the important catalysts that will be encountered in the course of ITP, and develop quantitative understanding of the action of these catalysts, (c) establish, convincingly, the chemical and physical mechanisms that determined how and to what extent benzene is retained in the waste slurry, why it is released during mixing pump operation, and any additional mechanisms that might lead to rapid release of benzene, and (d) affirm the adequacy of existing safety measures or devise such as may be needed.

The recommendations were preceded by four pages of discussion text . Review of the text indicates that there are four safety issues that must be resolved to the Board's satisfaction before ITP processing can resume:

1. A better understanding of chemistry issues related to ITP must be developed to determine the combination of controls and engineered systems necessary to prevent and mitigate benzene deflagration in process vessels;

2. The scientific understanding of the reactions leading to the generation of benzene is not well enough understood to ensure that defense-in-depth measures to prevent deflagration are adequate;

3. The scientific understanding of the mechanisms involved with the retention of benzene in the ITP System is not well enough understood to ensure that defense-in-depth measures to prevent benzene deflagration are adequate; and

4. The scientific understanding of mechanisms involved with the release of benzene in the ITP system is not well enough understood to ensure that defense-in-depth measures to prevent deflagration are adequate.

The Recommendation has been accepted by DOE. Preparation of the Implementation Plan is complete, and the Implementation Plan has been submitted to DOE-HQ.

ITP Flowsheet/Plant Configuration

Given the decision to eliminate Tank 22 from the ITP plant configuration, flowsheet changes will be made. Several alternatives have been proposed and are currently being evaluated. At the time of this Plan, it appeared that one alternative was favored. This alternative utilizes Tank 48 for the reaction vessel, Tank 49 for washed precipitate storage and Late Wash feed, Tank 50 for ITP and Late Wash washwater storage and recycle to Tank 48 as dilution water and transfer of ITP filtrate directly to Saltstone from the ITP Hold Tanks. Tanks 48, 49 and 50 will all have robust safety-related nitrogen inerting systems. New tankage is proposed to store ITP filtrate as soon as it can be provided, although this is not currently viewed as a predecessor to ITP resumption of operations. This alternative is subject to change as the evaluation process continues.

The above plant configuration, if adopted, will enable ITP to provide washed precipitate feed to Late Wash that meets the historical flowsheet values for Na concentration, nitrite concentration and wt % solids. The precipitate rheology will be different from the historical value because the precipitate will not receive as high an absorbed dose in Tank 49. Over time, radiation dose breaks down the precipitate, reducing the shear stress and thus making the precipitate easier to pump (see also Section 8.10).

The planned operation is to maintain the precipitate level in Tank 49 as low as possible without impacting Late Wash. The volume of washed precipitate in Tank 49 will be maintained between a low of 112 Kgal (the minimum level at which the Tank 49 slurry pumps can be operated at full speed) to a high of about 300 Kgal. The objective of the 300 Kgal artificial limit is to maintain the absorbed dose to the precipitate to less than 200 mega-rads. As operational experience is gained and more is learned about the fate of organic compounds in DWPF and in the recycle, this limit could be adjusted. Tank 49 precipitate volume is shown in Appendix G.1.

Production Capacity

The actual ITP cycle time is not known. The special testing and sampling requirements for the first three batches after operations resume are expected to be conducted as Process Verification Tests (PVT's). The scope of each PVT has not been defined, however, 45 days per PVT has been assumed in this Plan. Once the PVT's are completed, ITP will assume a normal cycle time. Durations of 35 days per batch, 30 days for the wash step and 3 days to transfer the washed precipitate to Tank 49 are assumed based on minimal operating experience. The 35 day batch time presumes that Tank 40 is used to stage feed prior to transfer into Tank 48. A typical cycle - 3 batches followed by the wash and transfer - would therefore be 138 days. (This can be compared to the cycle time assumed in the original ITP Basic Data Report of 123 days.) Outyear planning assumes two cycles per year, on average. Each cycle will produce, on average, about 140 Kgal of 10 wt % solids precipitate. ITP is therefore capable of producing about 280 Kgal of precipitate per year, which can support 54% DWPF attainment (about 290 cans/year) during Sludge Batch #1a & 1b. The ITP facility is therefore not expected to limit HLW system attainment in the long term. Funding constraints may limit ITP production, and HLW System production, as described in the Production Plan and Schedule section below.

An outage is planned at the end of every cycle. This time is used for corrective, predictive and preventive maintenance. It is also used to perform inspections and surveys as required for safety and environmental reasons. The minimum outage time is 30 days. The maximum outage duration is allowed to "float" in this Plan such that washed precipitate is available just as the inventory in Tank 49 decreases to 112 Kgal. The Tank 49 slurry pumps must be operated at full speed to adequately mix the tank. The speed of the slurry pumps must be reduced at levels below 112 Kgal due to net positive suction head requirements, thus this is the lower operating limit.

Production Plan and Schedule

The ITP Production Plan is shown in Appendix G.1. The next three ITP batches (PVT-2a, 2b and 2c) work off the washwater heel in Tank 49 that remains from the 1983 ITP Demonstration. This waste is blended with concentrated supernate from Tanks 25 and 27. Batch size is assumed to increase from about 600 Kgal for ITP Batch #2 to the flowsheet average of 800 Kgal in 50 Kgal increments. Samples will be taken during each batch to evaluate the adequacy of mixing.

Using F-Area concentrated supernate from Tanks 25 and 27 serves two purposes. These tanks are potassium-rich, so processing this waste yields more precipitate than other feeds. This enables a sufficient quantity of precipitate to be produced at the earliest date to support initial startup and continuous operation of Late Wash. Feeding Tanks 25 and 27 to ITP also increases space in the 2F Evaporator system which will be needed in early FY98.

For purposes of this Plan, it is assumed that ITP processes three batches followed by a wash starting in early FY98. This is expected to require a minimum of 168 days (3 batches at 45 days/batch plus one wash at 30 days plus a 3 day transfer). Per this assumption, if ITP can resume operations on or about October 1, 1997, washed precipitate would be ready on or about March 16, 1998.

The Cs-137 activity of ITP precipitate is no longer limited to 12.5 Ci/gal as in the past. Precipitate activity can be as high as the design basis of 39 Ci/gal. The activity planned in Cycle #1 and #2 is projected to be about 10 and 23 Ci/gal, respectively.

ITP Cycle #1 (C1/B1 - PVT-2c) will produce about 229 Kgal of 10 wt % precipitate in Tank 48. 208 Kgal of this material will be pumped to Tank 49, leaving the minimum Tank 48 pump heel of 21 Kgal. The Tank 48 slurry pumps will have to be slowed down and eventually shut down during this transfer.

Since the minimum precipitate heel in Tank 49 is 112 Kgal, only 96 Kgal of precipitate will actually be available to feed forward to Late Wash. The CPES "recipe" for Sludge Batch #1a demands 964 gallons of 10 wt % precipitate per canister, thus the 96 Kgal available will produce about 100 canisters.

Cycle #2 must start 30 days after Cycle #1 is complete in order to have enough precipitate to support the planned production.

ITP production is now planned until the end of the program in FY18. Recent supernate sample results from the 2F Evaporator's Tanks 26 and 46 revealed that the supernate was not at its saturation limit for potassium. Historical sample records for potassium content in other tanks were also examined, and again revealed that potassium was not at its saturation limit. Since potassium is highly soluble, this indicates that all the potassium in the Tank Farms is already in the supernate, and it is unlikely that additional quantities of potassium are residing in the saltcake as was previously believed. The total quantity of potassium in the Tanks Farms was also derived from historical essential materials purchase records, and yielded a quantity consistent with that predicted by the waste samples. The amount of potassium in the waste drives the amount of precipitate produced. Therefore, it appears that the current inventory of high level waste will produce much less precipitate than was previously anticipated. In contrast to earlier predictions of "excess" precipitate at the end of the HLW program, there may, in fact, be a relative shortage of precipitate. An evaluation is ongoing to assess the feasibility of operating DWPF with "lean precipitate feed."

8.4 Extended Sludge Processing

Scope

The existing sludge currently in the HLW tanks and future sludge from Canyon operations has been divided into nine discreet sludge batches. DWPF is currently vitrifying Sludge Batch #1a which is in Tank 51. For each of the nine batches, Appendices G.2 and G.3 identify the source of sludge, volume of sludge from each source tank, start/finish dates for feeding each batch to DWPF, canister yield, weight percent sodium, weight percent aluminum, and canister waste loading. Each batch has been modeled using ProdMod and is predicted to make an acceptable glass waste form via the Product Composition Control System (PCCS).

Slurry Pump Problems

The three new machined impeller pumps and the old cast impeller pump in Tank 51 have performed well with an acceptable seal leak rate. A spare machined impeller pump is ready to install if needed.

The Tank 42 standard slurry pumps have been started and briefly operated. Initial data shows that seal leakage is within specifications. Two of the pumps on Tank 42 are not drawing amperage indicative of the work expected, i.e., pumping sludge. It is theorized that the pumps are submerged in the sludge and are mixing only a small captive volume, raising the temperature of the captive sludge and thus causing cavitation. Work has begun on a test which will raise these two pumps into the liquid, operate them to check amperage, and then lower them in ten inch increments to resuspend the sludge. The other two pumps are operating well. It is not known if the arrangement of the four pumps can fully suspend all of the sludge in Tank 42 assuming that all four pumps are operating at capacity. Based on past dip samples of the sludge that was suspended, it is believed that the sludge is fully washed.

Production Capacity

The planning bases for the ESP facility are that 700 Kgal of sludge can be processed in two ESP tanks using the co-washing flowsheet. Aluminum dissolution, sludge washing, and sludge consolidation into one tank is assumed to require 24 months to complete. Recent settling data from Tank 51 confirms this assumption. Each of the planned batches of sludge will produce about 500 to 1,000 canisters of glass.

Production Plan

Sludge Batch #1a consisted of 491 Kgal of washed sludge at 16.8 wt % total solids at the completion of the final washwater decant and wt % solids adjustment. Of this amount, 403 Kgal are available to feed forward to DWPF for vitrification (the Tank 51 heel is assumed to be 88 Kgal based on net positive suction head requirements for the slurry pumps to operate at full speed). This amount of sludge will produce 470 canisters at 27.2 wt % waste loading. Given planned canister production of 60 in FY96, 150 in FY97 and 200 per year in FY98, FY99 and FY00, Sludge Batch #1a will last until 1/99.

The Tank 51 transfer pump will need to be lowered from its current elevation of 68" down to 2" in order to make all of the 403 Kgal available. This must be done by 2/98 based on planned canister production rates.

An alternative processing plan will be developed for Tank 42 in FY97. Experience from Tank 51 and testing via the Advanced Design Pump program will be used to develop this plan. The goal for Tank 42 is to have the tank fully operable at least one year before the sludge in Tank 51 runs out. This is projected to occur by 1/99, thus Tank 42 should be ready in FY98. At that time, the Tank 42 sludge can be slurried and transferred into Tank 51 as Tank 42 sludge washing is already complete. This becomes Sludge Batch #1b.

8.5 Evaporators

The 2H and 2F Evaporators will volume reduce the various waste streams coming into the Tank Farms in the near term. The operation of these two evaporators is crucial to the success of HLW and Site Missions. The Tank Farm currently has about 1,133 Kgal of working inventory available in Type III Tanks, excluding the ITP/ESP tanks and emergency spare requirements. The evaporators must keep current with waste generated by Canyon operations, DWPF recycle, and ESP. There is no near term plan to evaporate the 5 million gallon backlog of unevaporated HHW in H-Area as the salt and concentrate from this waste would consume the remaining salt receipt space if evaporated. This waste will gradually be fed to ITP as supernate.

Evaporator space gain is defined as the difference between evaporator feed and evaporator concentrate corrected for flush water and chemical additions necessary to operate the evaporator system. Space gain is predicted based on evaporation of each waste stream given the chemical constituents thereof. This is further described in Sections 8.5.1 through 8.5.4. Note that the best the evaporators can do is to volume reduce the influent streams. This results in a gradual decrease in Working Inventory as saltcake and caustic liquor builds up. The only planned method to actually increase the Working Inventory of tank space is to run ITP.

8.5.1 1H Evaporator

The 1H Evaporator vessel has a leaking tube bundle. Because this evaporator is planned to remain down, the condition in the Tank Farm Wastewater Operating Permit to remove the 1H Evaporator from active service by 1/1/98 has essentially been met. The 2H and 2F Evaporators are projected to be able to support the HLW Mission until the RHLWE starts up.

The 1H system was chemically decontaminated in FY96. The evaporator cell, the interior of the evaporator vessel, the Concentrate Transfer System (CTS) cell, the CTS tank interior and the CTS loop line were cleaned using alternate caustic/acid flushes similar to the method recently used for the 2H Evaporator vessel replacement. The 1H system is currently being put in lay-up mode.

8.5.2 2H Evaporator

The 2H Evaporator exceeded its space gain goal for FY96 by gaining over 1,648 Kgal vs. a goal of 1,000 Kgal. This was possible because the ESP washwater and DWPF recycle streams were evaporated in the 2H System, whereas the plan that the goal was based on assumed that 50% of these streams were transferred to the 2F Evaporator. Together, the 2H and 2F evaporators regained 2,105 Kgal of space, which exceeded their combined goal of 2,000 Kgal.

The primary role of the 2H Evaporator in FY97 will be to evaporate the 221-H Canyon LHW stream and the DWPF recycle stream. The forecast for H-Area fresh LHW is about 2 Kgal per month in FY97. After H-Canyon starts the HM process up in FY98, this rate increases to about 36 Kgal per month and remains there through FY02. All H-Area LHW is received directly into the 2H Evaporator system and evaporated.

The 2H Evaporator feed pump and evaporator vessel were both replaced 12/95. The new vessel has a Hastelloy tube bundle and warming coil that is expected to last for 30 years. Downtime for pot replacement is therefore not forecast. 2H Evaporator operation is based on a planned utility of 60% with a space gain as shown in Appendix G.3.

Video inspections and material balances made during April 1996 indicated that the salt volume in Tank 38 was 880 Kgal. Based on this information, the operation of the 2H Evaporator was changed to produce a concentrate stream with a specific gravity of 1.30-1.35, vice a previous level of 1.50-1.55. The lower specific gravity is desired as about 90% of the volume reduction can be attained by concentrating the waste to a Na molarity just below the point at which saltcake is formed. Recent inspections indicate that the saltcake volume in Tank 38 is decreasing as the low specific gravity concentrate dissolves salt, which is then decanted back to the evaporator feed tank. Eventually, a significant quantity of concentrated supernate will exist in the 2H System. This material will be periodically transferred to Tanks 30 and 39 to enable the evaporator to continue operating. This has the effect of extending the life of Tank 38 to accommodate the delays in ITP operations and therefore in emptying Tank 41.

Space gain for this evaporator is driven by the volume and salt content of H-LHW and DWPF recycle streams and by the specific gravity at which the evaporator is operated. The Appendix G.3 Tank Farm Material Balance uses an algorithm to forecast space gain. All H-LHW is planned to be evaporated in the 2H Evaporator. It is assumed that the volume reduction for H-LHW will be 71% based on historical and laboratory test data. In addition, DWPF recycle will be evaporated in the 2H Evaporator. It is assumed that the volume reduction for this stream will be 90%. Based on the latest CPES Material Balance, the space gain factor could be as high as 96% if the evaporator were operated at a higher specific gravity. The algorithm in gallons per month is therefore:

2H Space Gain = (H-LHW)*(0.71) + (DWPF Recycle)*(0.9)

Appendix G.3 indicates that the 2H Evaporator is planned to gain about 2 Mgal per year. The ability to do this was demonstrated in FY96.

8.5.3 2F Evaporator

The primary role of the 2F Evaporator will be to evaporate F and H-Area Canyon HHW, F-Canyon LHW, and some of the HHW currently backlogged in H-Area. By FY99, the 2F Evaporator will also evaporate washwater generated by washing the Tank 8 sludge in F-Area prior to sending this material to ESP and tank cleaning washwater after Tank 8 is empty but before it is closed. Washwater generated from all old-style tanks in F-Area will follow Tank 8 in this manner.

2F Evaporator utility is planned to be 60% with a space gain of about 150 Kgal per month during FY97. This is based on two waste transfers from H-Area to Tank 26 during the course of FY97. These transfers ensure that the buildup of salt resulting from the evaporation of DWPF recycle and other waste is shared between the 2H and 2F Evaporator systems. These transfers extend the life of Tank 38 and therefore the operation of the 2H Evaporator until Tank 41 can be emptied. The first of these transfers is planned in November 1996.

An algorithm is used to forecast space gain for the 2F Evaporator as shown in the Appendix G.3 Tank Farm Material Balance. All fresh F-LHW, F-HHW and H-HHW is planned to be evaporated with a space gain factor of 76%. This is based on historical experience as well as laboratory test data. The same factor applies for backlog waste from H-Area. Of the tank washwater shown in Appendix G.3, 50% is allocated to the 2F Evaporator as F-Area has half of the waste tanks that will be water washed. The space gain factor for this stream is conservatively estimated at 90%. ESP washwater will be generated in F-Area as sludge will be pre-washed in-situ before transfer to ESP. This waste stream is estimated to be the value in the "ESP" column of Appendix G.3 times 0.36 (36% of all sludge is in F-Area) times a space gain factor of 85%. This algorithm is therefore:

2F Space Gain = (F-LHW)*(0.76) +
(F-HHW)*(0.76) +
(H-HHW)*(0.76) +
(backlog)*(0.76) +
(0.36)*(ESP washwater)*(0.85) +
(0.50)*(tank washwater)*(0.90)

The 2F Evaporator can be shut down around the year 2013. The small amount of waste in F-Area can easily be shifted to the RHLWE for evaporation.

8.5.4 Replacement High Level Waste Evaporator

The RHLWE is currently in the construction phase. The planned startup date is 11/30/98. Construction is estimated to be 85% complete at the time of this Plan.

The RHLWE is planned to operate at 80% utility and at a space gain based on the forecasted availability of feed. This space gain values shown in Appendix G.3 are well within the expected capacity of the RHLWE. The design basis is 7,600 Kgal per year of overheads assuming feed at 33 gpm at 25-35% dissolved solids.

The plan for the RHLWE is to evaporate 100% of the DWPF recycle stream, plus the ESP washwater generated in H-Area (H-Area has about 64% of all sludge thus 64% of the sludge washwater is allocated to the RHLWE) plus the tank washwater generated in H-Area used to clean tanks that will not be returned to service (H-Area has 29 of the 51 tanks thus 56% of the tank washwater is allocated to the RHLWE). Space gain factors for these streams are the same as described in the previous section. The algorithm used to forecast RHLWE space gain in gallons per year is therefore:

RHLWE Space Gain = (1.0)*(DWPF recycle)*(0.96) +
(0.64)*(ESP washwater)*(0.85) +
(0.50)*(tank washwater)*(0.90)

The RHLWE project scope currently includes installation of gravity drain lines to Tanks 29-31 and Tank 37. However, that portion of the project scope is subject to change pending resolution of project TEC concerns. The RHLWE will start up filling Tank 30 with salt, because the other receipt tanks in that system are full. By the time the salt volume in Tank 30 has reached one million gallons, Tank 29 will be empty and ready for salt receipt service.

8.6 F/H Interarea Transfer Line

The capability to transfer from F-Area to H-Area has been restored. The control system and support facilities have been refurbished, tested and returned to service as of 4/17/96. The first F to H-Area transfer is planned for 2/97. Concentrated supernate from Tanks 25 and 27 will be transferred to Tank 40 to support resumption of PVT testing in ITP.

The H-Area to F-Area Interarea transfer line was unused for years and was recently modified from connecting to H-DB2 to H-DB8. It is now being tested. A water run will be conducted to verify the functionality of system components and overall system integrity. The first transfer in that line, from Tank 39 to Tank 26, is scheduled in November 1996.

8.7 Salt Removal

The salt removal sequence is similar to previous revisions of this Plan. The planned order of near-term salt removal is Tanks 41, 25, 29, 28, and 38. This should ensure that all three evaporator systems can avoid becoming saltbound. There is flexibility in this sequence as construction of waste removal equipment for Tanks 41, 25, 28 and 29 is nearly complete.

After Tank 38, salt will be removed from the old-style salt tanks (Tanks 1, 2, 3, 9, 10, 14 and 19) for feed to ITP. In support of the Ten Year Plan, these old-style tanks have been accelerated in the salt removal sequence. This acceleration is made possible by refinements in the Waste Composition Database. The potassium concentration in all salt tanks as well as the total potassium in the Tank Farm has been reduced from previous projections. This is based on numerous salt solution samples that show potassium to be below its saturation limit. Previously, it was assumed that some potassium was insoluble. Solid salt samples will be obtained to confirm these important planning parameters. The sequence for salt removal from all salt tanks is shown in Appendix G.1.

Traditional salt removal techniques relied on the installation and operation of three slurry pumps per salt tank. The slurry pumps are positioned just above the saltcake, and water is added to the tank. When the slurry pumps are started, the boundary layer of salt solution which was in contact with the saltcake is displaced, and the underlying saltcake is exposed to unsaturated water. When the water is saturated, the dissolved salt is transferred to ITP, the slurry pumps are lowered, and the process is repeated. This technique has been successfully demonstrated on Tanks 17, 19, 20 and 24. However, the dissolution ratio can range from 2-4 parts water per 1 part saltcake, adding unnecessarily large amounts of water to the Tank Farm. This approach is also expensive: it costs approximately $12M to equip a salt tank with slurry pumps and other supporting equipment.

Three less expensive alternative salt removal techniques have been proposed, including Modified Density Gradient, a Single Slurry Pump, and a Water Jet. In the Modified Density Gradient method, inhibited water is added to the salt tank and allowed to dissolve saltcake without agitation. Then the dissolved salt solution is removed. The Single Slurry Pump Method uses the same principles as the traditional salt removal technique described above, except that only one pump is used. A low pressure water jet ,which could be used for "point-and-shoot" salt dissolution, will also be demonstrated.

Some testing of these alternatives has been conducted in the field. See below for more details.

Tank 41 Salt Removal

Tank 41 will be the first salt tank fed to ITP. Relatively high concentrations of fissile U and Pu anticipated in Tank 41 saltcake prompted WSRC to conduct a Nuclear Criticality Safety Study. The concern was that insoluble fissile materials could concentrate in low spots in the salt formation inside Tank 41. Sampling and analytical studies indicated that initiation of salt dissolution can safely proceed. Completed evaluations indicated that the top 50" of saltcake can be safely dissolved. The criticality safety concern will be managed via sampling for confirmation of neutron poison content as waste removal proceeds in a deliberate fashion. The increased time requirement to remove salt in this way is incorporated into the schedule.

As before, there is a strong need to feed Tank 41 to ITP as soon as possible in order to maintain the operation of the 2H Evaporator. The initial salt removal from Tank 41 will be slow due to the lack of working capacity in the tank and the criticality sampling requirements. As salt is removed, larger and larger salt removal batches can occur. Tank 40 must be available to stage the dissolved salt from Tank 41 to allow insoluble solids to settle prior to transferring to Tank 48.

Tank 41 will be used to demonstrate two of the alternate salt removal technologies. The Modified Density Gradient demonstration started 7/96. Approximately 44 Kgal of supernate and interstitial liquid salt were removed before the test, to expose the saltcake. Approximately 20 Kgal of salt was dissolved (but not removed) before the demonstration was suspended in light of the ITP outage and tank space availability concerns. The Single Slurry Pump demonstration is planned in FY97. Salt removal will be completed with the three slurry pumps currently installed in Tank 41.

Tank 25 Salt Removal

Tank 25 will be the second tank fed to ITP. Tank 25 must be emptied and returned to salt service before Tanks 27 and 46 are filled with salt. Tank 25 will be ready for waste removal in FY97 with the first transfer of dissolved salt solution to ITP occurring in FY98. Slurry pump installation and run-in and completion of post-modification testing activities comprise the remaining Tank 25 scope.

Tank 25 will be the first F-Area tank to undergo waste removal. Prior to startup, the F-Area common area support infrastructure upgrades must be completed. These facilities include the motor control center, instrument control room, distributed control system, and bearing water makeup and distribution.

Succeeding F-Area tanks will use this infrastructure. Tank 25 will also require the F/H Inter-Area Line upgrade to be complete (see Section 8.6).

Tank 25 will be used to demonstrate a low pressure (approximately 60 gpm and 50 psi) water jet. A water jet which was originally designed to clean out tank trucks will be modified to allow SRS to use manual control of the sprayer nozzle necessary to conduct "point-and-shoot" demonstrations of the water jet. The modified water jet will be tested at TNX prior to installing it in the G-Riser of Tank 25. The test will evaluate the ability to accurately control spray direction, the effectiveness of the spray pattern, and its ability to dissolve saltcake from cooling coils and the tank walls. Water jet installation and operation are planned in FY97.

Tank 29 Salt Removal

Tank 29 will be the third tank fed to ITP. The RHLWE will start up dropping salt concentrate to Tank 30. Tank 30 is projected to be filled by FY04. Tank 29 must therefore have all of the salt removed, the cooling coils replaced (if needed) and the tank returned to salt receipt service by FY04. Tank 29 is currently projected to be empty by FY02. Tank 29 will be the only tank in the RHLWE system to be outfitted with slurry pumps. Only two pumps will be installed in Tank 29 pending results from alternate salt removal demonstrations. A third pump could be installed later if required.

Tank 38 Salt Removal

Tank 38 is currently projected to be the first salt tank to be designed with alternate salt removal technology. The three alternate demonstrations to be conducted in Tanks 25 and 41 will be used to generate the technical basis for the design of Tank 38. It is expected that this design has the potential to save up to $6 million per salt removal tank in capital costs and that it can be applied to Tanks 1, 2, 3, 9, 10, 27, 30, 31, 36 and 37 as well.

8.8 Sludge Removal

The technical basis for sludge removal is based on the use of four standard slurry pumps for each sludge tank. Sludge removal is performed in a manner that yields nine discreet batches (sometimes called "macro-batches" to distinguish them from the smaller batches used in ITP and DWPF) of sludge which will be individually segregated and characterized after pretreatment in ESP. Sludge Batch #1a is currently in ESP Tank 51 and is being fed to DWPF. This batch is expected to produce 470 canisters. Sludge Batch #1b is currently in ESP Tank 42 and is expected to produce 450 canisters. Sludge Batch #2a will consist of the sludge currently in Tanks 8 and 40. Design and construction activities will begin on Tank 8 in FY97 and complete in early FY99. Thirteen "new generation slurry pumps," which incorporate some minor design improvements over existing slurry pumps, have been purchased for installation in salt Tanks 25, 28, 29, and sludge Tank 8.

Two alternate sludge suspension technologies are being developed via the Tanks Focus Area: the Advanced Design Mixer Pump and AEA Technologies pumps and samplers. The Advanced Design Mixer Pump is the product of a three-year joint development effort between Savannah River and Hanford. The new pumps are expected to be better mixers, with higher reliability and easier decon-ability, thus minimizing personnel radiation exposure and maintenance costs, and reducing pump disposal costs. Hanford personnel had the lead in the design activities. Two pump designs were planned, but funding constraints forced the sites to choose a single design for further development. A prototype of this design has been fabricated by a vendor and is currently on site at TNX awaiting testing. If test results are favorable, the pump will be installed in a Hanford waste tank.

A variety of AEA Technology's sludge mixing pumps and samplers are being tested for possible application in SRS sludge tanks. Equipment under evaluation includes: either a fluidic diode pump or reverse flow diverter pump for inter-tank transfers or to feed the RHLWE; a fluidic sampler, for sampling suspended slurries; a combination of pulse tube mixers and RFD pumps, or RFD pumps alone, to stir the waste tanks; and a fluidic RFD pump for transferring sludge slurries in a proposed counter-current decantation circuit. All of these pumps and samplers are in use at British Nuclear Fuel's Sellafield plant in England. The appeal of these components is that they are commercially available, and they use compressed gases to create vacuum or pressure to move waste; thus, there are no moving parts submerged in the waste itself, making the equipment virtually maintenance-free. Continued tests are planned in FY97.

8.9 Defense Waste Processing Facility

Radioactive Operations began on March 12, 1996, with the transfer of Tank 51 sludge feed to the DWPF Sludge Receipt and Adjustment Tank. The first radioactive canister was poured on April 29, 1996. In FY96, DWPF poured 64 radioactive canisters and transported 52 canisters to the Glass Waste Storage Building. This represents completion of approximately 1% of the total number of canisters to be produced over the life of the facility.

Initial Radioactive Operations

Initial processing began with dilute sludge feed. Radioactive sludge was incrementally introduced into the process by combining it with the simulant heels in the various vessels per startup test FA-20.01, "Transition to Radioactive Operations" under the guidance of the DWPF Joint Test Group. The test focused on collecting baseline radiological data to determine if there were any shielding problems and to obtain an indication of expected radiation levels. The sludge-only portion of FA-20.01 has been completed. Coupled operation of sludge and precipitate feed also will be evaluated under FA-20.01 when Late Wash begins sending precipitate to DWPF.

Production Capacity

Attainment is defined as the design capacity multiplied by the design utility of the DWPF melter. DWPF was designed to support glass production at 228 pounds per hour, 24 hours per day. Canister fill height was originally intended to be 91", which was well above the minimum 86" (80% capacity) fill requirement dictated in the DOE-EM Waste Acceptance Product Specifications

(WAPS). At the 91" fill height, each canister contained 3,705 lbs of glass, and the design capacity of DWPF was calculated as follows:

$$\frac{228 \text{ lbs glass}}{\text{hr}} \times \frac{\text{can}}{3{,}705 \text{ lbs glass}} \times \frac{24 \text{ hr}}{\text{day}} \times \frac{365.25 \text{ day}}{\text{yr}} = 540 \frac{\text{cans}}{\text{yr}}$$

Improvements in glass pour height monitoring technology and the desire to put more glass in each canister have enabled DWPF to fill canisters to a height of 96", which puts 3,900 lbs of glass in each canister. Therefore, while the glass processing rate remains the same at 228 lbs/hour, the total number of canisters produced in a year actually decreases slightly:

$$\frac{228 \text{ lbs glass}}{\text{hr}} \times \frac{\text{can}}{3{,}900 \text{ lbs glass}} \times \frac{24 \text{ hr}}{\text{day}} \times \frac{365.25 \text{ day}}{\text{yr}} = 512 \frac{\text{cans}}{\text{yr}}$$

For consistency with previous HLW System Plans, attainment will continue to be calculated per the original 540 cans per year baseline. The design capacity for the DWPF plant therefore remains 540 canisters per year. The design utility of the plant is 75%, i.e., the plant is designed to operate 75% of the time. The assumed 25% downtime is attributed to melter replacements and planned outages. Therefore, the maximum average attainment over the long term is (0.75)*(540 cans/yr) = 405 cans/yr. This value is referred to as 75% attainment.

Production Plan

In the near term, the average attainment of DWPF, and therefore the HLW System, will be limited by either Late Wash or funding. Funding is allocated in such a manner that no one facility limits the System attainment rate. As it is currently configured, the Late Wash facility is expected to limit DWPF attainment to approximately 37%, or 200 canisters per year. However, funding has been set aside in ADS 25-LI, DWPF New Facility Planning in FY98 and FY99 to improve Late Wash attainment rates.

DWPF poured 64 canisters in FY96 between 4/29/96 and 9/30/96. At that rate, DWPF should be able to produce 152 cans in FY97. Planned production will escalate as follows:

FY96	60 canisters
FY97	150 canisters
FY98-03	200 canisters per year
FY04-05	250 canisters per year
FY06-18	300 canisters per year

This represents a significant acceleration of the HLW program. Previously, DWPF production was planned to plateau at 200 canisters per year from FY98 onward, which extended the program until FY26. The production rates shown above increase the DWPF annual production to 300 canisters per year, which enables all HLW to be vitrified by 2018, an eight year improvement over the 200 Canister Case (for additional information, refer to Appendix C.2). The Ten Year Plan production rates also support removing waste from all 24 old-style tanks by

2006. Process improvements in DWPF, principally in the Analytical Lab, will be needed to exceed the 200 canister per year level. Funding for DWPF attainment improvements has been allocated in the outyears under New Facility Planning. Drops in canister production rates associated with periodic melter replacement outages, which may last from 3-6 months, are not reflected in the production forecast of the Ten Year Plan.

At this writing, the ITP flowsheet remains under evaluation, and details about expected weight percent solids are not finalized. This Plan assumes that ITP will resume processing in October 1997 so that precipitate will be available to feed Late Wash in March 1998. Therefore, coupled operations with both sludge and precipitate feed to DWPF could begin in March 1998.

The current planning basis indicates that all waste will be vitrified in approximately 6,000 canisters by 2018. The total number of canisters to be produced and the program end date will vary as more waste is slurried, representative samples are taken, and more is learned about the various processes in the HLW System. New canyon missions, such as reprocessing of Spent Nuclear Fuel or Foreign Research Reactor Fuel, are not included in this Plan. Therefore, the total number of canisters to be produced should be regarded with some flexibility.

Recycle Handling

As a part of its normal operations, DWPF generates an aqueous recycle waste stream which originates from three sources in the DWPF process: the Melter Off-Gas Condensate Tank (MOGCT), the Slurry Mix Evaporator Condensate Tank (SMECT), and the Decon Waste Treatment Tank (DWTT). These three streams are collected in the Recycle Collection Tank for transfer to the Tank Farm. Availability of receipt space in the Tank Farm is a major factor in HLW System planning; therefore, it is treated in some detail here.

Melter Off-Gas Condensate Tank (MOGCT): The melter is not designed to accommodate thermal cycling; that is, once it has been brought up to temperature, it remains heated with a molten glass heel, even when waste feeding and pouring are temporarily suspended. Because the melter will always contain molten glass, the melter ventilation system must also remain operational. Several components of the melter off-gas system, including the offgas film cooler, the quencher, the steam atomized scrubbers, and the high efficiency mist eliminators, use steam to decontaminate the offgas before release to the atmosphere. Together, these components generate an aqueous waste stream which is collected in the MOGCT. This portion of the recycle stream volume remains constant, regardless of waste processing rates.

Slurry Mix Evaporator Condensate Tank (SMECT): The SMECT collects contaminated condensate from the Salt Cell Slurry Mix Evaporator condenser, the Sludge Receipt and Adjustment Tank condenser, and the Formic Acid Vent Condenser. The amount of aqueous waste produced by each of these processing vessels is determined by waste processing rates.

Therefore, at higher facility attainment rates, more recycle waste from the Salt Cell vessels will be produced.

Decon Waste Treatment Tank (DWTT): The DWTT collects contaminated aqueous waste that is compatible with nitric acid solutions. The largest component of the DWTT influent stream originates with the Analytical Laboratory sample line flushes. The DWTT contents are neutralized with caustic before being pumped to the Recycle Collection Tank for subsequent recycling to the Tank Farm. This flow is also variable, depending upon attainment.

Recycle Rate

The recycle generation rate during radioactive operations is projected as follows:

recycle gpm = 2.50 + (4.43)(att) + (0.16)(n)

where: 2.50 = minimum input to MOGCT
4.43 = minimum input to the SMECT
att = attainment expressed as a fraction
0.16 = factor applied to equipment decon wastes
n = the age of DWPF from 1 to a maximum of 4

Even at zero attainment, the Melter Off-Gas portion of the recycle continues to be generated at a minimum rate of:
= 2.66 gpm
= 1,398,000 gallons per year.

DWPF began sending recycle waste to the Tank Farm on December 24, 1995, when DWPF began Mercury Runs. As stated above, Radioactive Operations began on March 12, 1996. Actual DWPF recycle transfers for the period December 24, 1995 - September 30, 1996 totaled 1,122 Kgal, slightly less than the 1,477 Kgal predicted. This demonstrates that the algorithm above, which was developed prior to DWPF acquiring any radioactive operating experience, is a fair indicator of recycle production rates.

Thus, at 150 canisters or 28% attainment, the recycle in FY97 is expected to be:
= 2.5 + (4.43)(0.28) + (0.16)(1)
= 3.9 gpm
= 2,050 Kgal per year

This algorithm will be evaluated, and may be modified, based on additional actual operating experience. However, the fact remains that the MOGCT and the SMECT drain to DWPF's Recycle Collection Tank, which has a working capacity of 8,200 gallons. DWPF has no other capacity to store the recycle stream. Therefore, in order to support DWPF production, recycle transfers to the Tank Farm must occur about once per day. The current HLW System configuration for these transfers uses the S- to H-Area inter-area line to the Low Point Pump Pit, then to the HDB-8 Complex, and finally to Tank 43, which feeds the 2H Evaporator. Once the RHLWE is available, 100% of the DWPF recycle will be diverted to that system for evaporation.

Organic Waste Storage Tank (OWST)

The washed precipitate transferred from Late Wash to DWPF contains cesium tetraphenylborate and potassium tetraphenylborate. DWPF uses a precipitate hydrolysis process to destroy the tetraphenylborate, which cannot be processed through the melter. The precipitate hydrolysis process yields a side stream nominally referred to as "benzene," although in fact it contains approximately 15% other aromatic organic compounds and low levels of radioactivity. The benzene is then steam-stripped in the Precipitate Reactor (PR), further decontaminated and sampled in the Organic Evaporator (OE), and transferred outside the Vitrification building to the Organic Waste Storage Tank (OWST) via a welded, stainless steel overhead line.

The OWST is a double-shell, above-ground tank located west of the Vitrification Building in S-Area. The primary tank is constructed of 304L stainless steel, and has a capacity of 150,000 gallons. A floating roof inside the primary tank serves to reduce evaporation of the organic liquid. The roof begins to float when there are approximately 13,800 gallons of liquid in the tank. Therefore, a minimum heel of 13,800 gallons of benzene, once established, will always be maintained to limit benzene emissions. The vapor space between the floating roof and the fixed roof is blanketed with nitrogen gas, and ventilated through HEPA filters. The secondary tank is constructed of carbon steel, and includes a leak detection system. At the time of this Plan, the OWST liquid organic inventory was approximately 10 Kgal.

The DWPF benzene stream is classified under RCRA as a mixed waste, and so the OWST is operated under its own RCRA permit. RCRA regulations recognize incineration as the Best Demonstrated Available Technology (BDAT) for treatment of benzene wastes. The Consolidated Incineration Facility (CIF), located south of the OWST, will incinerate the DWPF benzene stream. The OWST is connected to the Consolidated Incineration Facility (CIF) by a second welded, carbon steel overhead line. For more information on the CIF, refer to Section 8.12.

Mercury Disposal

Mercury is entrained in the sludge as a result of Separations processing and must be removed from the sludge prior to vitrification. Initial plans for disposition of this mercury stream called for the mercury to be returned to the Separations facilities for re-use in their processes, but evolving Site missions have precluded re-use of the mercury stream. Since mercury is a toxic hazardous waste under the Resource Conservation and Recovery Act (RCRA), it must be disposed in compliance with RCRA regulations. The current Best Demonstrated Available Technology for mercury disposal is amalgamation. However, radioactive contaminants in the DWPF mercury stream may necessitate pre-treatment before amalgamation, or they may preclude amalgamation. Samples of actual mercury recovered after the start of DWPF Radioactive Operations will be collected and tested to verify which disposal options are technically feasible. Final disposition of the DWPF mercury was evaluated on a national basis under the Site Treatment Plan. The DWPF mercury will be stored at an on-site, permitted storage facility until disposition plans are finalized.

Replacement Melters

Ongoing vitrification operations will require periodic melter replacement. SRTC predicts that noble metals deposition (causing the electrodes to short-circuit) will be the most likely cause of melter failure, and that melter life expectancy will average about two years. Replacement melter projects are planned accordingly. Melter replacement outages may last from 3-6 months. However, drops in annual canister production rates associated with those outages are not reflected in the production forecast of the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6).

Melter #1 is already installed. It began operating in June 1994, was used for DWPF startup testing, and is currently in radioactive service. Melter #2 is on site and construction modifications are approximately 98% complete. An outage to replace Melter #1 with Melter #2 is planned in FY98. By that time, Melter #1 will have operated for 3.5 years, which is 175% of its anticipated two-year design life. (Melter #1 will be allowed to remain in service as long as it operates normally.) Additional supporting systems must be ready prior to the Melter #1 Replacement Outage. These include fabrication of the Melter #1 Storage Box, railroad car refurbishments, and Failed Equipment Storage Vault modifications. The Melter #3 vessel and frame and other major components (riser pour spout assembly, dome heaters, drain valve, refractories, etc.) are on site, and refractory assembly is underway. Overall lead time for a replacement melter project, from project inception through actual installation in the DWPF, is approximately 5 years.

Glass Waste Acceptance at Future Federal Repository

In the mid-1980's, the Department of Energy recognized that high level waste processing at DWPF would considerably precede licensing of a Federal Repository. Accordingly, DOE instituted a Waste Acceptance Process to ensure that the canistered waste forms could be accepted for eventual disposal at a Federal Repository. DOE has implemented a tiered approach to waste acceptance requirements, as follows.

Two branches of DOE are involved in this process. DOE's Office of Civilian and Radioactive Waste Management (DOE-RW) is responsible for the Federal Repository. DOE's Office of Environmental Restoration and Waste Management (DOE-EM) is responsible for all waste form producers. DOE-RW developed the **Waste Acceptance System Requirements Document (WASRD)**, which required DOE-EM to develop waste form production specifications. DOE-EM responded by producing the **Waste Acceptance Product Specifications for Vitrified High-Level Waste Forms (WAPS).** The WAPS are the basis for waste form activities at DWPF.

The WAPS are divided into five sections dealing with the waste form (borosilicate glass), the canister, the canistered waste form, quality assurance of waste acceptance process activities, and documentation and other requirements. DWPF is required to document its compliance with the WAPS in the Waste Form Compliance Plan (WCP), the Waste Form Qualification Report (WQR), the Production Records, and the Storage and Shipping Records.

The **Waste Form Compliance Plan (WCP)** provides general information about the DWPF process and product, and a detailed description of the methods and programs by which DWPF will demonstrate compliance with each specification in the WAPS, including tests, analyses, process controls and records that will be provided as evidence. The **Waste Form Qualification Report (WQR)** is a compilation of the results of those testing and analysis programs identified in the WCP. The common objective of those programs is to confirm DWPF's ability to produce a product which meets specifications. Parts of the WQR were used to gain approval for DWPF startup, and may be used in licensing a Federal Repository containing DWPF waste forms. The **Production Records** will summarize the entire production history of each canistered waste form, including canister fabrication, chemical composition and radionuclide inventory of the waste, Product Consistency Test (PCT) results, canister filling with glass, canister fill height, sealing of the filled canister, and other details. The Production Records are being provided to DOE-RW as soon as they are completed, in order to allow DOE-RW to review their content in a timely manner, identify any potential problems, and include any pertinent information in the repository license application. The **Storage and Shipping Records** cover storage of the canistered waste form at SRS (including any abnormal events during storage, such as thermal excursions) and loading each canister into a shipping cask. The Production Records and the Storage and Shipping Records will be the primary documentary evidence that individual canistered waste forms have satisfied the specifications.

8.10 Late Wash

Startup Schedule

Late Wash is currently scheduled to be Ready for Radioactive Operations February 28, 1997. At that point, the Late Wash Facility will have completed water runs with the original design intact, and the Late Wash portion of the Approval For Acceptance will have been submitted to DOE for approval. This will enable the DWPF/Late Wash project to be closed based on satisfactory completion of Late Wash water runs. If ITP flowsheet modifications prompt Late Wash Facility modifications, those Late Wash modifications will be installed under a separate project. System testing with waste simulants is expected to generate benzene; therefore, simulant testing will be deferred until after the modifications, if any, are installed, to avoid the increased cost and risk of installing hardware changes when benzene is present.

Readiness Reviews

The startup testing and readiness program for Late Wash will build upon the programs utilized in DWPF. A series of planned equipment tests are being conducted to verify the operability of each system. WSRC is conducting a Readiness Self-Assessment (RSA) addressing design, construction, testing, training, procedures, and safety documentation (other functional areas will have been covered by the DWPF RSA). The Late Wash RSA is in progress, and is scheduled to complete in November 1996.

Starting Feed

Under the proposed new ITP flowsheet, the ITP precipitate is expected to meet historical average feed specifications of 0.225 M sodium, 0.17 M nitrite, and 10 wt% solids. The only characteristic of the precipitate which may differ is shear stress. Under conditions of high curie content in the precipitate, an assumed two-year residence time in Tank 49, and a high precipitate inventory in Tank 49, the high absorbed radiation dose lowers the precipitate's shear stress to about 100 dynes/m^2. Under the current proposed ITP flowsheet, the curie content of the precipitate will be lowered by blending, the residence time will be greatly reduced given the just-in-time plan for close-coupled feed to DWPF, and the precipitate inventory will be kept low. Therefore, the absorbed dose to the precipitate will be much lower, and the shear stress of the precipitate is expected to be higher, around 100-300 dynes/m^2. The impact to Late Wash, if any, is being evaluated.

Production Capacity

The Late Wash cycle time is expected to be 61 hours without filter cleaning, or 93 hours with filter cleaning. This cycle time is based on cleaning the crossflow filters after every third batch. It is possible that less cleaning will be required, particularly as precipitate absorbed dose is reduced; however, the conservative assumption is used until actual radioactive operating data is available. The batch size will be 4 Kgal.

The Late Wash process is close-coupled with DWPF, meaning that there is no "wide spot " to accumulate late washed precipitate. The Late Wash process must wait for downstream tanks in DWPF to be emptied before Late Wash can transfer precipitate forward. Likewise, Late Wash cannot operate while DWPF is down. DWPF downtime is planned to be 25%. The net result of the interplay between the Late Wash and DWPF flowsheet batch times is that Late Wash becomes the rate limiting process in the HLW System. Current projections indicate that the maximum production rate Late Wash can support is somewhere between 130 and 200 canisters per year depending on the frequency of filter cleaning and the drainback characteristics of the washwater transfer route. This rate will be refined as actual production data is generated. Until more information is available, it is assumed that Late Wash can support 200 cans per year. As a contingency, $10 million is set aside in the Life Cycle Cost model that supports this Plan during FY98-00 for attainment enhancement at Late Wash. This project would likely contain a second Late Wash filtrate hold tank.

8.11 Saltstone Facility

Production Capacity

The Saltstone facility is currently staffed one shift per day, five days per week. About six hours each day are available for salt solution processing at a rate of up to 110 gpm. The other two hours each day are required for startup preparations in the morning and shutdown of the process at the end of the day. The plant utility is assumed to be 50% based on experience to date. Therefore, when feed is available, Saltstone can process about 19.8 Kgal of salt solution per day or 5,148 Kgal of salt solution per year.

Since ITP began its CLFL outage earlier this year, less feed has been available to Saltstone, so waste receipt and processing operations have been reduced to once per week. Saltstone will resume more frequent processing when ITP resumes processing in FY98. Starting in FY04, when ITP production further increases to support DWPF's 250 canister rate, Saltstone must increase its operations to two shifts per day, five days per week. This will enable Saltstone to operate at 110 gpm for 14 hours per day, with two hours for startup and shutdown. At this rate, Saltstone will be able to process 46.2 Kgal of salt solution per day, or 12,012 Kgal of salt solution per year.

Vaults

Saltstone operations require periodic construction of additional vaults, capping of filled vault cells and construction of permanent roofs. The required schedule for these repetitive projects is dependent upon the ITP production plan. Each vault cell can hold 232,000 cubic feet of saltstone grout, or approximately 1.1 million gallons of Tank 50 salt solution. The construction and startup of new vaults supports planned ITP production rates on a just-in-time basis. For a schedule of vault use through the end of the HLW program, refer to Appendix G.1.

Currently, construction of Vault #1 is complete and the vault is in service. Vault #1 has 6 cells, three of which are now filled. The Vault #1 operating plan is as follows: as each cell is filled to a height of 24 feet, a 1 foot thick clean concrete isolation cap is installed and the Rolling Weather Protection Cover (RWPC) is moved to the next set of two cells. When all 6 cells are filled and capped, the RWPC will be dismantled and discarded, and a permanent roof installed.

Vault #4 construction is complete and this vault is also in service. One of its twelve cells (Cell A) was filled in 1989 when 1100 Naval Fuels waste drums were disposed and grouted in place. A permanent roof is currently being installed in lieu of the RWPC. The permanent roof provides several advantages over the RWPC: the cells can be filled to height of 25 feet; more than one cell can be filled at a time if needed; and the need to dispose of the RWPC as radioactive waste is eliminated. Installation of the permanent roof is expected to complete in December 1996. Vault #4 grout filling is projected to resume in FY98.

The design for Vault #2 is complete. Like Vault #4, Vault #2 has been designed with twelve cells. However, the Vault #2 design differs somewhat from the Vault #4 design in that it includes a permanent roof as an inherent part of the vault design and construction. The Vault #2 design is considered the prototype for future Saltstone vaults, if the site chooses to continue building this type of disposal unit. (See the Saltstone Vault Alternatives discussion below for more details.) However, this Plan assumes that 6-cell vaults will be used (to maximize budget efficiencies) until such time as a better planning basis is available.

Saltstone Vault Alternatives

In July 1995, representatives of the EPA Region IV, SCDHEC, DOE and WSRC met in Rock Hill, South Carolina to negotiate strategies that would enable the Site to meet regulatory requirements while operating with constrained resources. Many site programs were targeted as potential areas for improvement. One such area was the Saltstone Facility, which was subsequently analyzed for potential privatization. The "Saltstone Privatization Feasibility Study," published in October 1995, concluded that facility privatization was feasible, provided the site could obtain SCDHEC concurrence. At a meeting with SCDHEC in November 1995, SCDHEC supported the Site's pursuit of more cost-effective operations, but found the possibility of a vendor introducing new waste streams to be unacceptable. Therefore, the privatized vendor operator scenario for Saltstone was abandoned.

Further analysis identified the high cost of building replacement vaults (currently projected at $22 million for a twelve cell vault, or $13 million for a six-cell vault, (in FY97 dollars) as another potential area for improvement. A Saltstone Vault Alternatives Study was initiated in January 1996 to explore possible alternatives in influent waste volume reduction or saltstone grout disposal. Volume reduction processes are being pursued with private vendors. Disposal alternatives included using the existing reactor basins as disposal sites, or adopting a modified saltstone vault concept. The reactor area basins were eliminated by a site screening study because they were less suitable for saltstone grout disposal than Z-Area. Development of the Z-Area landfill option is ongoing, as described below.

The "Pre-Conceptual Design Study for Z-Area Saltstone Waste Disposal Alternatives" (dated October 1996) briefly describes the design and construction of Geosynthetic Lined Waste Disposal Cells, which would be similar to municipal landfills. This design features low permeable soil and a geosynthetic liner below the cell, a prefabricated weather protection cover, a saltstone grout piping delivery system to accommodate heat of hydration limits, a positive ventilation system with HEPA filters, and leachate collection system. Cell capacity is estimated at 1.5 million gallons of grout each. Approximately 154 of these cells could be constructed over the life of the Saltstone Facility, for a total available capacity of about 230 million gallons. A cost study has been completed which compares the existing vault design to the proposed geosynthetically lined cells. Based upon pre-conceptual design information, the landfill option could provide cost savings of up to $9M per 12-cell vault equivalent. Further design work has been deferred pending availability of funding.

8.12 Consolidated Incineration Facility (CIF)

The Consolidated Incineration Facility (CIF) will treat and volume-reduce certain incinerable hazardous, low-level radioactive and mixed SRS wastes. The EPA recognizes incineration as the Best Demonstrated Available Technology (BDAT) for treating certain waste streams. Incineration will reduce the waste volumes by approximately 90%, reduce the chemical toxicity of the wastes, convert the residual ash to an environmentally immobile form, and eliminate off-site shipments of incinerable wastes. CIF will incinerate a variety of SRS-generated wastes, including oils, paint solids, solvents, rags, organic wastes (including DWPF benzene, see details below), miscellaneous waste sludges, and protective clothing.

Major components of the CIF include a rotary kiln incinerator, a secondary combustion chamber and an offgas treatment system. Boxes of solid waste are fed into the rotary kiln by a mechanical ram feeder. The kiln's rotating action continuously tumbles the boxes for more thorough destruction. Most liquid wastes (except DWPF benzene) are also fed to the rotary kiln. The kiln will operate at about 1400-1500°F (760-815°C); thermal cycling will be minimized. Combustion gases generated in the rotary kiln are further incinerated in the secondary combustion chamber to ensure thorough destruction of the organic waste components. Operating conditions will be controlled to ensure at least 99.99% destruction of the hazardous organic constituents of the waste. CIF will generate two waste streams: ash formed in the rotary kiln and scrubber blowdown from the offgas system. These two streams will be kept segregated, but both will be solidified with concrete into a form referred to as "ashcrete," which will be drummed and disposed on-site at the E-Area Vaults.

CIF will provide essential support to the High Level Waste System by incinerating the DWPF benzene stream. (For more information on DWPF benzene, refer to Section 8.9). An overhead, welded carbon steel recirculating transfer loop connects the DWPF Organic Waste Storage Tank (OWST) to the CIF. A branch connection from the loop line feeds the benzene directly to the secondary combustion chamber. This design provides an advantage to the CIF in that the benzene is burned as a supplemental fuel, and replaces a thermally equivalent amount of fuel oil needed to operate the secondary combustion chamber.

CIF construction is complete and startup testing is in progress. The CIF is currently scheduled to conduct its Pre-Trial Burn with simulated wastes in December 1996. The Trial Burn, which will use the same simulated wastes and which will be witnessed by EPA and SCDHEC officials, is scheduled for March 1997. Radioactive Operations are also scheduled to start in March 1997.

Additional planning details for the CIF will be included in the next revision of this Plan.

8.13 New Facility Planning

A complete list of active and planned projects through the end of the HLW program is shown in Appendix D. The projects are needed to support the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6). Some of the projects are repetitive, including Saltstone Vaults and Failed Equipment Storage Vaults as needed through the end of the program. Three outyear projects (one for ITP and two for DWPF) are identified for facility upgrades as needed over the life of the program.

There are eight New Start Projects included in the FY98 Outyear Budget Plan. These projects are described in ADS's 25-LI and 38-LI. Each of these is planned to be complete on a "just in time" basis. The remaining New Start Projects are briefly discussed below.

Tank Farm Storm Water Upgrades

This FY98 project will provide equipment to relieve the current storm water flooding that occurs in the Tanks 9-12 area of the H-Area Tank Farm. In the past, this condition has resulted in storm water standing on top of Tanks 9-12 and actually leaking into the tanks. In a worst case scenario, the head space in a waste tank could be filled with water, causing direct communication between the tank contents and the standing water in the Tanks 9-12 area. This could also occur with the HDB-2 complex. As an interim measure, three-foot-tall dikes have been constructed around the perimeters of Tanks 9-12 to keep the water out.

Tank Farm Support Services Upgrade

This FY99 project will replace the aging, underground support services in the F-Area Tank Farm and the H-Area East Hill Tank Farm with new above grade lines. The original service piping systems have exceeded their useful life. The replacement services include steam, cooling water, domestic water, plant and instrument air, and breathing air. The need for this project is evidenced by the extended steam outages experienced by the 2F Evaporator in FY94 and FY95. Routine three or four day outages became one and two month outages when excavations revealed whole line segments (not just isolated leaks or point failures) in unacceptable condition.

Glass Waste Storage Building (GWSB) #2

This FY02 project will provide storage space for vitrified waste after GWSB #1 is full. This is projected to occur in mid-2006 based on the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6) canister production rates, as shown in Appendix G.6. GWSB #2 must therefore be complete in FY06. This project will be funded over a four year period. The project could be completed more quickly, but the four year period will levelize the funding requirement. GWSB #2 will have the same capacity as GWSB #1 (2,286 cans).

The GWSB #2 design will be modular in order to accommodate construction of additional modules as necessary to support ongoing canister production and storage. Such an expansion is forecast in FY14, and will be needed to house approximately 1,500 canisters.

8.14 Tank Closure

SRS has begun efforts to close HLW tanks. The Tank 17-20 cluster in F-Area has been selected as the first set of tanks to be closed, for several reasons: these are old-style tanks, which will not be returned to service after waste removal; very little waste remains in any of the four tanks (see below for more details); Tanks 19 and 20 have a history of groundwater in-leakage; and, these are Type IV tanks, which lack internal structures, thereby simplifying the emplacement of backfill material. Tank 16, which has already undergone bulk waste removal, water washing and acid cleaning, will also be among the first tanks closed.

A recipe for the first layer of backfill, nominally referred to as "smart grout" for its waste-binding properties, has been developed and tested by Construction Technologies Laboratories (CTL) in Chicago. Of three formulations tested, one provided the reducing conditions, high pH, acceptable flowability, low segregation and low bleed water required to meet Savannah River's needs. This formulation will be prescribed in the Procurement specification for a vendor to provide the material. Controlled Low-Strength Material (CLSM), which will prevent tank subsidence, will be used as the second layer of backfill. The top layer will consist of "strong" grout, which can fill small void spaces at the top of the tank and will discourage intruders in the event institutional control is lost.

The regulatory process for tank closure is described above in Section 5.2.2. Fieldwork progress on each of the first five tanks is described below.

Tank 20

Tank 20 will be closed first. Bulk waste removal and water washing were completed in 1986. Ballast water was removed in July 1996. Photographic inspections of the tank interior revealed approximately 1/4" to 3/8" of sludge remains on the bottom of the tank, which equates to approximately 1,000 gallons of sludge. The waste has been characterized by process knowledge and sampling.

Contract negotiations with vendors to provide the tank's backfill materials have been initiated, but actual tank filling cannot begin until the site has obtained NRC agreement with DOE's proposal on "residual waste." In a meeting between DOE and NRC on September 17, 1996, NRC indicated that further study would be required. Disassembly and removal activities continue on tank-top equipment. In support of the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6), and pending the outcome of discussions with the NRC, Tank 20 will be closed in FY97.

Tank 17

Tank 17 bulk waste removal of 376 Kgal of sludge was completed in 1985. Today, Tank 17 contains about 275 Kgal of tritiated water, contaminated with K Reactor moderator, which was delivered to the tank in early 1992. This tritiated water will be transferred to either Tank 5 or 6 for continued storage, where it may soften the dry sludge in those tanks. Tank 17 currently contains about 2 Kgal of sludge. In support of the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6), Tank 17 will be closed in FY97.

Tank 19

Bulk waste removal from Tank 19 occurred in 1986 using two slurry pumps mounted in almost diametrically opposing risers. This equipment configuration created a "beachline" of sludge and zeolite, roughly 18 inches high, running across the diameter of the tank bottom. The zeolite particles are large, making them difficult to remove with slurry pumps; zeolite covers some piles of sludge. This sludge/zeolite heel was thought to have hardened over the years. In 1995, Tank 19 was identified as the location in which SRS planned to demonstrate a high pressure (100-200 gpm, 3,000 psi maximum) extendible nozzle for the break-up of this hardened sludge heel. However, pre-test waste samples obtained with a mud snapper revealed that the heel was, in fact, softer than expected, and probably easily mobilized. Therefore, the extendible nozzle originally intended for use in Tank 19 may be demonstrated in an alternate tank. In support of the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6), Tank 19 also will be closed in FY97.

Tank 18

Approximately 208 Kgal of sludge were removed from Tank 18 in 1986. Tank 18 will be the last tank closed in this cluster because Tanks 17, 19 and 20 can only transfer into Tank 18, and Tank 18 is the only tank of the four that can transfer out to FDB-1. The tank currently contains about 16 Kgal of sludge and 50 Kgal of supernate. In support of the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6), Tank 18 will be closed in FY98.

Tank 16

Tank 16 was the subject of a rigorous waste removal, water washing and acid washing demonstration in 1978-80. Waste removal from the tank primary is considered complete. However, large quantities of crystallized saltcake remain in the tank's annulus and will have to be removed prior to tank closure. Some of the crystallized saltcake may have evolved into natro-devyne, a hard, insoluble compound, which would not dissolve easily. Technology development of annulus cleaning techniques may be required. Acid washing of the annulus may be required. In support of the DOE-SR Ten Year Plan (QC-96-0005, Draft 8/6), Tank 16 will be closed in FY98.

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Appendix A - Acronyms

ADS	Activity Data Sheet
AOP	Annual Operating Plan
BA	Budget Authority
BO	Budget Outlay
CAB	Citizen's Advisory Board
CIF	Consolidated Incinerator Facility
Ci/gal	Curies per Gallon
CLFL	Composite Lower Flammability Limit
CLSM	Composite Low Strength Material
CPES	Chemical Process Evaluation System
CTS	Concentrate Transfer System
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DWPF	Defense Waste Processing Facility
EA	Environmental Assessment
EIS	Environmental Impact Statement
EM	Enviromental Restoration and Waste Management, - usually as a suffix to DOE
EPA	Environmental Protection Agency
ESP	Extended Sludge Processing
ETF	Effluent Treatment Facility
FFA	Federal Facility Agreement
FY	Fiscal Year
GWSB	Glass Waste Storage Building
HHW	High Heat Waste
HLW	High Level Waste
HLWIFM	High Level Waste Integrated Flowsheet Model
HQ	Headquarters - usually as a suffix to DOE
INMM	Integrated Nuclear Material Management
ITP	In-Tank Precipitation
LHW	Low Heat Waste
LI	Line Item
LLW	Low Level Waste
NEPA	National Environmental Policy Act
NMSP	Nuclear Materials Stabilization and Processing
ORR	Operational Readiness Review
PCCS	Product Composition Control System
PID	Process Interface Description
RBOF	Receiving Basin for Offsite Fuels
RCRA	Resource Conservation and Recovery Act
RHLWE	Replacement High Level Waste Evaporator
ROCTP	Radioactive Operations Commissioning Test Program
RW	Office of Civilian and Radioactive Waste Management- usually a suffix to DOE
SAR	Safety Analysis Report
SCDHEC	South Carolina Department of Health and Environmental Control
SIMP	System Integration Management Plan
SR	Savannah River - usually a suffix to DOE
SRS	Savannah River Site
SRTC	Savannah River Technology Center
STP	Site Treatment Plan
STPB	Sodium Tetraphenylborate
TEC	Total Estimated Cost
Tk	Tank
TOST	Technical Oversight Steering Team
WAPS	Waste Acceptance Product Specifications for Vitrified High Level Waste Forms
WASRD	Waste Acceptance System Requirements Document
WCP	Waste Form Compliance Report
WQR	Waste Form Qualification Report
WSRC	Westinghouse Savannah River Company

Appendix B - HLW Priorities

1. Maintain operating facilities in a safe condition:
    - 1a. Health & safety of workers & public
    - 1b. Stewardship of current waste inventories
    - 1c. Improvement programs/projects critical to 1a and 1b
    - 1d. Maintenance of facilities to ensure 1a and 1b

2. Support Critical Site Missions

3. Comply with Federal and State Regulatory Commitments

4. DWPF operation to support FY97 production of 150 canisters

5. High Level Waste System to support earliest introduction of precipitate:
    - 5a. Completion of DNFSB Recommendation 96-1 Implementation Plan commitments.
    - 5b. ITP Process Verification Tests
    - 5c. Late Wash Project
    - 5d. DWPF Salt Cell readiness

6. Maintain Continuity of Operations at a minimum rate of 200 canisters per year in FY98-01:
    - 6a. F to H-Area Inter-Area Line
    - 6b. Tank 40 agitation
    - 6c. ITP Safety Basis Upgrades and Cycles #2-5
    - 6d. Tank 25 salt removal
    - 6e. Tank 29 salt removal
    - 6f. Sludge Batch #1b
    - 6g. Tank 8 sludge removal for Sludge Batch #2a

7. Remove waste from old-style tanks at the earliest date consistent with priorities #1-6

8. Provide minimum essential infrastructure as required to support waste removal from tanks on a "just in time" basis

9. Invest a portion of available funding in technology initiatives that have a strong potential to reduce cost:
    - 9a. Modified Density Gradient Salt Removal
    - 9b. One Pump Salt Removal
    - 9c. Other Salt Removal Techniques (Water Jet)

Appendix B - HLW Priorities

10. Invest a portion of available funding in the development of tank or Tank Farm closure activities:
    - 10a. Preliminary Performance Evaluation/Performance Assessment
    - 10b. Regulatory Negotiations
    - 10c. Tank Closure Program Plan Development
    - 10d. Tank Closure Operations

11. Reduced Program Risk

    Technical, engineering or programmatic activities that improve planning, resolve technical issues, develop contingenc plans, add flexibility, make the program more robust, strengthen technical credibility, etc.

    - 11a. Salt Solution Treatment and Disposal Options

Appendix C.1 - Funding

		Final	10 Year Plan Baseline ($ x 1,000)										
ADS #	ADS Title	FY96 (BO)	FY97 (BA)	FY97 (BO)	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
21-AA	DWPF Program Management	22,410	21,111	21,111	6,090	5,670	5,274	5,243	5,211	5,367	5,528	5,694	5,865
22-AA	Vitrification	156,910	133,216	137,216	154,337	160,049	168,307	174,638	173,240	174,273	181,002	186,432	193,525
23-AA	Saltstone Z-Area	10,816	9,927	9,927	11,765	16,948	17,448	16,644	25,915	29,843	29,457	30,341	32,051
24-GP	DWPF General Plant Projects	1,084	860	860	2,577	2,832	2,832	2,947	3,066	3,158	3,253	3,350	3,451
25-LI	DWPF New Facility Planning	0	0	0	5,042	5,000	0	2,345	0	29,607	60,399	55,445	22,638
26-LI	DWPF Line Item	25,081	0	4,645	0	0	0	0	0	0	0	0	0
27-LI	Failed Equip Storage Vaults	0	0	0	285	2,844	2,512	0	0	0	0	0	0
31-AA	HLW Program Management	44,820	43,691	43,691	25,669	25,513	25,319	25,757	25,956	26,734	27,537	28,363	29,214
32-AA	H-Tank Farm	68,343	60,002	61,002	70,907	74,185	76,532	78,800	79,653	82,043	84,504	87,039	89,650
33-AA	F-Tank Farm	42,815	39,216	39,216	48,974	49,995	51,552	53,077	53,615	55,223	56,880	58,587	60,344
34-AA	ITP/ESP	63,857	65,555	66,555	73,298	79,828	75,958	78,054	82,330	87,577	87,058	93,597	98,529
35-AA	Effluent Treatment Facility	17,641	16,930	17,930	19,077	20,342	20,970	21,592	22,229	22,896	23,583	24,290	25,019
37-GP	HLW General Plant Projects	3,219	2,250	4,739	2,975	1,374	1,207	4,150	2,035	3,000	3,090	3,183	3,278
38-LI	HLW New Facility Planning	619	7,044	7,044	7,513	3,842	9,095	22,905	17,253	16,243	12,327	26,349	42,776
39-LI	New Waste Transfer Facility	4,200	0	0	0	0	0	0	0	0	0	0	0
310-LI	RHLWE	16,611	20,431	21,787	10,121	2,597	0	0	0	0	0	0	0
311-LI	DB & Pump Pit Containment	939	0	0	0	0	0	0	0	0	0	0	0
314-LI	Waste Removal	20,987	19,677	25,677	23,385	24,495	27,430	35,570	45,259	78,794	60,298	27,792	45,066
315-LI	Tank Farm Services Upgrade	1,288	3,804	6,060	6,085	4,916	0	0	0	0	0	0	0
316-LI	Storm Water Upgrades	0	0	0	1,501	8,499	4,500	0	0	0	0	0	0
	Total SRS High Level Waste	501,640	443,714	467,460	469,601	488,929	488,936	521,722	535,762	614,758	634,916	630,462	651,406
	Total in FY98 Constant $	501,640	443,714	467,460	469,601	474,688	460,869	477,450	476,018	530,296	514,850	499,855	485,296

Note: In FY98-FY06, Budget Authority (BA) = Budget Outlay (BO)

Appendix C.2 - Funding Comparison

FY96 TEN-YEAR PLAN vs 200-CANISTER CASE

($'s in Millions)

FY97-FY06

	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	10-Yr
FY96 TEN-YEAR PLAN											
Cum. # Cans Filled	210	410	610	810	1,010	1,210	1,410	1,660	1,910	2,210	
Cum. # Tks Closed	3	5	5	5	6	6	9	11	16	20	
Total $ (escalated)	444	470	489	489	522	536	615	635	630	651	5,480
FY98 Constant Yr $'s	444	470	475	461	477	476	530	532	513	514	4,891
200 CANISTER CASE											
Cum. # Cans Filled	210	410	610	810	1,010	1,210	1,410	1,610	1,810	2,010	
Cum. # Tks Closed	0	0	0	0	0	0	0	0	0	0	
Total $ (escalated)	438	460	485	489	512	528	535	569	578	595	5,188
FY98 Constant Yr $'s	438	460	471	461	468	469	462	476	470	470	4,644
Delta											
Cum. # Cans Filled	0	0	0	0	0	0	0	50	100	200	
Cum. # Tks Closed	3	5	5	5	6	6	9	11	16	20	
Total $ (escalated)	6	10	4	0	10	8	79	66	53	56	292
FY98 Constant Yr $'s	6	10	4	0	9	7	68	56	43	44	247

FY07 TO FY26

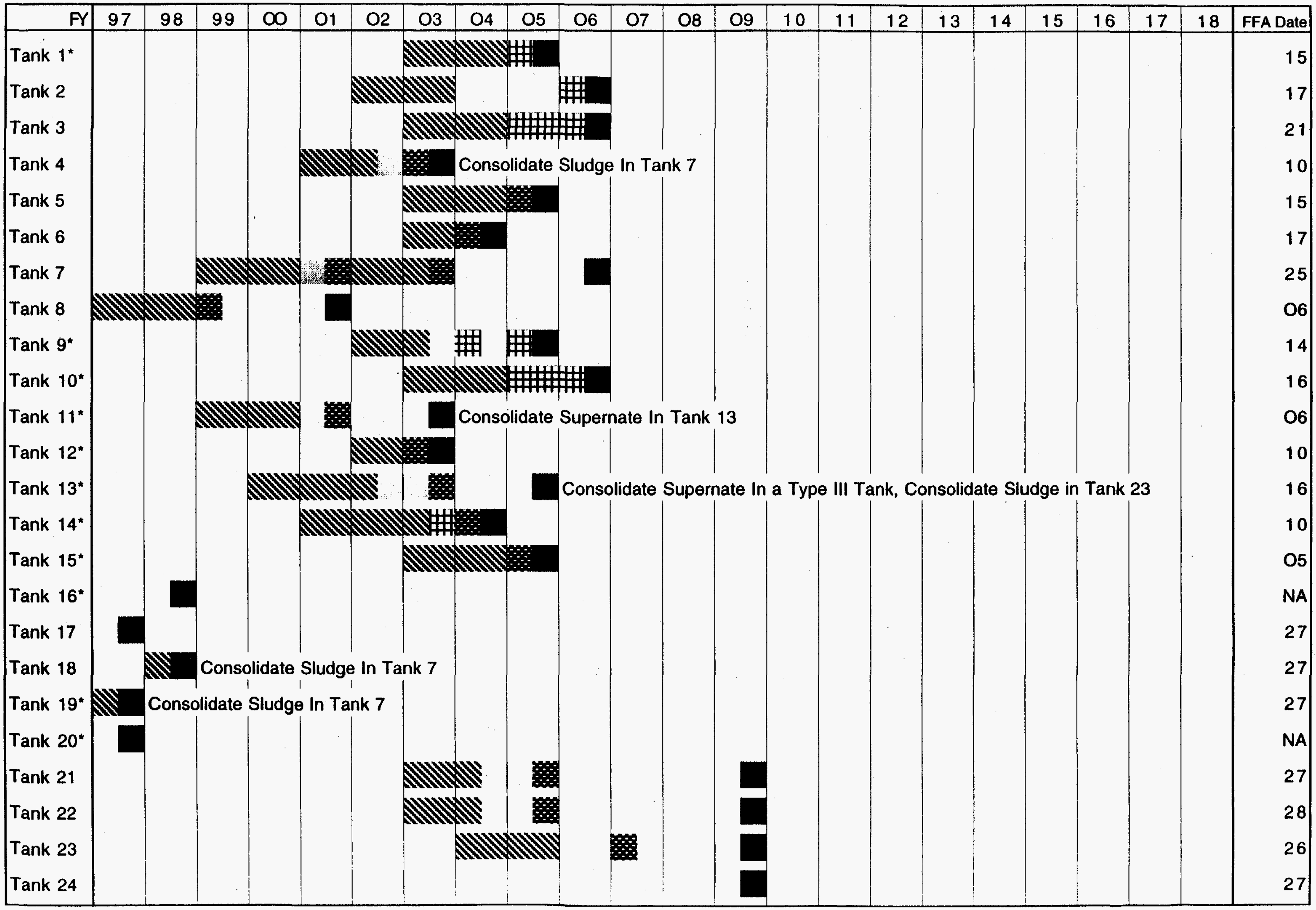
	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY97-FY26
FY96 TEN-YEAR PLAN ENDING IN FY18																					
Cum. # Cans Filled	2,510	2,810	3,110	3,410	3,710	4,010	4,310	4,635	4,960	5,310	5,660	5,911	--	--	--	--	--	--	--	--	
Cum. # Tks Closed	20	20	24	27	29	31	34	35	38	41	44	51	--	--	--	--	--	--	--	--	
Total $ (escalated)	646	598	603	669	687	625	623	611	673	699	605	542	110	114	118	122	126	131	136	141	14,058
FY98 Constant Yr $'s	495	445	436	469	468	413	400	381	407	411	345	300	59	59	60	60	60	61	61	62	10,342
200 CANISTER CASE ENDING IN FY26																					
Cum. # Cans Filled	2,210	2,410	2,610	2,810	3,010	3,210	3,410	3,610	3,810	4,010	4,210	4,410	4,610	4,810	5,010	5,210	5,410	5,610	5,810	5,911	
Cum. # Tks Closed	4	5	6	8	10	12	14	16	18	20	22	25	28	32	35	37	42	45	48	51	
Total $ (escalated)	611	631	627	665	682	697	702	726	829	844	879	916	953	909	868	859	850	873	757	684	20,750
FY98 Constant Yr $'s	468	469	453	467	465	461	451	452	502	496	501	507	512	474	440	422	406	405	341	299	13,635
Delta																					
Cum. # Cans Filled	300	400	500	600	700	800	900	1,025	1,150	1,300	1,450	1,501	1,301	1,101	901	701	501	301	101	0	
Cum. # Tks Closed	16	15	18	19	19	19	20	19	20	21	22	26	23	19	16	14	9	6	3	0	
Total $ (escalated)	35	-33	-24	3	5	-72	-79	-115	-157	-145	-274	-374	-843	-795	-751	-737	-724	-742	-622	-543	-6,692
FY98 Constant Yr $'s	27	-24	-17	2	3	-48	-50	-72	-95	-85	-156	-207	-453	-415	-380	-362	-346	-344	-280	-237	-3,293

Appendix D - HLW Projects

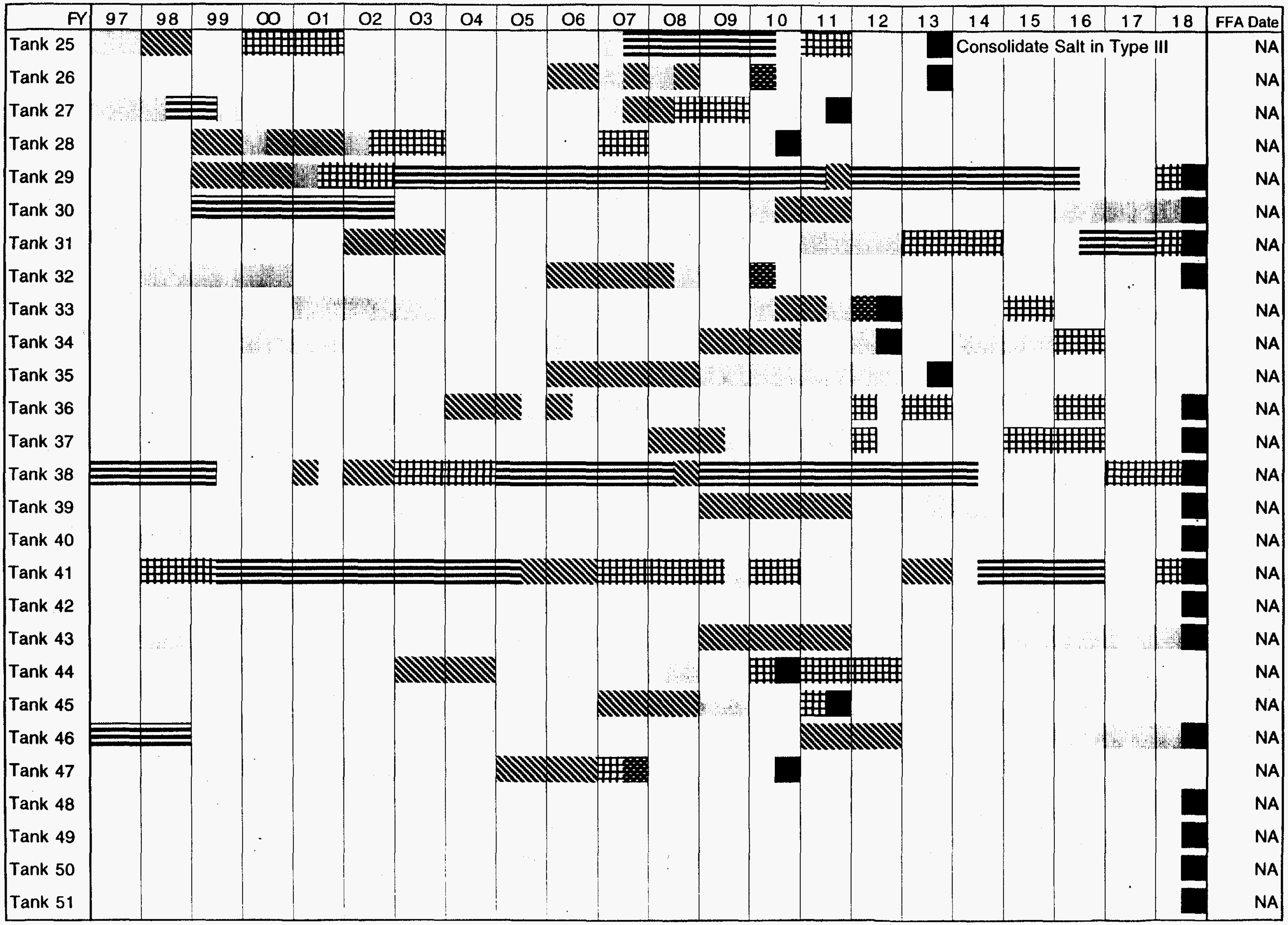
New Start FY	Project Number	Project Title	New Start FY	Project Number	Project Title
79	S-2081	• Waste Removal (Tks 1-24, ESP)	99	S-5785	• Tank Farm Support Services, Phase II
82	S-1780	• Defense Waste Processing Facility	99	S-2048	• Failed Equipment Storage Vaults #3-6
84	S-3781	• In-Tank Precipitation	00	W-5006	• In-Tank Precipitation Upgrades
85	S-3122	• New Waste Transfer Facility	01	S-4397	• Saltstone Vault #3
87	S-2821	• Diversion Box & Pump Pit Containment	02	TBD	• Saltstone Vault #5
	S-2787	• Consolidated Incineration Facility	02	W-6008	• DWPF Infrastructure Upgrades
	S-3291	• Waste Removal (Tks 25, 28, 29)	02	S-2045	• Glass Waste Storage Building #2
89	S-2860	• Waste Removal (241-2H, Tks 31 & 47)	04	TBD	• Saltstone Vault #6
	S-4062	• Replacement High Level Waste Evaporator	05	TBD	• Saltstone Vaults for Remainder of Program
93	S-3025	• Waste Removal (Tks 26, 30, 35-38)	06	TBD	• DWPF Infrastructure Upgrades for Remainder of Program
96	S-5515	• Saltstone Vault #4 Permanent Roof			
96	S-4558	• Tank Farm Services Upgrade	07	TBD	• Failed Equipment Storage Vaults
97	TBD	• Waste Removal Demonstration	07	TBD	• Tank Farm Upgrades
98	S-4881	• Tank Farm Storm Water Upgrades	09	TBD	• Glass Waste Storage Building #2 Expansion
99	S-3898	• Saltstone Vault #2	16	TBD	• Failed Equipment Storage Vaults

Note: Outyear projects are built on an as-needed basis to support the DOE-SR Ten Year Plan, (QC-96-0005, Draft 8/6).

Appendix E - Waste Removal Schedule



Appendix E - Waste Removal Schedule



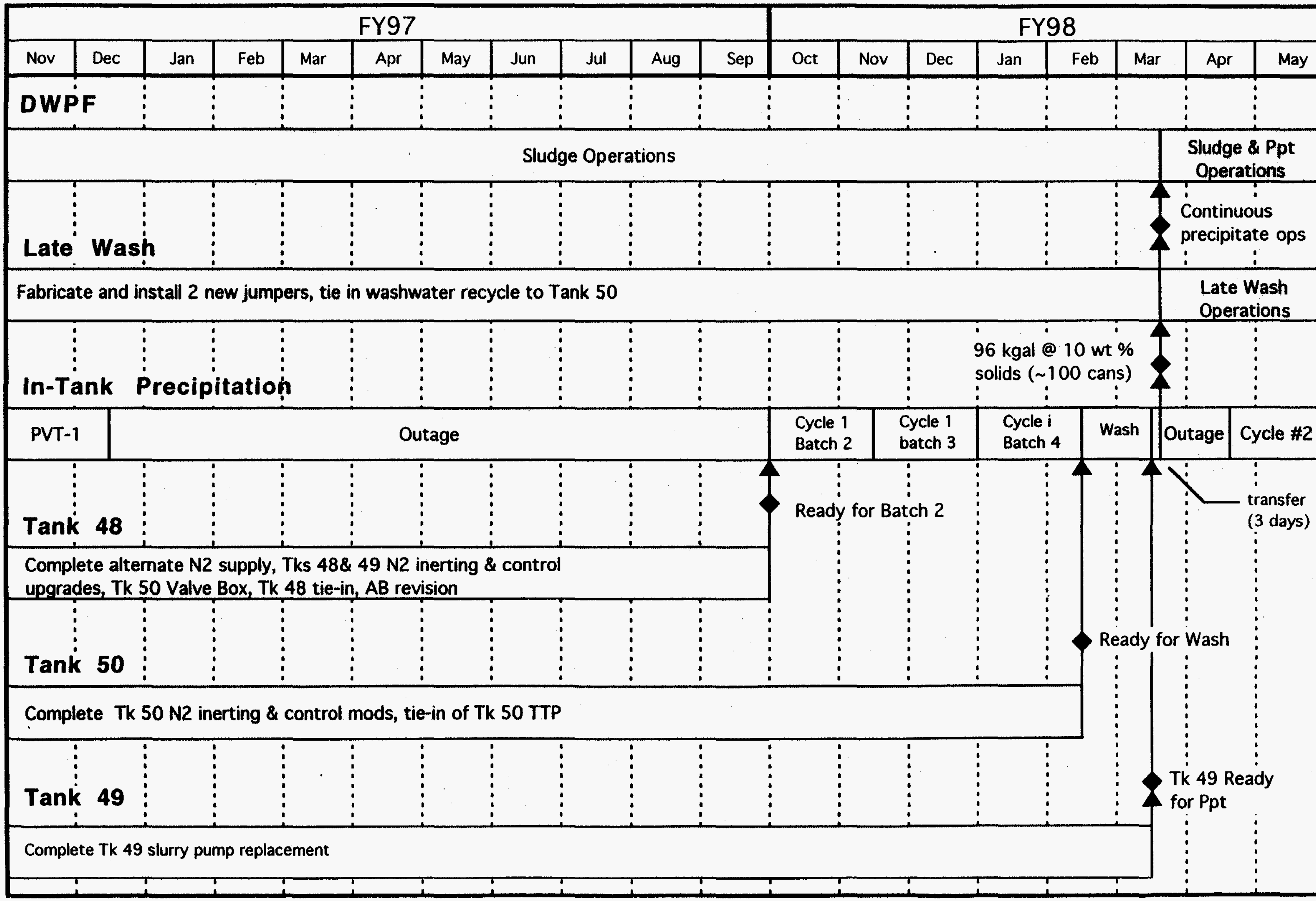
Appendix E - Waste Removal Schedule

FY	97	98	99	OO	O1	O2	O3	O4	O5	O6	O7	O8	O9	10	11	12	13	14	15	16	17	18	FFA Date

Key:

- * Tanks with a leakage history
- Waste Removal Project
- Supernate Removal
- Saltcake Removal
- Sludge Removal
- Refilling Salt/Supernate
- Tank Closure

Appendix F - HLW Level 1 Schedule



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Appendix G.1 - Salt Processing

IN-TANK PRECIPITATION FACILITY										
ITP Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to Tk 48 (Kgal)	Cum Ppt in Tk48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)
										0
C1/B1	9/2/95	128	48	252	us	252	53	10	0	0
			38	130	cs	130				
					stpb	46				
				382	total	428				
CLFL Outage	1/8/96	282	---	---	---	---	53		0	0
PVT-1	10/16/96	60	48	154	heel	154	53		0	0
					stpb	0.3				
					total	154				
CLFL Outage	12/15/96	290	---	---	---	---	53		0	0
PVT-2a	10/1/97	45	48		heel	154	64		0	0
			49	140	ww	140				
			25	140	cs	140				
					dw	120				
					stpb	31				
				280	total	585				
PVT-2b	11/15/97	45	48		heel	64	141		0	0
			27	150	cs	150				
			40	79	us	79				
					dw	220				
					stpb	46				
				229	total	559				
PVT-2c	12/30/97	45	48		heel	141	229		0	0
			27	220	cs	220				
					dw	240				
					stpb	63				
				220	total	664				
Wash	2/13/98	30					229		0	0
Xfer to Tk49	3/15/98	3					208			208
Outage	3/18/98	45							24	184

TANK 50 INPUTS		SALTSTONE			
Filtrate & *WashWater* (Kgal)	ETF Conc to Tk 50 (Kgal)	Salt Soln Received (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
				2.50	Starting condition.
383	187	570	923	3.02	Filling Vault #1.
0	412	412	667	3.39	
0	88	88	143	3.47	
265	66	331	536	3.77	
271	66	337	545	4.08	
397	66	463	750	4.50	
244	44	288	466	4.76	
	4	4	7	4.77	

Appendix G.1 - Salt Processing

IN-TANK PRECIPITATION FACILITY										
ITP Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to Tk 48 (Kgal)	Cum Ppt in Tk48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)
C2/B1	5/2/98	35	48		heel	21	71	23	19	165
			38/43	275	cs/us	275				
			32	300	cs	300				
					lw	235				
					stpb	66				
				575	total	897				
C2/B2	6/6/98	35	48		heel	69	121		19	146
			41	50	ds	135				
			27	100	cs	100				
			32	130	us	130				
			40	80	us	80				
					lw	235				
					stpb	31				
				360	total	780				
C2/B3	7/11/98	35	48		heel	121	181		19	128
			41	67	ds	180				
			27	120	cs	120				
			32	130	us	130				
					lw	235				
					stpb	36				
				317	total	822				
Wash	8/15/98	30					181		16	112
Xfer to Tk49	9/14/98	3					160		2	270
Outage	9/17/98	45							24	246

TANK 50 INPUTS		SALTSTONE			
Filtrate & *WashWater* (Kgal)	ETF Conc to Tk 50 (Kgal)	Salt Soln Received (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
605	65	670	1086	5.37	
571	65	636	1030	5.95	After 6.0 cells, start filling Vault #4. Vault #4 has 11 cells available.
553	65	618	1001	6.51	
236	56	292	473	7.78	
	6	6	9	7.79	
	84	84	136	7.86	

Appendix G.1 - Salt Processing

IN-TANK PRECIPITATION FACILITY										
ITP Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to Tk 48 (Kgal)	Cum Ppt in Tk48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)
C3/B1	11/1/98	35	48		heel	21	68	23	19	227
			41	148	ds	400				
			27	80	cs	80				
			32	130	us	130				
					lw	170				
					stpb	28				
				358	total	829				
C3/B2	12/6/98	35	48		heel	68	110		19	208
			41	148	ds	400				
			27	80	cs	80				
			32	65	us	65				
					lw	170				
					stpb	26				
				293	total	809				
C3/B3	1/10/99	35	48		heel	110	149		19	190
			41	148	ds	400				
			27	80	cs	80				
					lw	170				
					stpb	23				
				228	total	783				
C3/B4	2/14/99	35	48		heel	149	164		19	171
			41	148	ds	400				
			32	150	us	150				
					lw	170				
					stpb	9				
				298	total	878				
Wash	3/21/99	30					164		16	155
Xfer to Tk49	4/20/99	3					143		2	296
Outage	4/23/99	45							24	272

TANK 50 INPUTS		SALTSTONE			
Filtrate & *WashWater* (Kgal)	ETF Conc to Tk 50 (Kgal)	Salt Soln Received (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
717	65	782	1267	9.57	
654	65	719	1165	10.23	
590	65	655	1061	10.82	
669	65	734	1189	11.49	
182	51	233	377	11.70	
	5	5	8	11.70	
	76	76	123	11.77	

Appendix G.1 - Salt Processing

IN-TANK PRECIPITATION FACILITY

ITP Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to Tk 48 (Kgal)	Cum Ppt in Tk48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)
C4/B1	6/7/99	35	48		heel	21	67	20	19	253
			41	148	ds	400				
			32	100	us	100				
			28	75	cs	75				
					lw	149				
					stpb	27				
				323	total	772				
C4/B2	7/12/99	35	48		heel	67	109		19	235
			41	148	ds	400				
			32	75	us	75				
			28	75	cs	75				
					lw	149				
					stpb	27				
				298	total	793				
C4/B3	8/16/99	35	48		heel	109	160		19	216
			25	148	ds	400				
			34	100	cs	100				
					lw	149				
					stpb	31				
				248	total	789				
Wash	9/20/99	30					160		16	200
Xfer to Tk49	10/20/99	3					139		2	337
Outage	10/23/99	45							24	313

TANK 50 INPUTS		SALTSTONE			
Filtrate & *WashWater* (Kgal)	ETF Conc to Tk 50 (Kgal)	Salt Soln Received (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
708	59	767	1243	12.47	
684	59	743	1204	13.15	
631	59	690	1118	13.77	
198	51	249	403	14.00	
	5	5	8	14.01	
	76	76	123	14.07	

Appendix G.1 - Salt Processing

IN-TANK PRECIPITATION FACILITY										
ITP Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to Tk 48 (Kgal)	Cum Ppt in Tk48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)
C5/B1	12/7/99	35	48		heel	21	79	14	19	294
			25	148	ds	400				
			32	100	us	100				
			34	100	cs	100				
					lw	145				
					stpb	35				
				348	total	801				
C5/B2	1/11/00	35	48		heel	78	128		19	276
			25	148	ds	400				
			34	100	cs	100				
					lw	145				
					stpb	31				
				248	total	754				
C5/B3	2/15/00	35	48		heel	128	176		19	257
			25	148	ds	400				
			34	90	cs	90				
					lw	145				
					stpb	29				
				238	total	792				
Wash	3/21/00	30					176		16	241
Xfer to Tk49	4/20/00	3					155		2	394
Outage	4/23/00	45							24	370

TANK 50 INPUTS		SALTSTONE			
Filtrate & *WashWater* (Kgal)	ETF Conc to Tk 50 (Kgal)	Salt Soln Received (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
725	82	807	1307	14.81	
627	82	709	1148	15.45	
618	82	700	1133	16.09	
208	70	278	450	16.34	
	7	7	11	16.35	
	105	105	170	16.44	

Appendix G.1 - Salt Processing

IN-TANK PRECIPITATION FACILITY

ITP Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to Tk 48 (Kgal)	Cum Ppt in Tk48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)
C6/B1	6/7/00	35	48		heel	21	62	24	19	351
			25	148	ds	400				
			29	100	cs	100				
					lw	121				
					stpb	25				
				248	total	667				
C6/B2	7/12/00	35	48		heel	62	98		19	333
			25	122	ds	330				
			34	70	cs	70				
					lw	121				
					stpb	23				
				192	total	606				
C6/B3	8/16/00	35	48	98	heel	98	136		19	314
			25	111	ds	300				
			29	60	cs	60				
			34	30	cs	30				
					lw	121				
					stpb	23				
				299	total	632				
C6/B4	9/20/00	35	48		heel	136	173		19	295
			25	111	ds	300				
			29	60	cs	60				
			34	30	cs	30				
					lw	121				
					stpb	23				
				201	total	670				
Wash	10/25/00	30					173		16	279
Xfer to Tk49	11/24/00	3					152		2	429
Outage	11/27/00	45							24	405

TANK 50 INPUTS		SALTSTONE			
Filtrate & *WashWater* (Kgal)	ETF Conc to Tk 50 (Kgal)	Salt Soln Received (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
607	51	658	1067	17.04	
508	51	559	906	17.55	
498	51	549	890	18.05	At 18 cells, start filling Vault #2.
498	51	549	890	18.55	
212	44	256	415	18.78	
	4	4	7	18.78	

Appendix G.1 - Salt Processing

IN-TANK PRECIPITATION FACILITY

ITP Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to Tk 48 (Kgal)	Cum Ppt in Tk48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)
FY2001	10/1/00	360	7	157	cs	157	316	12	193	528
			38	250	cs	250				
			33	50	cs	50				
			29	37	cs	37				
			17	278	cs	278				
			20	23	cs	23				
			29	778	ds	2100				
					lw	1454				
					stpb	195				
				1573	total	4544				
FY2002	10/1/01	360	11	222	cs	222	255	20	193	590
			28	31	cs	31				
			24	274	cs	274				
			47	75	cs	75				
			13	200	cs	200				
			33	50	cs	50				
			29	202	ds	546				
			28	593	ds	1600				
					lw	792				
					stpb	156				
				1647	total	3946				
FY2003	10/1/02	360	19	246	cs	246	292	24	193	689
			36	50	cs	50				
			19	13	ds	34				
			28	190	ds	512				
			38	370	ds	1000				
			4	247	cs	247				
			13	150	cs	150				
			33	50	cs	50				
			14	153	ds	412				
					lw	907				
					stpb	180				
				1469	total	3788				
FY2004	10/1/03	360	4	33	ds	89	166	37	241	614
			21	117	cs	117				
			9	229	ds	618				
			13	305	cs	305				
			38	684	ds	1848				
			22	300	cs	300				
			4	100	cs	100				
					lw	515				
					stpb	101				
				1768	total	3993				

TANK 50 INPUTS		SALTSTONE			
Filtrate & *WashWater* (Kgal)	ETF Conc to Tk 50 (Kgal)	Salt Soln Received (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
3361 *174*	529	4064	6584	22.48	At 24 cells, start filling Vault #3.
3487 *181*	570	4238	6866	26.33	At 30 cells, start filling Vault #5.
3382 *208*	780	4370	7079	30.30	
3393 *119*	609	4121	6676	34.05	At 36 cells, start filling Vault #6.

Appendix G.1 - Salt Processing

IN-TANK PRECIPITATION FACILITY

ITP Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to Tk 48 (Kgal)	Cum Ppt in Tk48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)
FY2005	10/1/04	360	9	298	ds	805	135	30	241	508
			1	470	ds	1270				
			10	74	ds	200				
			3	229	ds	618				
			36	30	cs	30				
			1	19	cs	19				
			22	211	cs	211				
					lw	421				
					stpb	82				
				1331	total	3656				
FY2006	10/1/05	360	23	344	cs	344	208	15	289	427
			36	50	cs	50				
			34	30	cs	30				
			10	134	ds	363				
			2	525	ds	1418				
			3	296	ds	800				
					lw	647				
					stpb	127				
				985	total	3385				
FY2007	10/1/06	360	26	500	cs	500	186	19	289	324
			36	50	cs	50				
			25	12	cs	12				
			27	88	cs	88				
			47	603	ds	1627				
			41	37	ds	100				
			28	229	ds	618				
					lw	579				
					stpb	114				
				1519	total	3688				
FY2008	10/1/07	360	26	266	cs	266	207	13	289	242
			44	276	cs	276				
			32	163	cs	163				
			27	504	ds	1361				
			41	333	ds	900				
					lw	643				
					stpb	126				
				1542	total	3735				

TANK 50 INPUTS		SALTSTONE			
Filtrate & *WashWater* (Kgal)	ETF Conc to Tk 50 (Kgal)	Salt Soln Received (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
3476 *106*	940	4522	7326	38.16	At 42 cells, start filling Vault #7.
3511 *127*	710	4348	7044	42.11	
3509 *153*	884	4546	7365	46.25	At 48 cells, start filling Vault #8.
3473 *168*	693	4334	7021	50.19	At 54 cells, start filling Vault #9.

Appendix G.1 - Salt Processing

IN-TANK PRECIPITATION FACILITY

ITP Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to Tk 48 (Kgal)	Cum Ppt in Tk48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)
FY2009	10/1/08	360	37	178	cs	178	193	31	289	146
			45	118	cs	118				
			41	16	cs	16				
			35	276	cs	276				
			27	519	ds	1400				
			41	370	ds	1000				
					lw	600				
					stpb	118				
				1477	total	3706				
FY2010	10/1/09	360	33	50	cs	50	184	38	218	112
			35	400	cs	400				
			30	300	cs	300				
			41	335	ds	905				
			44	444	ds	1200				
					lw	570				
					stpb	112				
				1529	total	3537				
FY2011	10/1/10	360	37	100	cs	100	169	32	169	112
			35	200	cs	200				
			33	50	cs	50				
			31	100	cs	100				
			45	519	ds	1400				
			44	414	ds	1117				
					lw	526				
					stpb	103				
				1383	total	3596				
FY2012	10/1/11	360	31	156	cs	156	173	35	173	112
			35	300	cs	300				
			33	59	cs	59				
			45	589	ds	1589				
			36	37	ds	100				
			37	148	ds	400				
			44	111	ds	300				
					lw	536				
					stpb	105				
				1400	total	3545				

TANK 50 INPUTS		SALTSTONE			
Filtrate & *WashWater* (Kgal)	ETF Conc to Tk 50 (Kgal)	Salt Soln Received (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
3500 *163*	929	4592	7439	54.36	
3370 *149*	698	4217	6832	58.20	At 60 cells, start filling Vault #10.
3488 *138*	631	4257	6896	62.07	At 66 cells, start filling Vault #11.
3423 *141*	965	4529	7337	66.18	

Appendix G.1 - Salt Processing

IN-TANK PRECIPITATION FACILITY

ITP Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to Tk 48 (Kgal)	Cum Ppt in Tk48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)
FY2013	10/1/12	360	39	400	cs	400	223	30	223	112
			34	300	cs	300				
			36	627	ds	1694				
			31	185	ds	500				
					lw	693				
					stpb	137				
				1512	total	3724				
FY2014	10/1/13	360	39	528	cs	528	209	27	209	112
			34	200	cs	200				
			31	809	ds	2183				
					lw	650				
					stpb	128				
				1537	total	3689				
FY2015	10/1/14	360	43	242	cs	242	109	26	109	112
			34	60	cs	60				
			37	731	ds	1974				
			33	222	ds	600				
					lw	338				
					stpb	65				
				1255	total	3279				
FY2016	10/1/15	360	43	200	cs	200	171	42	171	112
			30	300	cs	300				
			46	350	cs	350				
			37	74	ds	200				
			34	208	ds	561				
			36	407	ds	1100				
					lw	531				
					stpb	104				
				1539	total	3346				
FY2017	10/1/16	360	43	200	cs	200	181	31	181	112
			30	300	cs	300				
			46	350	cs	350				
			25	133	ds	359				
			38	620	ds	1674				
					lw	563				
					stpb	110				
				1603	total	3556				

TANK 50 INPUTS		SALTSTONE			
Filtrate & *WashWater* (Kgal)	ETF Conc to Tk 50 (Kgal)	Salt Soln Received (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
3395 *181*	613	4189	6786	69.99	At 72 cells, start filling Vault #12.
3417 *168*	630	4215	6828	73.82	
3419 *87*	912	4418	7157	77.84	At 78 cells, start filling Vault #13.
3262 *152*	623	4037	6540	81.51	At 84 cells, start filling Vault #14.
3399 *153*	623	4175	6764	85.30	

Appendix G.1 - Salt Processing

IN-TANK PRECIPITATION FACILITY										
ITP Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to Tk 48 (Kgal)	Cum Ppt in Tk48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)
FY2018	10/1/17	360	43	200	cs	200	156	29	156	112
			30	227	cs	227				
			46	310	cs	310				
			41	355	ds	958				
			38	407	ds	1100				
			29	945	ds	2553				
			31	421	ds	1137				
					lw	485				
					stpb	95				
				2865	total	7065				

Key:

cs - concentrated supernate
ds- dissolved saltcake
dw - dilution water
lw - late wash spent wash water
stpb - sodium tetraphenylborate
us - unconcentrated supernate

Notes:

- Assume each ITP batch duration is 35 days. A 30 day wash occurs at the end of each cycle.
- ITP filtrate is transferred directly to Tank 50.
- Late Wash spent wash water is transferred directly to Tank 48, and is worked off in each subsequent ITP batch.
- ProdMod uses a 30-day month, hence the 360 day year.
- Assume 2:1 dissolution water:salt cake ratio, with 90% conservation of volume.
  Therefore, dissolved salt solution volume calculated as follows: 0.9 x (Saltcake Volume x 3).
- Assume ITP outyear (2001 - 2018) production includes two cycles per year, with three batches per cycle.
- Tank 48 has a 151 Kgal minimum requirement during washing, and a 21 Kgal heel after transferring to Tank 49.
- Tank 49 has a 112 Kgal heel after transferring to Late Wash.
- The amount of precipitate processed at Late Wash is dependent upon DWPF attainment, and so is calculated as follows:
  ppt fed to LW = [(Activity Duration in days/360 days per year) x # cans per year x 964 gal 10 wt% ppt per can]/1000 gal per Kgal.
- Assume Late Wash's maximum process rate is 50% attainment, or (540 cans/yr x 50%) x 964 gal ppt/can = 260 Kgal ppt/year, until Late Wash attainment improvement modifications are installed in FY98-99.
- Assume there is no lag time between accumulating influents to Tank 50 and processing at Saltstone.
- The volume increase from salt solution to grout is 1.62.
- Each vault cell can hold up to 1,100 Kgal of salt solution, or 1,782 Kgal grout.
- All vaults have 6 cells, except for Vault #4, which has 12 cells.

TANK 50 INPUTS		SALTSTONE			
Filtrate & *WashWater* (Kgal)	ETF Conc to Tk 50 (Kgal)	Salt Soln Received (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
3321 *133*	623	4077	6605	89.01	At 90 cells, start filling Vault #15.

Appendix G.2 - Waste Removal and Sludge Processing

WASTE REMOVAL			EXTENDED SLUDGE PROCESSING							
Sludge Batch	Sludge Source Tanks	Waste Removed (Kgal)	Start Washing Date	Process Tanks	End Settling Date	Vol After Al Dissl (Kgal)	Al Removed (wt%)	Na (wt%)	WW to TF (Kgal)	Start Feed to DWPF, Feed Tk
1A	15H		---	51	---	491	75	8.8	704	Mar-96
	17F									Tank 51
	18F									
	21H									
	22H									
	51H heel					-88				
	total:					403				
1B	15H		Dec-96	42	Dec-98	495	75	8.25	611	Jan-99
	17F									Tank 51
	18F									
	21H									
	22H									
	42H heel					-88				
	total:					407				
2A	8F	164	Mar-99	40, 42	Mar-01	164	75	8.9	1594	Apr-01
	40H	173				173				Tank 40
	40H heel	-88				-88				
	total:	249				249				

Appendix G.2 - Waste Removal and Sludge Processing

WASTE REMOVAL			EXTENDED SLUDGE PROCESSING							
Sludge Batch	Sludge Source Tanks	Waste Removed (Kgal)	Start Washing Date	Process Tanks	End Settling Date	Vol After Al Dissl (Kgal)	Al Removed (wt%)	Na (wt%)	WW to TF (Kgal)	Start Feed to DWPF, Feed Tk
2B	7F(p)	147	Sept-01	42, 51	Sept-03	147	75	8.6	1265	Oct-03
	11H	140				70				Tank 51
	18F	42				42				
	19F	20				20				
	total:	349				279				
3A	4F	128	Jun-03	40, 42	Jun-05	128	75	7.7	1750	Jul-05
	7F(r)	62				62				Tank 40
	12H	215				108				
	14H	34				17				
	total:	439				315				
3B	5F	34	Jun-05	42, 51	Jun-07	34	50	8.7	1373	Jul-07
	6F	25				25				Tank 51
	15H	312				156				
	21H	14				14				
	22H	60				60				
	total:	445				289				
4	13H	223	Mar-07	40, 42	Mar-09	167	75	8.8	1794	Apr-09
	23H	43				43				Tank 40
	47F	265				265				
	total:	531				475				

Appendix G.2 - Waste Removal and Sludge Processing

WASTE REMOVAL			EXTENDED SLUDGE PROCESSING							
Sludge Batch	Sludge Source Tanks	Waste Removed (Kgal)	Start Washing Date	Process Tanks	End Settling Date	Vol After Al Dissl (Kgal)	Al Removed (wt%)	Na (wt%)	WW to TF (Kgal)	Start Feed to DWPF, Feed Tk
5	25F	22	Jan-10	42, 51	Jan-12	22	75	8.1	2139	Feb-12
	26F	328				379				Tank 51
	27F	13				13				
	28F	21				21				
	32H	176				88				
	35H	52				26				
	44F	64				64				
	45F	23				23				
	51 heel	88				88				
	total:	787				724				
6	29H	20	May-13	40, 42	May-15	10	75	8.1	1667	Jun-15
	31H	20				10				Tank 40
	33F	81				81				
	34F	29				29				
	36H	22				11				
	37H	19				10				
	38H	16				8				
	39H	63				32				
	40H heel	88				88				
	41H	25				13				
	42H heel	75				75				
	43H	251				126				
End	total:	709				493			End:	Sep-18

Appendix G.2 - Waste Removal and Sludge Processing

WASTE REMOVAL			EXTENDED SLUDGE PROCESSING							
Sludge Batch	Sludge Source Tanks	Waste Removed (Kgal)	Start Washing Date	Process Tanks	End Settling Date	Vol After Al Dissl (Kgal)	Al Removed (wt%)	Na (wt%)	WW to TF (Kgal)	Start Feed to DWPF, Feed Tk

Notes:

- Assumes a six month period for waste removal from source tank to ESP processing tanks.
- Assumes the total ESP wash, Aluminum dissolution, sampling and characterization cycle time is 24 months for all batches, and completes just-in-time to feed to DWPF. Note that Batches 2b and 3b are forecast to be processed by DWPF in just 21 months, so ESP processing of Sludge Batches 3a and 4 must be accelerated by 3 months each to maintain continuous sludge feed to DWPF.
- Assumes ESP washed sludge volume increases by 150% of the original volume after the first wash; decant to within 18" of the sludge level.
- Batch #1a canister yield based on 614,000 lbs insoluble solids in 491,000 gallons slurry in Tank 51, less an 88,000 gallon heel.
- Batch durations in DWPF based on 60 cans in FY96, 150 cans in FY97, 200 cans/year in FY93-03, 250 cans/year in FY04-05, and 300 cans/year in FY06-18, with 3900 lbs of glass per can.
- Na (wt%), ESP wash water, feed to DWPF, waste loading and canisters produced for all Batches are based on ProdMod analyses.
- Assume 16.7 wt % solids in Batch 1A feed to DWPF, and 19 wt% feed to DWPF for all other batches.
- Includes processing of 2 wt% sludge heels from salt tanks in Batches 5 and 6.
- GWSB#1 holds 2,286 canisters, less 122 unusable positions, less 5 non-radioactive test cans, leaves a working capacity of 2,159 canisters. (Note: 570 positions currently unusable. Per letter HLW-OVP-95-0088, dated 11/08/95, 448 of those positions can be safely repaired after the start of Rad Ops.
- GWSB#2 will be built in two modules, with a combined capacity of 2,286 canisters.
- GWSB#2 Expansion capacity will be defined sufficient to contain the balance of forecasted canisters.
- Each GWSB fills to capacity.
- Assumes no other canisters are stored from other facilities (ie., West Valley).
- Assumes that a Federal Repository will be available to begin transporting 500 canisters per year starting in FY2015.

Appendix G.3 - Tank Farm Material Balance Data

End of	*Influents*							*Backlog*		*Effluents*				Working	
Mo/Year	F-LHW	F-HHW	H-LHW	H-HHW	DWPF	Tank WW	ESP	Tk	Volume	2H Evap	2F Evap	RHLWE	ITP	Inventory	Notes
Sep-96														1,133,000	
Oct-96	15,450	500	2,700	0	170,000	0	0	39	642,000	155,025	493,463	0	0	1,592,838	Tk 39 backlog to 2F Evap
Nov-96	15,450	19,120	2,000	0	170,000	0	0			154,500	25,928	0	0	1,566,695	
Dec-96	15,450	19,120	2,000	0	170,000	0	0			154,500	25,928	0	0	1,540,553	
Jan-97	15,450	19,120	2,000	0	170,000	0	0	30	576,000	154,500	457,928	0	0	1,946,410	Tk 30 backlog to 2F Evap
Feb-97	15,450	19,120	2,000	0	170,000	0	0			154,500	25,928	0	0	1,920,268	
Mar-97	15,450	19,120	2,000	0	170,000	0	0			154,500	25,928	0	0	1,894,125	
Apr-97	15,450	19,120	2,000	0	170,000	0	0			154,500	25,928	0	0	1,867,983	
May-97	15,450	19,120	2,000	0	170,000	0	0			154,500	25,928	0	0	1,841,840	
Jun-97	15,450	19,120	2,000	0	170,000	0	0			154,500	25,928	0	0	1,815,698	
Jul-97	15,450	19,120	2,000	0	170,000	0	0			154,500	25,928	0	0	1,789,555	
Aug-97	15,450	19,120	2,000	0	170,000	0	0			154,500	25,928	0	0	1,763,413	
Sep-97	15,450	19,120	2,000	0	170,000	0	0			154,500	25,928	0	0	1,737,270	
Oct-97	15,450	19,120	2,000	0	196,000	0	0			177,900	25,928	0	140,000	1,848,528	Tk 25 cs to ITP
Nov-97	15,450	19,120	2,000	0	196,000	0	0			177,900	25,928	0	150,000	1,969,785	Tk 27 to ITP
Dec-97	15,450	19,120	2,000	0	196,000	0	0			177,900	25,928	0	220,000	2,161,043	Tk 27 to ITP
Jan-98	15,450	19,120	2,000	0	196,000	0	200,000			293,100	90,728	0	0	2,112,300	
Feb-98	15,450	19,120	2,000	0	196,000	0	0			177,900	25,928	0	0	2,083,558	
Mar-98	15,450	19,120	5,500	1,500	196,000	0	0			180,525	25,928	0	0	2,052,440	
Apr-98	13,950	19,120	5,500	1,500	196,000	0	0			180,525	24,803	0	100,000	2,121,698	Tk 27 cs to ITP
May-98	13,950	19,120	11,000	3,000	196,000	0	0			184,650	24,803	0	230,000	2,318,080	Tk 27 cs (100) & Tk 32 us (130) to ITP
Jun-98	13,950	19,120	2,000	0	196,000	0	0			177,900	24,803	0	250,000	2,539,713	Tk 27 cs (120) & Tk 32 us (130) to ITP
Jul-98	13,950	19,120	22,800	27,000	196,000	0	0			193,500	24,803	0	0	2,479,145	
Aug-98	13,950	19,120	22,800	27,000	196,000	0	0			193,500	24,803	0	0	2,418,578	
Sep-98	13,950	19,120	22,800	27,000	196,000	0	0			193,500	24,803	0	0	2,358,010	
Oct-98	13,950	19,120	22,800	27,000	202,000	0	0			198,900	24,803	0	0	2,296,843	
Nov-98	13,950	19,120	22,800	27,000	202,000	0	0			198,900	24,803	0	0	2,235,675	
Dec-98	13,950	19,120	22,800	27,000	202,000	0	0			108,000	24,803	90,900	210,000	2,384,508	Tk 27 cs (80) & Tk 32 us (130) to ITP
Jan-99	13,950	19,120	22,800	27,000	202,000	0	0			108,000	24,803	90,900	145,000	2,468,340	Tk 27 cs (80) & Tk 32 us (65) to ITP
Feb-99	13,950	19,120	35,800	27,000	202,000	0	0			117,750	24,803	90,900	0	2,403,923	
Mar-99	13,950	19,120	35,800	27,000	202,000	0	0			117,750	24,803	90,900	80,000	2,419,505	Tk 27 cs to ITP
Apr-99	13,950	19,120	35,800	27,000	202,000	0	67,000			117,750	46,511	129,492	150,000	2,498,388	Tk 32 us to ITP
May-99	13,950	19,120	35,800	27,000	202,000	0	67,000			117,750	46,511	129,492	0	2,427,270	
Jun-99	13,950	19,120	35,800	27,000	202,000	0	67,000			117,750	46,511	129,492	0	2,356,153	
Jul-99	13,950	19,120	35,800	27,000	202,000	0	67,000			117,750	46,511	129,492	0	2,285,035	
Aug-99	13,950	19,120	35,800	27,000	202,000	0	67,000			117,750	46,511	129,492	0	2,213,918	
Sep-99	13,950	19,120	35,800	27,000	202,000	0	67,000			117,750	46,511	129,492	0	2,142,800	
Oct-99	18,710	38,610	35,800	27,000	210,000	0	66,000			121,350	64,374	132,516	175,000	2,239,920	Tk 32 us (100) & Tk 28 cs (75) to ITP
Nov-99	18,710	38,610	35,800	27,000	210,000	0	66,000			121,350	64,374	132,516	0	2,162,040	
Dec-99	18,710	38,610	35,800	27,000	210,000	0	66,000			121,350	64,374	132,516	150,000	2,234,160	Tk 28 cs (75) & Tk 32 us (75) to ITP
Jan-00	18,710	38,610	35,800	27,000	210,000	0	66,000			121,350	64,374	132,516	100,000	2,256,280	Tk 41 empty, Tk 34 cs to ITP
Feb-00	18,710	38,610	35,800	27,000	210,000	0	66,000	39	546,000	121,350	64,374	542,016	0	2,587,900	Tk 39 backlog to 2F Evap
Mar-00	18,710	38,610	2,000	0	210,000	0	66,000			96,000	64,374	132,516	1,271,000	3,816,470	Tk 41 RTSS
Apr-00	18,710	38,610	2,000	0	210,000	0	66,000			96,000	64,374	132,516	200,000	3,974,040	Tk 32 us (100) & Tk 34 cs (100) to ITP
May-00	18,710	38,610	2,000	0	210,000	0	66,000			96,000	64,374	132,516	100,000	4,031,610	Tk 34 cs to ITP
Jun-00	18,710	38,610	2,000	0	210,000	0	66,000			96,000	64,374	132,516	90,000	4,079,180	Tk 34 cs to ITP
Jul-00	18,710	38,610	2,000	0	210,000	0	66,000			96,000	64,374	132,516	70,000	4,106,750	Tk 34 cs to ITP
Aug-00	18,710	38,610	2,000	0	210,000	0	66,000			96,000	64,374	132,516	30,000	4,094,320	Tk 34 cs to ITP
Sep-00	18,710	38,610	2,000	0	210,000	0	66,000			96,000	64,374	132,516	30,000	4,081,890	Tk 34 cs to ITP, Tk 25 empty

Appendix G.3 - Tank Farm Material Balance Data

End of	Influents							Backlog		Effluents				Working	
Mo/Year	F-LHW	F-HHW	H-LHW	H-HHW	DWPF	Tank WW	ESP	Tk	Volume	2H Evap	2F Evap	RHLWE	ITP	Inventory	Notes
2001	238,320	516,480	116,400	0	2,514,000	0	399,000			1,218,600	695,376	1,361,124	1,115,000	4,687,790	
2002	198,880	346,320	393,600	0	2,514,000	0	633,000			1,426,500	613,992	1,495,908	951,000	5,089,390	
2003	30,000	360	116,400	0	2,514,000	520,000	852,000			1,218,600	532,818	1,856,052	660,000	5,324,100	
2004	30,000	360	24,000	0	2,730,000	330,000	875,000			1,246,500	454,770	1,881,000	684,000	5,601,010	
2005	30,000	360	24,000	0	2,730,000	900,000	835,000			1,246,500	698,310	2,114,460	30,000	5,170,920	
2006	30,000	360	24,000	0	2,946,000	1,080,000	687,000			1,343,700	731,358	2,207,412	80,000	4,766,030	
2007	30,000	360	24,000	0	2,946,000	0	964,000			1,343,700	335,106	1,880,964	985,000	5,346,440	
2008	30,000	360	24,000	0	2,946,000	0	897,000			1,343,700	313,398	1,842,372	1,519,000	6,467,550	
2009	30,000	360	24,000	0	2,946,000	560,000	449,000			1,343,700	420,246	1,836,324	1,542,000	7,600,460	
2010	30,000	360	24,000	0	2,946,000	280,000	713,000			1,343,700	379,782	1,862,388	1,477,000	8,669,970	
2011	30,000	360	24,000	0	2,946,000	280,000	1,070,000			1,343,700	495,450	2,068,020	1,529,000	9,755,780	
2012	30,000	360	24,000	0	2,946,000	280,000	357,000			1,343,700	264,438	1,657,332	1,383,000	10,766,890	
2013	30,000	360	24,000	0	2,946,000	560,000	278,000			1,343,700	364,842	1,737,828	1,400,000	11,774,900	
2014	30,000	360	24,000	0	2,946,000	560,000	834,000			1,343,700	544,986	2,058,084	1,512,000	12,839,310	
2015	30,000	360	24,000	0	2,946,000	420,000	556,000			1,343,700	391,914	1,834,956	1,537,000	13,970,520	
2016	30,000	360	24,000	0	2,946,000	0	0			1,343,700	22,770	1,325,700	1,255,000	14,917,330	
2017	30,000	360	24,000	0	2,946,000	840,000	0			1,343,700	400,770	1,703,700	1,539,000	16,064,140	
2018	30,000	360	24,000	0	2,946,000	560,000	0			1,343,700	274,770	1,577,700	1,603,000	17,302,950	
2019	30,000	360	24,000	0	2,946,000	0	0			1,343,700	22,770	1,325,700	1,499,000	18,493,760	

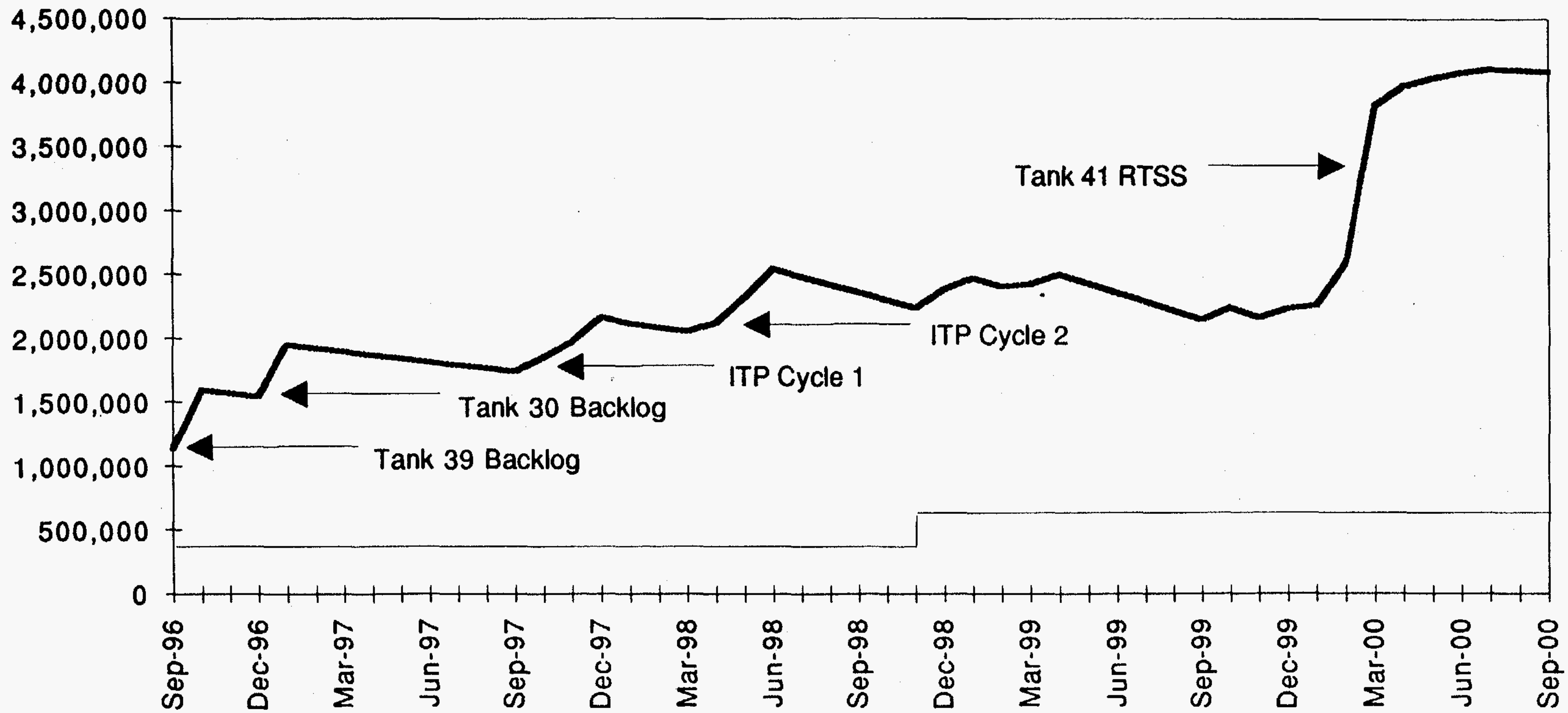
Appendix G.3 - Tank Farm Material Balance Data

	2H Evaporator		2F Evaporator							RHLWE				
End of Mo/Yr	Tk 38 Salt Inv. (gal)	Tk 41 Salt Inv. (gal)	Tk 25 Salt Inv. (gal)	Tk 27 Salt Inv. (gal)	Tk 28 Salt Inv. (gal)	Tk 44 salt Inv. (gal)	Tk 45 salt Inv. (gal)	Tk 46 Salt Inv. (gal)	Tk 47 salt Inv. (gal)	Tk 30 Salt Inv. (gal)	Tk 29 Salt Inv. (gal)	Tk 31 salt Inv. (gal)	Tk 36 salt Inv. (gal)	Tk 37 Salt Inv. (kgal)
Sep-96	800,000	1,231,000	1,000,000	449,000	1,000,000	1,000,000	1,000,000	5,000	1,000,000	5,000	1,000,000	1,000,000	1,000,000	1,000,000
Oct-96	817,675							169,488						
Nov-96	835,175							178,130						
Dec-96	852,675							186,773						
Jan-97	870,175							339,415						
Feb-97	887,675							348,058						
Mar-97	905,175	1,150,000						356,700						
Apr-97	922,675	1,100,000						365,343						
May-97	940,175	1,033,000						373,985						
Jun-97	957,675							382,628						
Jul-97	975,175							391,270						
Aug-97	992,675							399,913						
Sep-97	1,010,175							408,555						
Oct-97	1,030,275	885,000						417,198						
Nov-97	1,050,375	737,000						425,840						
Dec-97	1,070,475							434,483						
Jan-98	903,375	589,000						507,925						
Feb-98	923,475	441,000						516,568						
Mar-98	944,450							525,210						
Apr-98	965,425							533,478						
May-98	987,775							541,745						
Jun-98	1,007,875							550,013						
Jul-98	933,175							558,280						
Aug-98	958,475							566,548						
Sep-98	983,775	293,000						574,815						
Oct-98	1,009,675	145,000						583,083						
Nov-98	1,035,575		955,000					591,350		5,000				
Dec-98		9,740						599,618		9,040				
Jan-99		19,480						607,885		13,080				
Feb-99		32,470						616,153		17,120				
Mar-99		45,460						624,420		21,160				
Apr-99		58,450						654,396		29,488				
May-99		71,440						684,371		37,816				
Jun-99		84,430						714,347		46,144				
Jul-99		97,420	807,000					744,322		54,472				
Aug-99		110,410	659,000					774,298		62,800				
Sep-99		123,400	511,000					804,273		71,128				
Oct-99		136,550						839,987		79,552				
Nov-99		149,700						875,701		87,976				
Dec-99		162,850						911,415		96,400				
Jan-00		176,000		449,000				947,129		104,824				
Feb-00		189,150		621,214						249,748				
Mar-00		193,850		656,928						258,172				
Apr-00		198,550	363,000	692,642						266,596				
May-00		203,250	241,000	728,356						275,020				
Jun-00		207,950	130,000	764,070						283,444				
Jul-00		212,650	19,000	799,784						291,868				
Aug-00		217,350		835,498						300,292				
Sep-00		222,050		871,212						308,716				

Appendix G.3 - Tank Farm Material Balance Data

	2H Evaporator		2F Evaporator							RHLWE				
End of Mo/Yr	Tk 38 Salt Inv. (gal)	Tk 41 Salt Inv. (gal)	Tk 25 Salt Inv. (gal)	Tk 27 Salt Inv. (gal)	Tk 28 Salt Inv. (gal)	Tk 44 salt Inv. (gal)	Tk 45 salt Inv. (gal)	Tk 46 Salt Inv. (gal)	Tk 47 salt Inv. (gal)	Tk 30 Salt Inv. (gal)	Tk 29 Salt Inv. (gal)	Tk 31 salt Inv. (gal)	Tk 36 salt Inv. (gal)	Tk 37 Salt Inv. (kgal)
2001		301,430	0	1,189,188						384,532				
2002		450,110	341,392							475,324				
2003		529,490	651,030							606,132				
2004	Tk 38 empty	590,090	958,620		0					733,232				
2005		650,690	1,281,750		323,130					886,272				
2006		715,610			607,308					1,043,160	0			
2007		780,530			927,234						120,616			
2008		845,450			1,225,452	0					236,944			
2009		910,370				181,066					352,600			
2010		975,290				433,668					471,152			
2011		1,040,210				801,938					612,552			
2012	0	1,105,130				939,196					708,320			
2013	65,880					1,064,858	0				813,032	0		
2014	131,760						305,806					140,296		
2015	197,640						514,540					255,800		
2016	263,520				0		522,130					314,720		
2017	329,400				43,522		571,720					415,640		
2018	395,280				74,965		607,310					502,560		
2019	461,160				82,251		614,900					561,480		

Appendix G.4 - Tank Farm Material Balance Graph



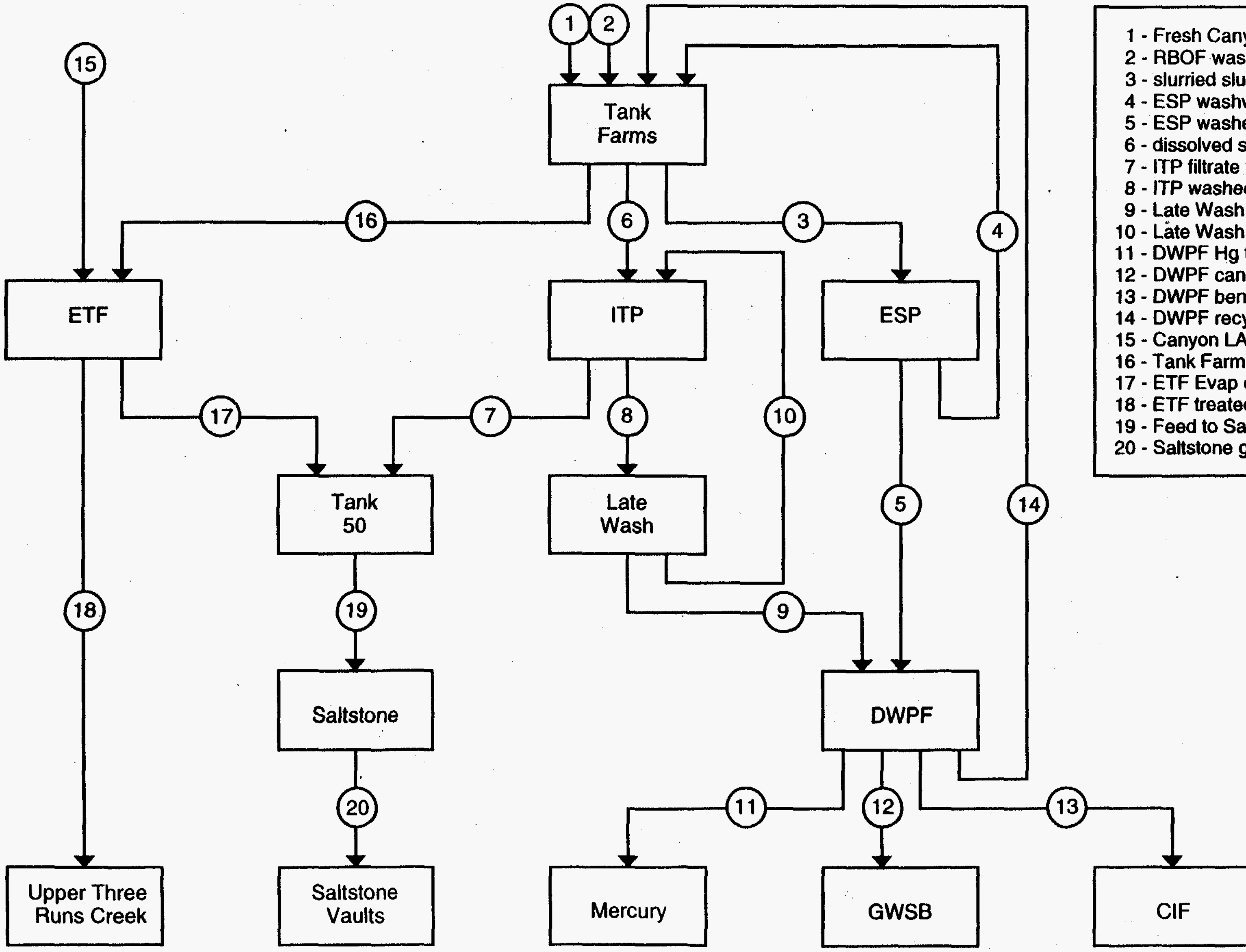
Appendix G.5 - Vitrification Processing

Sludge Batch #	Start Feed to DWPF (Feed Tk)	Duration (Years)	Sludge Feed (Kgal)	ITP Cycles Feeding	Ppt Vol from LW (Kgal)	Organics to OWST (Kgal)	Waste Loading (wt%)	Canisters Produced (Each)	Cum Cans in GWSB (Each)	Notes:
1A	Mar-96 (51)	2.90	328	C1-4	434	32	27.2	470	470	
1B	Jan-99 (51)	2.20	343	C5-8	416	49	28.0	450	920	
2A	Apr-01 (40)	2.53	423	C9-13	467	40	27.1	505	1,425	
2B	Oct-03 (51)	1.75	466	C14-17	398	50	30.4	431	1,856	
3A	Jul-05 (40)	2.00	534	C18-21	550	51	30.2	595	2,451	
3B	Jul-07 (51)	1.75	454	C22-24	491	51	30.9	531	2,982	
4	Apr-09 (40)	2.85	789	C25-30	771	63	27.9	834	3,816	
5	Feb-12 (51)	3.30	1,005	C31-36	933	89	27.0	1010	4,826	
6	Jun-15 (40)	3.25	1,054	C37-43	1003	90	27.0	1085	5,911	
End	Sep-18									

Appendix G.6 - Glass Waste Storage Building Fill Rate

End of Year	Canisters Produced	Total Cans In GWSB#1	Total Cans In GWSB#2	Total Cans In GWSB#2 Exp	Notes:
1996	60	60			Start filling GWSB#1.
1997	150	210			
1998	200	410			
1999	200	610			
2000	200	810			
2001	200	1010			
2002	200	1210			
2003	200	1410			
2004	250	1660			
2005	250	1910			
2006	300	2159	51		End GWSB#1, start GWSB#2.
2007	300		351		
2008	300		651		
2009	300		951		
2010	300		1251		
2011	300		1551		
2012	300		1851		
2013	300		2151		
2014	300		2286	165	End GWSB#2, start GWSB#2 Expansion.
2015	300			465	*Start shipping 500 cans/yr to Federal Repository.*
2016	300			765	
2017	300			1065	
2018	300			1365	
2019	101			1466	
	TOTAL:			**5911**	

Appendix H - Simplified HLW System Flowsheet



1 - Fresh Canyon HLW
2 - RBOF waste
3 - slurried sludge to ESP
4 - ESP washwater
5 - ESP washed sludge to DWPF
6 - dissolved salt to ITP
7 - ITP filtrate to Tank 50
8 - ITP washed Ppt to Late Wash
9 - Late Wash Ppt to DWPF
10 - Late Wash washwater to ITP
11 - DWPF Hg to storage
12 - DWPF canisters to GWSB
13 - DWPF benzene to OWST/CIF
14 - DWPF recycle to Tank Farms
15 - Canyon LAW to ETF
16 - Tank Farm LAW to ETF
17 - ETF Evap concentrate to Tk 50
18 - ETF treated water to outfall
19 - Feed to Sallstone
20 - Saltstone grout to Vaults

DOE-HQ
R. Erickson
L. Gunn
K. Picha

DOE-SR
C. E. Anderson, 704-S
S. M. Blanco, 704-S
M. S. Glenn, 703-A
H. B. Gnann, 704-S
T. T. Henderson, 703-H
M. R. Jump, 704-118S
L. T. Ling, 703-H
J. W. McCullough, 703-H
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R. J. Schepens, 704-S
W. F. Spader, 704-S
A. L. Watkins, 704-S

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M. N. Wells, 719-4A
W. A. Wilson, 719-4A
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M. N. Nelson, 773-41A
T. D. Ross, 742-9G
L. W. Wiker, 719-11A

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D. W. Beckenhauer, 703-7C
L. G. Frelin, 703-H
M. T. Keefer, 241-153H
A. J. Norkus, 742-13G
T. E. Pate, 742-13G
K. Rashidi, 742-13G

HLW QA
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R. L. Malloy, 719-4A

HLW Training & Proc.
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E. C. Temple, 705-C

D. G. Thompson, 704-49S

DWPF
M. N. Brosee, 704-S
W. T. Davis, 704-99S
J. T. Carter, 704-25S
R. K. Cauthen, 704-15S
H. H. Elder, 704-S
W. D. Kerley, 704-25S
M. S. Miller, 704-56H
M. J. Montini, 704-S
C. G. Nickell, 704-24S
J. F. Ortaldo, 704-S
P. M. Patel, 512-11S
S. F. Piccolo, 704-S
J. W. Ray, 704-35S
J. F. Sproull, 704-S
K. R. Wells, 210-S
J. W. Wilson, 210-S
A. L. Whittenburg, 704-Z

HLW Engg.
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R. C. Blaine, 704-20S
R. W. Brandon, 719-4A
J. N. Brooke, 719-4A
T. B. Caldwell, 742-4G
R. M. Campbell, 719-4A
D. P. Chew, 719-4A
W. D. Clark, 241-120H
B. G. Croley, 704-56H
P. D. d'Entremont, 703-H
V. G. Dickert, 703-H
E. N. Dixon, 742-4G
B. R. Hess, 703-H
G. M. Johnson, 703-H
B. L. Lewis, 703-H
T. J. Lex, 719-4A
J. E. Marra, 704-56 (5)
S. L. Marra, 703-H
B. A. Martin, 241-102F
T. M. Monahon, 703-H
P. L. Rutland, 241-152H
E. Saldivar, Jr., 742-4G
R. L. Salizzoni, 707-H (5)
R. M. Satterfield, 719-4A
S. A. Saunders, 707-H
R. Schwamberger, 742-4G
G. D. Thaxton, 703-H
G. A. Taylor, 703-H
W. Van Pelt, 241-152H
S. Venkatesh, 241-153H
A. W. Wiggins, 241-152H

HLW Ops
D. B. Amerine, 241-121H
G. Davis, 241-100F
M. J. Green, 241-2H
D. M. Grimm, 707-H
J. E. Herbert, 241-2H
M. D. Johnson, 704-56H
L. G. Lawson, 241-168H
M. J. Mahoney, 241-2H

W. H. Pettigrew, 241-121H
C. A. Polson, 707-H

HLW Proj. Mgmt.
D. W. Armstrong, 704-60S
C. J. Boasso, 742-2G
D. R. Buchanan, 742-2G
H. M. Handfinger, 703-H
R. R. Hopkins, 742-3G
D. M. Matos, 719-4A
F. D. O'Brien, 719-4A
R. A. Stokes, 704-61S (4)
R. W. Wilson, 703-H
J. C. Woeber, 719-4A
R. L. Yancey, 704-S

EDD
R. E. Meadors, 773-41A

EPD
C. R. Hayes, 742-5A

NMPD
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T. C. Robinson, 221-F
G. C. Rodrigues, 703-F
M. F. Sujka, 703-A

SRTC
A. S. Choi, 704-1T
S. D. Fink, 773-A
M. V. Gregory, 773-42A
E. W. Holtzscheiter, 773-A
R. A. Jacobs, 704-T
L. M. Papouchado, 773-A
P. Paul, 773-42A
M. J. Plodinec, 773-42A
W. L. Tamosaitis, 773-A

SWER
S. E. Crook, 704-45S
B. A. Daugherty, 705-3C
R. T. Duke, 705-3C
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