HLW-OVP-97-0068

High Level Waste Management Division

High-Level Waste System Plan Revision 8 (U)

June 30, 1997

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

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

Westinghouse
Savannah River Company
Aiken, SC 29808

0 9 SEP 1997

HLW-OVP-97-0068

Mr. F. R. McCoy, III, Assistant Manager
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U. S. Department of Energy
Savannah River Operations Office
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Dear Mr. McCoy:

<u>HIGH LEVEL WASTE SYSTEM PLAN, REVISION 8 (U)</u>

Attached is the final version of the HLW System Plan, Revision 8. This revision more closely aligns the SRS HLW program planning with the "Accelerating Cleanup: Focus 2006, Discussion Draft." This Plan, however, does take into consideration the changes necessary in the program due to program completions and delays in FY97 and the expected levels of funding for HLW in FY98. Several improvements are incorporated in this Plan as compared to Revision 7. Additional improvements are already in progress for Revision 9. It is anticipated that this Plan will be revised and issued again as Revision 9 in Fall 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 5-2963 of my staff.

Sincerely,

A. B. Scott, Jr.
Vice President and General Manager
High Level Waste Management Division

MNW:mnw/cb

Att.

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High Level Waste Management Division

High Level Waste System Plan Revision 8

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Executive Summary

Introduction

This revision of the High Level Waste (HLW) System Plan more closely aligns the SRS HLW program planning with the "Accelerating Cleanup: Focus 2006, Discussion Draft." This Plan, however, does take into consideration the changes necessary in the program due to program completions and delays in FY97 and the expected levels of funding for HLW in FY98. The funding assumptions used as a basis for Revision 8 of the HLW System Plan is the President's Budget for FY98, and the "Accelerating Cleanup: Focus 2006, Discussion Draft" funding levels for FY99 and beyond.

The FY98 President's budget funding level supports production of 200 sludge canisters; however, it does not support some activities critical to the overall future success of the High Level Waste Mission. Therefore, this Plan has identified incremental work packages with funding estimates that should be accomplished if additional funding could be identified. These incremental work packages include: 1) CIF full operations, 2) ITP processing of three precipitate batches, 3) Saltstone operations to support ITP, 4) upgrades to support the start of precipitate operations in FY99, 5) Tank Farm and DWPF deferred Capital Equipment projects, 6) HLW System attainment upgrades, 7) alternative waste removal demonstrations, 8) conceptual design and possible DHEC approval of Saltstone Vault alternative, 9) Tank 19 waste removal, 10) Tank 19 closure. The total additional funding required to complete these incremental work packages is $31M. These incremental packages are described in more detail in Appendix C.

A DOE Complex-Wide EM Integration opportunity exists where West Valley glass canisters could be received and stored at SRS to reduce overall cost to the complex. While this is not included in this Plan, it is described in Section 6.4.

Schedules, forecasted budget, milestones, cost estimates, operational plans and facility status information is current as of June 30, 1997.

State of the HLW System

H-Tank Farm: At the time of this Plan, H-Tank Farm has approximately 639,000 gallons of space available. The 2H Evaporator has achieved ~1,176,000 gallons of space gain in FY97. The 2H evaporator is currently shut down pending installation of hardware and software upgrades to resolve a Potential Inadequacy in Safety Analysis (PISA) related to source term in the evaporator vessel. The 2H evaporator is expected to resume operations in July 1997 and achieve its space gain goal of 1,600,000 gallons for FY97.

Design and construction of the Replacement High Level Waste Evaporator (RHLWE) continues. Gravity drain lines to Tanks 31 and 37 were deleted from the project scope because of Total Estimated Costs (TEC) concerns. Operating expense reductions forced WSRC to defer RHLWE startup activities, resulting in an overall delay of radioactive startup from November 1998 to June 1999.

F-Tank Farm: At the time of this Plan, F-Tank Farm has approximately 468,000 gallons of space available. The 2F Evaporator has achieved ~693,000 gallons of space gain in FY97. However, the 2F evaporator was recently shut down pending resolution of a PISA related to source term in the evaporator vessel. Even after the PISA is resolved, the 2F evaporator operation may be limited based on lack of feed and budget constraints.

The Inter-Area Transfer Line is in use for transfers between the Tank Farms.

Waste Removal and Tank Closure: The Waste Removal project scope focuses on outfitting tanks with waste removal equipment. Design and/or construction of Waste Removal facilities on Tanks 8, 19, 25 and 29 is progressing. Leak detection and monitoring upgrades on Tanks 21 and 22 to support ESP wash water storage nears completion. Alternative salt waste removal demonstrations have been deferred pending availability of funding and resumption of ITP operations. 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.

The HLWMD has begun to close Tank 20 and Tank 17 in F-Area. At the time of this Plan, the reducing grout pours and the CLSM pours are complete in Tank 20, and the strong grout pours are being planned. A residual heel is being removed from Tank 17.

Pretreatment: Extended Sludge Processing (ESP) continues to provide washed sludge to support Defense Waste Processing Facility (DWPF) canister production. Approximately 158,000 gallons of washed sludge have been transferred to date. Slurry pump seal leakage is within specifications. The composition of sludge batches 2B-6B has changed since the last revision of this Plan, to accommodate several additional sources of sludge, including 2 wt% insoluble solids in saltcake, small sludge heels that must be removed to meet anticipated tank closure requirements, and sludge from the new F-Canyon and H-Canyon waste forecasts.

The In-Tank Precipitation (ITP) facility's outage to resolve benzene issues continues. Evaluation of ITP chemistry and flowsheet changes is ongoing. Authorization Basis changes are in progress, and safety basis upgrades are being installed. ITP is expected to resume radioactive waste processing in April 1998.

The Late Wash Facility achieved its milestone to be Ready for Radioactive Operations on Feb. 28, 1997 per the original facility design. Late Wash has completed water runs using the original design. Facility modifications will be required to address benzene concerns and increase attainment. Simulant Runs will be conducted in FY00, prior to the start of Radioactive Operations in April 2000.

Defense Waste Processing Facility: DWPF has produced a total of 162 radioactive canisters to date, of which 98 were produced in FY97. This represents completion of approximately 2.7% of the total number of canisters to be produced over the life of the facility. Melter pouring problems hampered attainment early in the year, but these are now resolved. Recycle waste volume is expected to increase commensurate with achieving higher attainment rates. DWPF expects to achieve its production goal of 150 canisters in FY97. The current planning basis indicates that all waste will be vitirified in approximately 5,978 canisters by 2021. This Plan also assumes that operating experience will improve waste processing performance, such that the program end date can be achieved by the end of 2020.

Glass Waste Storage: Glass Waste Storage Building #1 is currently storing 152 radioactive canisters.

Effluent Treatment Facility (ETF): ETF continues to operate as planned. ITP flowsheet changes will impact the transfer route between ETF and Saltstone for disposal of the ETF evaporator concentrate stream. This stream may be diverted to Tank 43 during Tank 50 valve box construction, and thereafter will bypass Tank 50 and be transferred directly to Saltstone.

Saltstone: The Saltstone Facility has reduced its waste processing rates commensurate with the ITP outage and subsequent reduced waste volumes. Some facility modifications are planned in response to benzene concerns. Three of six cells have been filled in Vault #1. Vault #4 is the current active vault. Saltstone has processed a total of 2.5 million gallons of salt solution from Tank 50, disposing 4.0 million gallons of saltstone, since startup in June 1990.

Consolidated Incineration Facility (CIF): CIF conducted its Trial Burn from April 14-20, 1997. Radioactive Operations began on April 24, 1997, when the CIF initiated treatment of the M-Area Filter Paper Take Up Rolls.

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 will continue to improve it in the future.

- refine the various production planning models;
- optimize processes to reduce the number of canisters produced;
- incorporate operating data to refine cycle times for new facilities;
- refine waste characterization via the Waste Composition Database, particularly in the area of cesium, potassium and insoluble solids concentrations in the salt tanks; and characterize aluminum compounds in sludge;
- use resource loaded schedules at the Department and Division level;
- empty Type III salt tanks and return them to salt receipt service, particularly Tank 41;
- replace cooling coils in Tanks 29 and 30;
- identify tank closure criteria and conduct Performance Evaluations;
- incorporate actual costs into tank closure planning; and
- complete Performance Evaluations and Conceptual Design for Saltstone Vault alternatives.

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 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 "Accelerating Cleanup: Focus 2006, Discussion Draft".

The HLW System planning bases are described in Sections 1.0-6.0. Key issues and assumptions are described in Section 7.0. The production plan described in detail in Section 8.0 has been structured to align closely with the format of the "Accelerating Cleanup: Focus 2006, Discussion Draft." The Appendices include supporting tables and figures. Appendix A provides a list of acronyms, and Appendix H shows simplified process flowsheets. These appendices should be particularly useful to those who are not familiar with this Plan.

One goal of the planning process is to continuously improve the HLW System Plan to better serve the needs of stakeholders. Revision 8 of this Plan incorporates several improvements since Revision 7:

- ProdMod, the integrated linear programming computer simulation of the HLW System using Aspen Speedup(R) software, has been updated to reflect recent operating experience in DWPF and Saltstone;
- ProdMod now uses the Waste Composition Database as its sole source of waste tank data;
- Both ProdMod and CPES have been updated to incorporate the new ITP flowsheet;
- Sludge Batch compositions have been refined to include sludge in salt tanks, as well as future sludge;
- All ten sludge batches have been modeled and optimized to maximize waste loading and minimize the number of canisters produced;
- Early ITP operations will balance precipitate demand with resource limitations; and,
- An improved system for communications has been established between the HLWMD and NMS&S to improve forecasting.

ITP flowsheet modifications are still being evaluated, and impacts to related facilities (Late Wash, DWPF, Saltstone and ETF) are being assessed. The FY98 Annual Operating Plan (AOP) is being developed at this time. DOE-EM Integration activities could lead to new missions for SRS HLWMD, particularly in regard to possible temporary storage of glass canisters from the West Valley site at DWPF's Glass Waste Storage Building. The "Accelerating Cleanup: Focus 2006, Discussion Draft" is expected to be finalized within the next two months. Tank Closure activities are in progress for the first two waste tanks to be closed; closure of these two tanks will contribute to the basis for projecting cost and schedule for closing other tanks. Revision 9 of this Plan will address these items.

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;
- Retire and close HLW tanks and support systems per regulatory-approved approach; and,
- 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. A detailed high level waste system operating plan that supports all aspects of the HLW Mission is shown in Appendix G.

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 facilities 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 "Accelerating Cleanup: Focus 2006, Discussion Draft." 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 Scope

Key HLW facilities and supporting projects are grouped by function in the "Accelerating Cleanup: Focus 2006, Discussion Draft" as shown below. The Consolidated Incineration Facility (CIF) is included because of the supporting role it will play in treating the DWPF's benzene waste stream.

- SR-HL01: H-Tank Farm
  - *H-Area Tank Farm*
  - *2H Evaporator*
  - *Replacement High Level Waste Evaporator Project*
- SR-HL02: F-Tank Farm
  - *F-Area Tank Farm*
  - *2F Evaporator*
  - *F/H Inter-Area Line*
- SR-HL03: Waste Removal and Upgrade Projects
  - *Waste Removal projects*
  - *Tank Closure projects*
- SR-HL04: Pretreatment
  - *Extended Sludge Processing*
  - *In-Tank Precipitation*
  - *Late Wash*
- SR-HL05: Vitrification
  - *Defense Waste Processing Facility*
  - *Replacement Melter projects*
  - *Failed Equipment Storage Vault projects*
- SR-HL06: Glass Waste Storage
  - *Glass Waste Storage Building #1*
  - *Glass Waste Storage Building #2 project*
  - *Glass Waste Storage Building #2 expansion*
- SR-HL07: Effluent Treatment Facility
- SR-HL08: Saltstone
  - *Saltstone Facility*
  - *Saltstone Vaults #1 and #4*
  - *Saltstone Vault projects*
- SR-HL09: Tank Farm Safety Projects
  - *Tank Farm Services Upgrade (H-Area) project*
  - *Tank Farm Services Upgrade (F-Area) project*
  - *Tank Farm Storm Water System Upgrade project*
- SR-SW01: Consolidated Incineration Facility project

The inter-relationships of these facilities and projects are shown in Appendix H, Simplified HLW Flowsheet Diagram.

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

5.1 Planning Oversight
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 HLWMD.

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 weekly **HLW Interface Meeting** among HLWMD Facility Managers and others ensures that near-term activities impacting multiple facilities are closely coordinated to maximize effective allocation of resources.

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.

Waste Acceptance Criteria are in place for all waste-receiving facilities. Influent waste streams must be compatible with existing equipment and processes, must remain within the safety envelope, and must meet downstream process requirements.

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 originally developed as a design document for DWPF. The strength of this model is the size of the database it can manage. 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 each of the ten sludge macro-batches using tank-specific waste characterization data for each sludge tank. This model assumes all salt wastes are blended into an "average salt" composition. CPES was recently updated to reflect the new ITP flowsheet.

The **Product Composition Control System (PCCS)** verifies that the tank farm waste blends proposed by CPES will be processable in DWPF and will produce acceptable glass. PCCS examines glass property constraints, including liquidus temperature, viscosity, durability, homogeneity, solubility, alumina content, and frit content. PCCS also determines the optimum glass blend to maximize waste loading in glass.

The **HLW Integrated Flowsheet Model (HLWIFM)** is a non-linear, dynamic simulation in Speedup^{R} software that addresses daily variability over a planning period of approximately 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).

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 are 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 uses 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. 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. 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. ProdMod uses the Waste Composition Database as its source of waste data. ProdMod has been updated to include the new ITP flowsheet, and to reflect actual operating experience in DWPF and Saltstone.

The **HLW System Plan 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. The Cost Model is used to determine the cost impacts of accelerating the HLW production schedule to meet the goals of the "Accelerating Cleanup: Focus 2006, Discussion Draft".

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.

The **Federal Facility Agreement (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 "Accelerating Cleanup: Focus 2006, Discussion Draft," the current waste removal program schedule shows removal of waste from all 24 non-compliant tanks by FY10. SRS anticipates that SCDHEC will approve the F/H Area High Level Waste Removal Plan and Schedule when they approve the "HLW Tank Systems Closure Program Plan," which was submitted to SCDHEC in December 1996.

The **National Environmental Policy Act (NEPA)** requires federal agencies to assess the potential environmental impacts of constructing and operating new facilities or modifying existing facilities. Four NEPA documents 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 **Site Treatment Plan (STP)** for SRS describes the development of treatment capacities and technologies for mixed wastes. This allows 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.

DWPF has met its STP commitments to submit permit applications, enter into contracts, initiate construction, conduct systems testing, commence operations, and submit a schedule for processing backlogged and currently generated mixed waste. In the schedule submitted to SCDHEC on 5/21/96, SRS committed 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 production plan described in this System Plan meets this STP commitment.

CIF has met its STP commitments to submit permit applications, enter into contracts, initiate construction, and conduct systems testing. The STP includes the following two commitments for CIF:

> *"Operations shall commence no later than 6/30/97. Commence operations shall mean the introduction of waste into the CIF rotary kiln or secondary combustion chamber for treatment after the trial burn has been completed."*

This commitment was met on April 24, 1997 when CIF began radioactive operations with the initiation of treatment of the M-Area Filter Paper Take Up Rolls.

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

In a letter to SCDHEC on May 13, 1997, SRS states that "...based on the April 24 commencement of radioactive operations date, the waste processing schedule is due to SCDHEC on October 21, 1997."

6.0 Planning Bases

6.1 Reference Date

The reference date of this Plan is June 30, 1997. Schedules, forecasted budget, milestones, cost estimates and operational plans were current as of that date.

6.2 Funding

The funding required to support this Plan from FY98 through FY22 is shown in Appendix C by individual projects and is based on the following:

- FY98 funding of $413,800,000 per the President's Budget;
- FY99-06 funding per the "Accelerating Cleanup: Focus on 2006 - Discussion Draft" guidance;
- Outyear funding after FY06 as required to complete waste removal from all waste tanks by FY20 and closure of all HLW facilities by FY22.

This does not include funding for the Consolidated Incineration Facility or M-Area.

Incremental funding of $28,000,000 in FY98 as shown in Appendix C-1 page 2 will enhance HLW Program performance by accelerating Late Wash startup, coupled DWPF operations, waste removal and tank closure scope.

6.3 Key Milestones and Integrated Schedule

Key milestones relate to the processes required to remove waste from storage, process it into glass or saltstone grout, and close HLW facilities. Key milestones shown below are supported by the budget as described in Section 6.2 per the "Accelerating Cleanup: Focus 2006, Discussion Draft" submittal. Dates shown in bolded italics are actual dates.

Key Milestone	rev. 5	rev. 6	rev. 7	rev. 8
• Start up In-Tank Precipitation	7/95	***9/95***	***9/95***	***9/95***
• Initiate DWPF radioactive operations	12/95	12/95	***3/96***	***3/96***
• Late Wash Ready for radioactive operations (except benzene modifications)	6/96	6/96	2/97	***2/97***
• Consolidated Incineration Facility radioactive ops	2/96	5/96	3/97	***4/97***
• Complete closure of Tank 20			12/96	7/97
• Complete closure of Tank 17			9/97	9/97
• Resume ITP Radioactive Operations			10/97	4/98
• Initiate RHLWE radioactive operations	4/99	11/98	11/98	6/99
• Complete closure of Tank 19			9/97	7/99
• Tank 8 ready to start in-situ washing (Batch#2a)	2/01	2/00	10/98	8/99
• Tank 25 ready for salt removal (2nd ITP)	3/97	3/97	11/98	10/99
• Precipitate ready to feed Late Wash			3/98	1/00
• Initiate Late Wash radioactive operations				4/00
• Initiate DWPF Coupled Operations				4/00
• Complete closure of Tank 16			9/98	9/00
• Complete closure of Tank 18			9/98	9/00
• Tank 11 ready for sludge removal (Batch#2b)	9/05	9/02	3/01	7/01
• Tank 29 ready for salt removal (3rd ITP)	7/99	12/99	10/00	10/01
• Tank 28 ready for salt removal (4th ITP)	5/04	9/01	9/01	9/02
• Tank 38 ready for salt removal (5th ITP)	8/06	9/02	9/02	TBD
• Closure complete on 14 old-style tanks			FY06	FY06
• Waste removed from 24 old-style tanks			FY06	FY07
• Shut down old F-Area Control Room			FY06	FY09
• Closure complete on all 24 old-style tanks			FY09	FY10
• Shut down old H-Area Control Room			FY09	FY11
• Start shipping canisters to the Federal Repository				FY15
• Waste removal complete from all tanks			FY18	FY21
• Complete shipping canisters to Federal Repository				FY26

6.4 Complex-Wide EM Integration

The contractor EM Integration Team effort resulted in one cost reduction initiative that will affect SRS HLW operations if it is implemented. This initiative involves sending all of the estimated 300 West Valley HLW canisters to SRS for storage in GWSB #1. The proposed schedule would ship 75 canisters per year from FY01 through FY04. Execution of this initiative could reduce expenditures at West Valley by $70 million per year once all canisters are safely housed at SRS. To enable this transfer of canisters, two construction related activities would need to occur at SRS: 1) a canister receiving facility would need to be designed, constructed and started up by the end of FY00; and 2) the schedule for completion of GWSB #2 would need to be accelerated by one year. These two activities would require spending an additional $30 million at SRS between now and 2006. Other issues include: stakeholder involvement, analysis of environmental impacts, development of an approved canister transport cask, obtaining approved transportation corridors, and resolution of state equity concerns. Further development of this initiative has been placed on hold indefinitely.

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 "Accelerating Cleanup: Focus 2006, Discussion Draft" Plan and Schedule

Issue: SRS's ability to meet the "Accelerating Cleanup: Focus 2006, Discussion Draft" 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 "Accelerating Cleanup: Focus 2006, Discussion Draft" 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 14 of those tanks, by 2006. The HLW program could be complete (all HLW vitrified) by 2020.

To accelerate the waste processing schedule, funding requirements must be met as specified in the "Accelerating Cleanup: Focus 2006, Discussion Draft". This funding is required over the ten year planning period (FY97-06) to accelerate waste removal projects, purchase additional cold chemicals, fund supporting facilities (like Saltstone vaults), and improve production attainment to increase production to 200 or more canisters per year.

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.

Assumptions: The H-Area encasement will not fail and the H-Area Type IV Tanks will not leak or fail. Sufficient funding will be allocated for maintenance of the Tank Farms, and planned Line Item projects will remain on schedule to help refurbish and preserve the Tank Farm infrastructure. These projects include:

Tank Farm Services Upgrades (HTF West Hill)	FY97-FY99
Tank Farm Storm Water Upgrades	FY98-FY00
Tank Farm Services Upgrades (FTF and HTF East Hill)	FY97-FY02

Contingency: Remove sludge from old-style tanks earlier by consolidating it in new-style tanks prior to 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. Obtain additional funding.

7.3 Tank Farm Waste Storage Space

Issue: Unexpected increases in influent waste forecasts, delays in resumption of ITP operations, and extended evaporator outages are quickly consuming the Tank Farms' available waste storage space. Insufficient waste storage space will limit the Tank Farms' ability to support operations in DWPF and F- and H-Canyon.

Background: Between November 1996 and March 1997, F-Canyon transferred ~320,000 gallons of waste to F-Tank Farm, versus their forecast of ~165,000 gallons for that period. This unanticipated doubling of F-Canyon influent increased the demand on the 2F evaporator and created additional salt waste in F-Tank Farm.

Completion of DNFSB 96-1 activities in ITP have extended the schedule for resumption of ITP operations from October 1997 until April 1998. Waste from Tanks 25, 27, 32 and 39 has been identified as feedstocks for Cycle 1 and Cycle 2 processing. These tanks have already been sampled, and are now "stabilized" (i.e., no new waste will be added) to preserve the integrity of the analytical results pending delivery of feed to ITP. Therefore, 896,000 gallons of space in those four tanks is currently unavailable to receive new waste.

In May 1997, both the 2H and 2F Evaporators were shut down pending resolution of a Potential Inadequacy in Safety Analysis (PISA) related to the source term in the evaporator vessels. At the time of this Plan, neither evaporator has resumed operations.

At the time of this Plan, F-Tank Farm has ~468,000 gallons of space available, and H-Tank Farm has ~ 639,000 gallons of space available.

Assumptions: ITP will resume Radioactive Operations no later than April 1998. Closer coordination between HLW and the Canyons will improve HLW's ability to support Canyon operations. The Canyon's waste stream volumes and the DWPF recycle volumes will be less than or equal to the forecast. The 2H Evaporator's PISA will be resolved, the evaporator will be restarted in July 1997, and it will achieve its planned 1,600,000 gallons space gain for FY97. The 2F Evaporator's PISA will be resolved, and TSR resource constraints will be removed so that the 2F evaporator can restart continuous operations in November 1997. The RHLWE will start up as planned in June 1999.

Contingency: Continued operation of the 2H evaporator at under-saturated salt conditions dissolves existing saltcake in Tank 38. Periodically, this liquor will be transferred to Tanks 30 and 40 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 8.4). 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.

Assumptions: Minimum analytical needs can be identified, appropriately scheduled and accommodated by onsite facilities such that HLW System attainment will not be adversely impacted. Other improvements can be identified and implemented to reduce turn-around time.

Contingency: Alternative analytical methods which can decrease turnaround time are being evaluated as substitutions for previously planned methods. Specifically, DWPF will be demonstrating new methodology (known as "aliquotting") in its Analytical Cell mock-up this summer. Aliquotting eliminates some analytical steps and shortens others so that the feed analysis time should be reduced from 72 hours to 18-24 hours. Currently, this demonstration and an implementation decision are on track to be completed by 9/97.

Other 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 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 new Authorization Basis criteria. ITP processing is the only source of true space gain in the Tank Farms.

Background: ITP completed concentration of Batch #1, but benzene generation rates greatly exceeded expectations. The DNFSB issued Recommendation 96-1 which recommended against further processing until benzene generation, retention and release mechanisms are adequately understood to ensure that measures to prevent and/or mitigate deflagration are adequate.

Dedicated teams are currently evaluating ITP chemistry, flowsheet changes, and the Authorization Basis. Safety basis upgrades are in progress.

Assumptions: Facility modifications will be installed, safety basis upgrades will be completed, laboratory test results will be favorable, and a phased resumption of processing will be successfully implemented such that ITP will be able to attain processing rates supportive of this Plan as projected in Appendix G.

Contingency: F-Canyon, H-Canyon, and/or DWPF processing could be slowed down or halted.

7.6 HLW System Attainment Uncertainty

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

Background: The RHLWE is still under construction. Effectiveness of slurrying sludge in ESP is being evaluated. Tank 42 will be deinventoried and redeployed as a feed staging tank for ITP. The ITP/Late Wash flowsheet is being revised. ITP filtrate production is now close-coupled to Saltstone operations, but Saltstone's current days-only operations will not support ITP filtrate production during peak periods. 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 projections are that Late Wash's maximum production rate will support ~200 canisters per year, depending on flowsheet variables. Melter pouring problems slowed DWPF attainment for the first eight months of FY97. 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: RHLWE will operate at a capacity sufficient to support the HLW System. The mound of unslurried sludge in Tank 51 can be suspended without adversely impacting feed to DWPF. Use of Tank 42 as a staging tank for ITP will increase confidence in salt feed chemistry and ultimately decrease ITP cycle time. Saltstone operations can be adjusted to accommodate ITP filtrate production rates. Other ITP and Late Wash attainment improvements can be achieved using funding already set aside in DOE-SR Ten Year Plan Project SR-HL03, Waste Removal and Upgrade Projects, in FY98-99. Late Wash will support 200 canisters per year. The new insert recently installed in the DWPF melter will control past pouring problems. Facilities will be started up, experience will be gained, and production batch durations will be defined, meshed and altered as necessary to achieve a HLW System production rate consistent with the "Accelerating Cleanup: Focus 2006, Discussion Draft".

Contingency: Additional funding could be requested to improve or replace processes. Canister production could be slowed. Support of Canyon operations could be slowed. All HLW production could be halted.

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 will require capital upgrades to facilities. Implementation of a revised Authorization Basis (AB) program has begun. As administrative control programs are defined, further procedure revisions and equipment upgrades will be required. Equipment functional classification and backfit analyses are expected to result in TSR changes and equipment upgrades. Implementation of TSRs is also expected to cause increases in some routine operations and maintenance costs.

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

Dedicated, interdisciplinary teams representing Engineering, Operations, Procedures, Maintenance and Training are working to develop and implement TSRs. Implementation is planned in three phases. In Phase I, procedures, training and surveillances are being upgraded and implemented. Also, all conductivity probes and steam control interlock valves are being upgraded on the 2H Evaporator. 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 began, and a schedule for Phase II was prepared. TSR implementation for ITP/ESP and F&H Tank Farms, and backfit analysis for ITP, is ongoing. However, at the time of this Plan, further Phase II work is delayed pending resolution of funding and resource issues.

Phase III will implement the resulting upgrades, which may include control rooms and transfer lines. Full compliance with the requirements of 5480.22 will be achieved at the end of Phase III.

The cost of some routine tasks associated with operating and maintaining Safety Class and Safety Significant Systems is expected to increase relative to similar tasks for General Service systems, because of additional TSR-driven requirements related to work package preparation and closure, and quality assurance documentation for procurement of materials.

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: Operations will continue under the BIO until the TSR program can be fully implemented. HLW system attainment could be slowed to make resources available to support the TSR program.

7.8 *Key HLW Processing Parameters Uncertainty*

Issue: Subtle changes in a few key waste characteristics could dramatically impact HLW processes and the overall length of the HLW Program.

Background: This Plan assumes that there are 1.95 lbs of insoluble solids in each gallon of settled sludge in the Tank Farms. Any change in that figure will have a direct impact on the total number of canisters that will be produced. This Plan assumes that all of the aluminum in the sludge is in the form gibbsite, $Al(OH)_3$, which is soluble, and can be removed by the aluminum dissolution process at ESP. However, some could be in the form of boehmite, AlO(OH), or aluminum silicates, which do not dissolve completely, and therefore would not be removed in ESP. This could impact processing in DWPF. This Plan assumes that 2 wt% insoluble solids are entrained in saltcake. If the actual amount is higher, more canisters of glass will be produced. This Plan assumes that the accepted total potassium inventory in the Tank Farms is complete. An increase in the amount of potassium will drive increases in total ITP precipitate production.

Assumptions: Waste sample analyses are being refined to obtain additional needed information without increasing the number of samples. Sample results will confirm the waste composition and characteristics described above. Operating experience in all HLWMD facilities will improve our understanding of the relationships among waste composition, waste characteristics and waste processing. Facility processes will be adjusted as necessary. Blending of feed to ITP and ESP will compensate for any transient (high or low) conditions in individual waste tanks.

Contingency: Additional waste tank samples could be retrieved and analyzed. Modifications to some facilities could be required. The total number of canisters may increase. The overall High Level Waste program could be lengthened.

7.9 *Year 2000 Compliance*

Issue: Many of the HLWMD's computer systems are not "Year 2000 Compliant," and may not work properly, or may not work at all, after January 1, 2000, unless repairs are made in advance. All HLWMD processes could be impacted.

Background: The software in many microprocessors assumes that in any four digit year, the first two digits are always 1 and 9, and the last two digits indicate a particular year. That is, many microprocessors interpret "99" as "1999." At the turn of the century, the last two digits of the new year will be "00," but many microprocessors will interpret that as the year 1900. This will cause disruptions in programs which use timing or date-related functions. Each manufacturer's code is different, so solutions must be developed for each different microprocessor, application or system. No one solution will work for everything. Fixes may include modifications to hardware as well as software.

Affected HLWMD systems include process control systems (i.e., the Distributed Control Systems in F-Tank Farm, DWPF, the RHLWE, H-DB8 and Waste Removal), programmable logic controllers, data acquisition systems, engineering and scientific systems, process support systems, and databases or data intensive systems (DWPF's LIMS and PIMS, and the HLWMD WMS), and others. Efforts are already underway to inventory, prioritize, and fix affected systems in HLWMD. However, sufficient manpower and financial resources are not currently available to fix all affected systems before December 31,1999.

Assumptions: Highest priority will be given to fixing those systems related to human health, safety and the environment. Vendors of affected hardware and software will provide some support. Additional resources can be identified and allocated to implement solutions. Production outages can be scheduled so as to minimize the impact on HLW system attainment.

Contingency: All HLW processing, including receipt of Canyon wastes, could be slowed or halted until appropriate repairs can be made.

<u>*8.0 Integrated Production Plan*</u>

<u>*8.1 Overview*</u>

Under the assumptions stated in the "Accelerating Cleanup: Focus 2006, Discussion Draft," the overall HLW System attainment will be 46% with program completion in FY22. All of the FFA Waste Removal Plan and Schedule commitments will be met, with the exception of Tank 15. The Tank 15 waste removal schedule currently exceeds the FFA schedule by one year, but efforts are underway to accelerate the Tank 15 schedule. The funding required to support the HLW program is shown in Appendix C.

This section describes the effect of each influent and effluent stream in the Tank Farms, and its impact on Tank Farm operations, as illustrated in Appendix G.1. Sections 8.2 through 8.10 describe the production requirements for each HLW facility to support this Plan.

<u>***HLW System Material Balance***</u>

The Tank Farm Material Balance shown in Appendix G.1 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.

Tank Space Available: 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 "Available" tank space. The Available Tank Space is calculated as follows.

The old-style tanks (Tanks 1-24) are excluded because they do not meet current requirements for secondary containment and leak detection, and so the Tank Farm Industrial Wastewater Operating Permit does not generally allow waste to be added to those tanks.

ITP Tanks 48, 49 and 50 are excluded primarily because unplanned additions of large waste volumes would alter the waste composition, possibly violating strict process chemistry controls.

ESP Tank 51 is excluded from the Available Tank Space calculation because unplanned additions of waste would alter the washed sludge composition, almost certainly interrupting feed to DWPF while the waste is remediated.

Each Tank Farm is required to maintain 1,271,000 gallons of space in Type III/IIIA Tanks, to accommodate emergency storage of waste in the unlikely event of a tank leak.

For planning purposes, the maximum capacity of all the remaining Type III and Type IIIA tanks is assumed to be 362", which is 10" less than the Technical Standard limit of 372". The only exceptions to this are the 2F and 2H Evaporator feed tanks, Tanks 26 and 43, in which the Operating Limit is 350", due to the elevation of the feed pump motor.

The "Available Tank Space" column in Appendix G.1 is the total available tank space in the Type III Tanks after excluding the tanks identified above, and deducting 2,542,000 gallons for emergency spare space. At the time of this Plan, the F- and H-Tank Farms have a combined 1,107,000 gallons of space available.

Influents - F-Canyon Low Heat Waste (LHW) and High Heat Waste (HHW): F-Canyon recently completed reprocessing of EBR-II fuel. Reprocessing of Taiwan Research Reactor (TRR) fuel is still in progress and is expected to generate ~3,000 gallons of high heat waste per month and ~12,000 gallons of low heat waste per month through February 1998. Plutonium scrap processing is expected to start in September 1997 and continue through April 2000, generating ~ 500 gallons of high heat waste per month and ~23,000 gallons of low heat waste per month. A Process Vessel Vent (PVV) flush, tentatively scheduled for March 1998, will generate an additional ~20,000 gallons of low heat waste. For planning purposes, F-Canyon de-inventory flushes are assumed to occur from May-September 2000, generating ~15,000 gallons of low heat waste per month and ~2,000 gallons of high heat waste per month. Starting in October 2000, shutdown flows of ~10,000 gallons per month low heat waste and zero high heat waste are forecast.

Influents - H-Canyon Low Heat Waste (LHW) and High Heat Waste (HHW): H-Canyon began Plutonium-238 and Plutonium-242 flushes in April and will continue through October 1997. The ~36,000 gallons of low heat waste generated by these flushes are being stored in H-Canyon, and will be sent to the Tank Farms in two 18,000 gallons batches, in November and December 1997.

H-Canyon will be processing K14 charges from July 1997 through April 1998. Operating the head-end of the process from July 1997 through January 1998 will generate ~ 1,000 gallons of low heat waste per month, followed by operating the first cycle from February 1998 through April 1998, which will produce ~21,000 gallons of low heat waste per month. Anion exchange recovery of Neptunium will begin in February 1998, if approved by DOE. A Warm Canyon PVV filter flush is scheduled in March 1998, which will generate ~18,000 gallons of low heat waste containing ammonium nitrate and radionuclides. A special low-assay Plutonium flush with a projected volume of 78,000 gallons low heat waste is tentatively scheduled in Spring 1998. For planning purposes, this Plan assumes that the 78,000 gallons will be transferred in three equal volumes of 26,000 gallons in April, May and June 1998. Processing of Mark 16 and Mark 22 charges will begin in July 1998 and continue through December 2000, generating ~10,000 gallons of low heat waste per month, and ~14,000 gallons of high heat waste per month. Beginning in January 2001, the only forecast activity is HB Line Plutonium scrap processing, which will generate just ~3,000 gallons of low heat waste per month, and zero high heat waste.

Influents - DWPF Recycle: DWPF recycle is based on planned production of 150 canisters (30% attainment) in FY97, 200 canisters (40% attainment) per year in FY98-04, 225 canisters (45% attainment) in FY05, and 250 canisters per year (50%) thereafter. The recycle volume will range from 2,268,000 gallons per year to 3,629,000 gallons per year as attainment increases. The recycle algorithm is explained in Section 8.6.

Influents - Tank Wash Water: 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 140,000 gallons, which is a level of about 40 inches in most tanks. The annulus wash is assumed to be two 25,000 gallon 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 wash water values are based on CPES and ProdMod modeling for each of the remaining sludge batches. The wash water for each batch is generated during the 24 month period immediately before the batch is fed to the DWPF. No distinction is made between the water used to slurry and transport the sludge to the ESP tanks, aluminum dissolution waste, and sludge wash water. All of the wash water will be evaporated. For more details on ESP, refer to Section 8.5.1.

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. 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 - Evaporators: The 2F, 2H, and RHLWE reduce the volume of dilute, influent waste streams. Reference to "evaporator space gain" is a misnomer, because evaporator operations can only minimize the effect of waste additions as saltcake and caustic liquor accumulate. The only true source of Tank Farm space gain is to run ITP. For more details on evaporator operations, refer to the "Evaporator Salt Inventory" section below, and Sections 8.2.2 and 8.3.2.

Effluents - In-Tank Precipitation: ITP space gain occurs when concentrated supernate, unconcentrated supernate, or dissolved saltcake is fed to ITP. Previous revisions of the System Plan waited to recognize space gain from dissolved salt until the entire tank had been emptied and returned to salt service. However, this Plan credits recovered space immediately, since that space could be made available to store 1) concentrated supernate from an active evaporator drop tank, or 2) any liquid waste, in the unlikely event of a tank leak. ITP space gain is based on executing the ITP Production Plan shown in Appendix G. For more details on ITP, refer to Section 8.5.2.

Evaporator Salt Inventory

The evaporators volume reduce the various waste streams coming into the Tank Farms. This is crucial to the success of HLW and Site Missions. The evaporators must keep current with waste generated by Canyon operations, DWPF recycle, ESP spent wash water, and HLW tank wash water.

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 its chemical constituents. This is further described in Sections 8.2.2 and 8.3.2.

When the saltcake level reaches 1.0 million gallons in a salt receipt tank, the tank is considered full. (The remaining 0.3 million gallons of space typically contains concentrated supernate.) At that time, another salt receipt tank is required or the evaporator will become salt bound and shut down. Appendix G.1 shows the salt formation in each of the three evaporator systems. Note that the volume of concentrated supernate is not explicitly shown, because this Plan assumes that concentrated supernate can be transferred out of the evaporator systems as needed, and either fed directly to ITP or stored in another Type III tank. Evaporator operating plans are carefully balanced with ITP feed plans, so that the evaporators can support the influent waste forecast without becoming salt bound.

8.2 H Tank Farm

The H-Tank Farm receives, stores, evaporates, and transfers high level waste.

8.2.1 H-Tank Farm Space Available

The H-Tank Farm includes twelve old-style waste storage tanks, eleven new-style tanks, and three evaporator systems. At the time of this Plan, H-Tank Farm has ~1,252,000 gallons of space available.

Tank 32 and Tank 39 have been sampled for feed to ITP in Cycle 1 and Cycle 2. To preserve the integrity of the sample data, no new waste will be added to either of these tanks until the transfers to ITP have been completed. These transfers should be complete by early FY99.

8.2.2 H-Tank Farm Evaporators

The **1H Evaporator** vessel has a leaking tube bundle. There are no plans to restart this evaporator. Therefore, the condition in the Tank Farm Wastewater Operating Permit to remove the 1H Evaporator from active service by 1/1/98 has been met.

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 in lay-up mode.

The primary role of the **2H Evaporator** in FY97 is to evaporate the 221-H Canyon LHW stream and the DWPF recycle stream. All H-Area LHW and DWPF recycle is received directly into the 2H Evaporator system and evaporated. At the time of this Plan, H-Tank Farm had received ~26,000 gallons of low heat waste from H-Canyon (most of which was associated with special H-Canyon PVV flushes), and ~1,200,000 gallons recycle from DWPF (FYTD). The 2H Evaporator has achieved ~1,176,000 gallons space gain. The 2H evaporator utility averaged 76% from October 1996 - April 1997. This is significantly better than the 60% utility expected. Although it is currently shut down pending resolution of a PISA related to source term in the evaporator vessel, the 2H Evaporator is expected to resume operations in July 1997 and reach its 1,600,000 gallons space gain goal for FY97.

The current forecast for the remainder of FY97 calls for an additional ~52,000 gallons of H-LHW, and ~722,000 gallons of DWPF recycle. This is a marked increase in the DWPF recycle rate relative to receipts to date, because past melter pouring problems limited attainment, and therefore temporarily reduced recycle production. However, melter pouring problems now appear to be resolved (see Section 8.6), and DWPF attainment rate is expected to increase, so the recycle volume will increase accordingly.

Video inspections and material balances made during April 1996 indicated that the salt volume in Tank 38 was 880,000 gallons, which is approaching the maximum capacity of the tank. The 2H Evaporator's only other salt receipt tank is Tank 41, which is already filled. Plans to dissolve the Tank 41 salt were suspended pending resumption of Radioactive Operations at ITP. Therefore, to extend the useful life of Tank 38, 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. Approximately 90% of the waste volume reduction can still be achieved at the lower specific gravity, by concentrating the waste to a sodium 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 the Tank Farm to enable the evaporator to continue operating.

Space gain for the 2H 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.1 Tank Farm Material Balance uses an algorithm to forecast space gain. Based on historical and laboratory test data, the volume reduction for H-LHW is typically 71%. Space gain factors for all streams are based on historical and laboratory test data where available, process models, and projections of waste stream composition. The space gain factor for DWPF recycle could be as high as 96% if the evaporator were operated at a higher specific gravity. However, since the evaporator is currently operating at a lower specific gravity, this Plan assumes that the volume reduction for DWPF recycle is 90%. For now, the 2H space gain algorithm is:

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

After the RHLWE starts up, half of the DWPF recycle will be diverted to the RHLWE system. The 2H Evaporator space gain algorithm then will be:

2H Space Gain = (H-LHW)*(0.71) +(0.5)(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.

The 2H Evaporator vessel was replaced in December 1995, and the feed pump was replaced in January 1997. The new vessel has a Hastelloy tube bundle and warming coil that is expected to last for 30 years. Therefore, downtime for pot replacement is not forecast. 2H Evaporator operation is based on a planned utility of 60% with a space gain as shown in Appendix G.1.

The 2H Evaporator system can be shut down around FY15, at which time the RHLWE will assume responsibility for all F- and H-Tank Farm evaporations.

The **Replacement High Level Waste Evaporator (RHLWE)** is currently in the construction phase. The planned startup date is June 1999. Construction is estimated to be 93% 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. The space gain values shown in Appendix G.3 are well within the expected capacity of the RHLWE. The design basis is 7,600,000 gallons per year of overheads assuming feed at 33 gpm at 25-35% dissolved solids.

The RHLWE will evaporate 50% of the DWPF recycle stream; plus 64% of the ESP wash water (H-Area has about 64% of all sludge, thus 64% of the sludge wash water is allocated to the RHLWE); plus 56% of the tank wash water generated in H-Area (H-Area has 29 of the 51 tanks, thus 56% of the tank wash water is allocated to the RHLWE); plus 100% of the H-Area High Heat Waste Stream. The space gain factor for DWPF recycle evaporated through the RHLWE is expected to be 96%. This is higher than the space gain achieved for the same stream in the 2H evaporator, because the RHLWE will operate at a higher, salt-producing specific gravity than 2H does. The space gain factor for the ESP wash water is estimated at 85%. The space gain factor for tank wash water is estimated at 90%. All fresh Canyon wastes can be evaporated with a space gain factor of 76%. The algorithm used to forecast RHLWE space gain in gallons per year is therefore:

RHLWE Space Gain = (0.50)*(DWPF recycle)*(0.96) +
(0.64)*(ESP wash water)*(0.85) +
(0.50)*(tank wash water)*(0.90)+
(1.00)*(H-High Heat Waste)*(0.71)

The RHLWE project scope currently includes installation of gravity drain lines to Tanks 29 and 30. Gravity drain lines to Tanks 31 and 37 were deleted from the project in light of project TEC concerns. Hot tie-ins are scheduled from August 1997 - April 1998. The RHLWE will start up with Tank 32 as its feed tank, and Tank 30 as its drop tank. 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.

8.2.3 H-Tank Farm Waste Removal Operations

Tank 32 and Tank 39 have been selected to provide supernate to ITP as feedstock for Cycle 1 and Cycle 2. (For a complete description of the ITP feed plan, refer to Appendix G.2.) Supernate volumes and need dates are as follows:

	Transfer to Tk 48	Transfer Date	
Tank 32	240,000 gal	2/98	
	210,000 gal	4/98	
	100,000 gal	7/98	
	60,000 gal	9/98	(con't)

(con't)

	Transfer to Tk 48	Transfer Date
Tank 39	170,000 gal	2/98
	210,000 gal	4/98
	200,000 gal	9/98
	200,000 gal	11/98

Salt Removal

Tank 41 will be the first tank to feed dissolved salt cake 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 42 must be available to stage the dissolved salt from Tank 41 to allow insoluble solids to settle prior to transferring to Tank 48.

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 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. This design is expected to save up to $6 million per salt removal tank in capital costs, and to be applicable to Tanks 1, 2, 3, 9, 10, 27, 30, 31, 36, 37, 44, 45 and 46.

Sludge Removal

Sludge from **Tank 11** will be processed as part of Sludge Batch 2B. To support timely ESP processing, H-Tank Farm preparations must begin promptly. In FY98, as-built drawings must be developed, a waste removal design contract must be awarded, and most of the waste removal design work must be completed. In FY99, the design must be completed, a construction contract must be awarded, and most of the construction must be completed. In FY00, the construction must be completed and four slurry pumps must be installed. In FY01, the slurry pumps will be tested and sludge removal must be initiated so that the transfer is complete by December 2000, when aluminum dissolution is scheduled to begin.

Sludge from **Tank 12** and **Tank 14** will be processed as part of Sludge Batch 3A. In FY99, as-built drawings must be developed, and work must begin to award a design contract, since the design must be complete in mid-FY00. By the end of FY00, work must have begun to award a construction contract; construction will take all of FY01 and some of FY02. Also in FY02, four slurry pumps must be installed and tested in each tank. The sludge will be transferred to Tank 40 in FY03.

Work on **Tank 15** must begin in FY02 to support transfer of partially washed sludge to Tank 51 in FY06. Work on **Tank 21** and **Tank 22** must begin in early FY03 to support transfer of partially washed sludge to Tank 51 in FY07.

8.2.4 H-Tank Farm New Facility Planning

For details on projects currently planned in H-Tank Farm, refer to Appendix D.

8.3 F-Tank Farm

The F-Tank Farm receives, stores, evaporates, and transfers high level waste.

8.3.1 F-Tank Farm Space Available

The F-Tank Farm includes twelve old-style waste storage tanks, ten new-style tanks, and two evaporator systems. At the time of this Plan, F-Tank Farm has ~468,000 gallons of space available.

Supernate from Tank 25 and Tank 27 has been sampled for feed to ITP in Cycle 1 and Cycle 2. To preserve the integrity of the sample data, no new waste will be added to either of these tanks until the transfers to ITP have been completed. These transfers should be complete by early FY99.

8.3.2 F-Tank Farm Evaporators

The **1F Evaporator** was shut down in 1988 because of high maintenance and lack of feed. There are no plans to restart this evaporator system. At the time of this Plan, no chemical cleaning has been done and no decontamination and decommissioning activities have occurred.

The primary role of the **2F Evaporator** in FY97 and FY98 is to evaporate F-Canyon HHW and LHW, H-Canyon HHW, and some of the unconcentrated supernate backlogged in H-Area. At the time of this Plan, F-Tank Farm had received ~380,000 gallons of waste from F-Canyon (FYTD). Approximately 580,000 gallons of backlogged waste from Tank 39 had been transferred to Tank 26. The 2F evaporator has achieved ~693,000 gallons of space gain. The 2F evaporator utility averaged 72% from October 1996 - April 1997, including a twelve-month high of 97.8% in March. This is significantly better than the 60% utility expected. However, at the time of this Plan, the 2F Evaporator has been shut down pending resolution of a PISA concern regarding the source term in the evaporator vessel. After the PISA concern is resolved, resumption of 2F evaporator operations may be limited based on feed and budget constraints.

Starting in FY99 and FY00, the 2F Evaporator will also evaporate spent wash water generated by in-situ washing of F-Tank Farm sludge, and spent wash water from cleaning F-Tank Farm tanks that are being retired.

The 2F evaporator currently evaporates 100% of the F-Canyon HHW and LHW, and 100% of the H-Canyon HHW, plus backlogged waste from H-Tank Farm. In addition, 2F will evaporate 36% of the ESP wash water (F-Area has about 36% of all sludge, thus 36% of the sludge wash water is allocated to 2F); plus 44% of the tank wash water (F-Area has 22 of the 51 tanks, thus 44% of the tank wash water is allocated to 2F); when these streams are generated, starting in FY99. Therefore, the algorithm used to forecast space gain for the 2F Evaporator is:

$$\begin{aligned}\text{2F Space Gain} = \; & (1.00)*(\text{F-LHW})*(0.71) + \\ & (1.00)*(\text{F-HHW})*(0.71) + \\ & (1.00)*(\text{H-HHW})*(0.71) + \\ & (\text{backlog})*(0.76) + \\ & (0.36)*(\text{ESP wash water})*(0.85) + \\ & (0.44)*(\text{tank wash water})*(0.90)\end{aligned}$$

HLWMD experience operating HLW evaporators indicates that the average life expectancy of evaporator vessels is 10.5 years. The 2F Evaporator vessel will reach 10.5 years of service in April 2000. The plan is to operate the 2F evaporator until failure, so a replacement outage is not specifically scheduled at this time. SRS must first determine whether vessel replacement is warranted, given the current condition of the installed vessel, and the schedule for permanently removing the 2F evaporator from service. If SRS does decide to replace the 2F evaporator vessel, new jumpers for the replacement vessel and a disposal box for the failed vessel must be fabricated. Also, SRS must determine whether the new vessel should be installed as is (with the stainless steel tube bundle already in place), or whether the stainless steel tube bundle should be replaced with a Hastelloy tube bundle. Both the replacement vessel with a stainless steel tube bundle and a separate Hastelloy tube bundle are already available on site.

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

8.3.3 F/H Interarea Transfer Line

The capability to transfer between F-Tank Farm and H-Tank Farm has been restored. Unconcentrated supernate was transferred from Tank 39 to Tank 26 in November and January. Concentrated supernate from Tank 34 was transferred to Tank 39 in June, which enables the HLWMD to stage feed for ITP while managing available space in F-Tank Farm. Concentrated supernate from Tanks 25 and 27 will be transferred to Tank 48 to support resumption of radioactive operations in ITP.

8.3.4 F-Tank Farm Waste Removal Operations

Tank 25 and Tank 27 have been selected to provide supernate to ITP as feedstock for Cycle 1 and Cycle 2. (For a complete description of the ITP feed plan, refer to Appendix G.2.) Volumes and need dates are as follows:

	Transfer to Tk 48	Transfer Date
Tank 25	170,000 gal	12/97
Tank 27	140,000 gal	7/98

Salt Removal

Tank 25 will be the second salt 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 FY00, with the first transfer of dissolved salt solution to ITP occurring in FY00. 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-Tank Farm tank to undergo salt 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 may be used to demonstrate a low pressure (approximately 60 gpm and 50 psi) water jet for salt dissolution. 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 tank walls. Water jet installation and operation have been deferred pending availability of funding and resumption of ITP operations.

Sludge Removal

Sludge from **Tank 8** must be delivered to Tank 40 by October 2001 to support final processing of Sludge Batch 2A. In order to meet that date, F-Tank Farm preparations must begin promptly. In FY97, design of waste removal facilities must be completed, and work must start on awarding a construction contract. Construction must be completed in FY98, so that four slurry pumps can be installed and tested, and in-situ washing can begin in FY99. In-situ washing is scheduled to complete just-in-time to transfer the sludge to Tank 40. After the sludge has been removed, Tank 8 will be water washed and prepared for closure in FY01-02.

During Tank Closure activities, residual waste and wash water from Tanks 20, 17 and 19 will be collected in **Tank 18**. At the end of FY99, the whole inventory in Tank 18 will be consolidated in Tank 7.

Tank 7 as-built drawings are already complete. The waste removal design contract must be awarded and the design completed in FY99. A construction contract must be awarded and construction started in FY00. Construction must be completed, slurry pumps installed and tested in FY01 so that in-situ washing can begin in FY02.

Tank 4 work must begin in early FY01 to support transfer of partially washed sludge to ESP Tank 40 in FY05. Work on **Tank 5** and **Tank 6** must begin in early FY03 to support transfer of partially washed sludge to ESP Tank 51 in FY07.

8.3.5 F-Tank Farm New Facility Planning

For details on projects currently planned for F-Tank Farm, please refer to Appendix D.

8.4 Waste Removal

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 "Accelerating Cleanup: Focus 2006, Discussion Draft," waste will be removed from all of the old-style tanks by 2010. 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 41, 25, 29, 28, 31, and 38 must receive priority to support the key volume reduction mission of the 2H, 2F and RHLWE Evaporator systems. After Tank 38, salt will be removed from the old-style salt tanks (Tanks 1, 2, 3, 9, 10, and 14) for feed to ITP. The complex interdependency of the safety and process requirements of the various HLW facilities drives the sequencing of waste removal from individual tanks.

<u>Tank Space Availability</u>: 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 1,649,000 gallons, so a significant portion of this Plan is dedicated to planning in this area.

8.4.1 Salt Removal Demonstrations

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, and 14) for feed to ITP. In support of the "Accelerating Cleanup: Focus 2006, Discussion Draft," 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 rely 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.

In an effort to curb costs, the outyear budget for salt removal equipment has already been reduced to $6M per tank. Three less expensive alternative salt removal techniques have been proposed, although none of the three have been fully demonstrated yet. The three proposed techniques include 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. A Modified Density Gradient demonstration started in Tank 41 in July 1996. Approximately 44,000 gallons of supernate and interstitial liquid were removed before the test, to expose the saltcake. Approximately 20,000 gallons of salt was successfully dissolved, but not removed; further work on the Tank 41 demonstration was suspended in light of the ITP outage and tank space availability concerns.

The **Single Slurry Pump** demonstration is also planned in Tank 41. The Single Slurry Pump method uses the same principles as traditional salt removal techniques, except that only one pump is used. Salt removal will be completed with the three slurry pumps currently installed in Tank 41.

A **Low Pressure Water Jet**, which could be used for "point-and-shoot" salt dissolution, may also be demonstrated in Tank 25. However, all work on alternative salt removal techniques has been suspended pending availability of funding and resumption of ITP operations.

8.4.2 Sludge Removal Demonstrations

The technical basis for sludge removal uses four standard slurry pumps for each sludge tank. Sludge removal is performed in a manner that yields ten discreet macro-batches 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 466 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. Thirteen "new generation slurry pumps," which incorporate some 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 has been successfully tested at TNX. The pump will be installed in a Hanford waste tank.

A variety of AEA Technology's sludge mixing pumps and samplers are being considered for possible application in SRS sludge tanks. 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. The AEA fluidic samplers are being installed in ITP Tanks 48 and 49 for sampling slurry, and in the ESP Tanks 42 and 51 for sampling sludge.

8.4.3 HLW System Upgrades

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 recurring, extended steam outages experienced by the 2F Evaporator since FY94. Routine three or four day outages become one and two month outages when excavations revealed whole line segments (not just isolated leaks or point failures) in unacceptable condition.

Tank Farm Storm Water Upgrades: This FY98-00 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.

8.4.4 Closure Program

The Savannah River Site has begun to close HLW tanks. This is the first time anywhere in the DOE Complex that HLW tanks are being closed. SRS will close HLW tank systems under the F/H Tank Farm Industrial Waste Water Operating Permit and South Carolina Regulation R.61-82, "Proper Closeout of Waste Water Treatment Facilities." In addition, SRS recognizes that future RCRA/CERCLA remediation actions may be required to clean up contaminated soils in the Tank Farms. Therefore, the SRS Tank Closure Program is structured to be consistent with the comparative analyses performed as part of a RCRA corrective measures study, and a CERCLA feasibility study under the FFA.

The performance objectives for HLW tank system closure are the groundwater protection standards applied at the point where groundwater discharges to the surface (seepline), and the surface water quality standards applied in the receiving stream. Closure options for each tank are evaluated to show conformance with the performance objectives as part of the overall evaluation.

DOE has determined that the material remaining in the tank systems at closure satisfies NRC criteria for "incidental waste," which requires that incidental waste:

(a) "has been processed (or will be further processed) to remove key radionuclides to the maximum extent that is technically and economically practical;
(b) 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
(c) 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."

The general protocol for SRS tank closure is as follows. Bulk waste is removed and the tank is water washed. Any waste remaining in the tank after water washing is considered residual waste. The residual waste is characterized, and a method for stabilizing the residual contaminants is proposed. The proposed closure configuration is 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 are also included in the calculations. The portion of the performance objectives remaining after subtracting non-tank sources is apportioned among the tanks to determine individual, tank-specific performance objectives. Detailed tank-specific closure modules are prepared for each tank and submitted to SCDHEC for approval. SCDHEC approval is a prerequisite to starting emplacement of backfill material.

Three distinctly different layers of backfill material are placed in each tank. The first layer of backfill, nominally referred to as "reducing grout" for its waste-binding properties, was developed and tested by Construction Technologies Laboratories (CTL) in Chicago. The second layer of backfill is Controlled Low-Strength Material (CLSM), which will prevent tank subsidence. The top layer is "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 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 removal of sludge heels and emplacement of backfill material. Tank 16, an H-Area Type II tank which has already undergone bulk waste removal, water washing and acid cleaning, also will be closed. Tanks 20 and 17 are being closed in parallel.

Tank 20 is being 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 ~1,000 gallons of residual sludge on the bottom of the tank. The waste was characterized by process knowledge and sampling. SCDHEC approved the Tank 20 Closure Module on January 30, 1997. DOE-SR has determined through their ongoing interactions with the NRC that the NRC has "no objection" to the closing of Tanks 20 and 17. WSRC began placing the "reducing grout" in Tank 20 on April 24, 1997. At the time of this Plan, emplacement of the reducing grout was already complete. Approximately 518 cubic yards (2 feet deep in the tank) was used. CLSM pouring is complete; approximately 7,000 cubic yards of CLSM (~32 feet deep) were emplaced. In support of the "Accelerating Cleanup: Focus 2006, Discussion Draft", Tank 20 will be closed in FY97.

Tank 17 closure is proceeding in parallel with closure of Tank 20. Bulk waste removal of 376,000 gallons of sludge was completed in 1985. Approximately 280,000 gallons of tritiated water was transferred from Tank 17 to Tank 6 in March, leaving a sludge heel of ~10,000 gallons. Water brushes are being used to move the sludge heel toward diaphragm pumps for removal from Tank 17 to Tank 18. At the time of this Plan, ~200,000 gallons of combined wash water and sludge have been pumped from Tank 17 to Tank 18, of which ~8,500 gallons was sludge. Approximately 1,500 gallons of sludge remain in Tank 17; the goal is to leave no more than 700 gallons. In support of the "Accelerating Cleanup: Focus 2006, Discussion Draft," Tank 17 will be closed in FY97.

Tank 19 bulk waste removal 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 only two slurry pumps; zeolite covers some piles of sludge. Waste samples obtained with a mud snapper in 1995 revealed that the heel is soft and probably easily mobilized. Therefore, the current plan for Tank 19 heel removal is to use the same type of water brushes and diaphragm pumps currently deployed in Tank 17. The residual waste and wash water from Tank 19 will be consolidated in Tank 18. In support of the "Accelerating Cleanup: Focus 2006, Discussion Draft", Tank 19 will be closed in FY99.

Tank 18 will be the last tank closed in this cluster because Tanks 17, 19 and 20 can only transfer into Tank 18, and because Tank 18 is the only tank of the four that can transfer out to FDB-1. The tank currently contains about 16,000 gallons of sludge and 50,000 gallons of supernate. In support of the "Accelerating Cleanup: Focus 2006, Discussion Draft", Tank 18 will be closed in FY00.

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 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 "Accelerating Cleanup: Focus 2006, Discussion Draft", Tank 16 will be closed in FY00.

8.5 HLW Pretreatment

Three HLW facilities are included under Pretreatment in the "Accelerating Cleanup: Focus 2006, Discussion Draft." They include the Extended Sludge Processing (ESP) Facility, the In-Tank Precipitation (ITP) Facility, and the Late Wash Facility.

8.5.1 Extended Sludge Processing (ESP)

The ESP facility uses steam and caustic to dissolve excess aluminum in sludge, which improves glass viscosity and reduces the total number of canisters to be produced; then washes the sludge with water to remove excess sodium, in order to make the sludge compatible with vitrification processing.

Production Capacity

The planning basis for the ESP facility has changed. Whereas the original facility flowsheet was based on using two tanks for co-washing while a third tank fed DWPF, one tank (Tank 42) will soon be redeployed as a feed staging tank for ITP. This precludes using a co-washing flowsheet. Therefore, the revised ESP flowsheet calls for Tanks 40 and 51 to alternate roles as processing and feed tanks. Both tanks will be retro-fitted with steam spargers to provide aluminum dissolution capability. Partial washing of sludge will occur in-situ. Then the partially washed sludges will be consolidated in either Tank 40 or 51 for final washing and blending just prior to starting feed to DWPF. Sludge batch preparation, from in-situ washing and aluminum dissolution through sludge consolidation and final wash and blending is still assumed to require 24 months to complete. Recent settling data from Tank 51 confirms this assumption.

Production Plan

The existing sludge currently in the HLW tanks and future sludge from Canyon operations have been divided into ten discreet sludge batches. Sludge Batches 1A, 1B and 2A have been modeled by CPES. Sludge Batches 2B-6B will be modeled through CPES prior to issuing System Plan, Revision 9. The composition of batches 2B-6B has changed since the last revision of this Plan, to accommodate several additional sources of sludge, including 2 wt% insoluble solids residing in saltcake; small tank heels that must be removed to meet anticipated tank closure requirements; and sludge from the new F-Canyon and H-Canyon forecasts. These additional sludge sources have necessarily increased the total number of canisters to be produced, bringing the current total to 5,978 canisters. For each of the ten batches, Appendix G.3 identifies: the source of the sludge in each batch, the volume of sludge from each source tank, the start date and duration of washing, the feed volume available to DWPF, the start and finish dates for feeding each batch to DWPF, canister yield, weight percent sodium, weight percent aluminum, and canister waste loading. Each batch is predicted to make an acceptable glass waste form.

Tank 51 is currently feeding Sludge Batch #1A to DWPF. At the completion of the final washwater decant and wt% solids adjustment, Sludge Batch #1A consisted of 491,000 gallons of washed sludge at 16.8 wt% total solids. Of this amount, 403,000 gallons were available to feed forward to DWPF for vitrification. (The Tank 51 heel is assumed to be 88,000 gallons 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. At the time of this Plan, approximately 138,000 gallons of sludge has been transferred to DWPF. Sludge Batch #1A is projected to last until 12/98.

The Tank 51 transfer pump will need to be lowered from its current elevation in order to make all of the 403,000 gallons available. This must be done in FY98, based on planned canister production rates.

A region of unslurried sludge was recently discovered in Tank 51 near the B4 riser. Process records indicate that the sludge may have consolidated prior to the final Tank 51 wash, in which case, this region of sludge may not be fully washed. WSRC is evaluating the tank to determine whether slurrying this sludge and mixing it with the rest of the tank would impact DWPF's Waste Acceptance Criteria for sodium in sludge. The slurry pump in the B4 riser, which is nearest the unslurried sludge, can only operate at low speed, and must be replaced.

Design and installation of aluminum dissolution equipment on Tank 51 is planned to start in July 2000, and be complete by November 2001, in order to support processing of Sludge Batch 2B, starting in December 2001.

Tank 42 currently contains 267,000 gallons of partially washed sludge. WSRC has determined that the Tank 42 sludge will need one more wash prior to consolidating it with the Tank 51 sludge. The additional wash will lower the sodium in the Tank 42 sludge, which will help to lower the total sodium in Sludge Batch #1B when Tank 42 is consolidated with Tank 51. This is expected to improve some aspects of DWPF sludge processing. Activities in support of the extra wash are already underway. In April, ~112,000 gallons of spent wash water was decanted from Tank 42 to Tank 43, and 210,000 gallons of fresh wash water was added to Tank 42. (Note: At the time of this Plan, further work on Tank 42 is on hold pending resolution of a PISA regarding possible hydrogen retention in settled sludge.)

Two of Tank 42's four slurry pumps are operating well, but problems with the other two slurry pumps must be resolved before sludge washing can begin. The slurry pump in riser G is drawing less amperage than expected for pumping sludge. The pump may be submerged in the sludge and 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 the pump into the liquid, operate it to check amperage, and then lower it in ten inch increments to resuspend the sludge. The slurry pump in riser H has already been raised into the liquid region and, after adjusting the variable speed drive, the pump seems to be operating well. It will also be lowered in ten inch increments. It is not known if the arrangement of the four pumps can fully suspend all of the sludge in Tank 42 even if all four pumps are operating at capacity.

Final washing and settling of the Tank 42 sludge is expected to take three months. At that time, approximately 170,000 gallons of spent wash water will be decanted. Representative sludge samples from Tank 42 and Tank 51 will be combined, vitrified, and analyzed to confirm that the glass product will meet established waste acceptance criteria. Then the Tank 42 sludge will be consolidated in Tank 51 for continued feed to DWPF. This will be the start of Sludge Batch 1B, which must be ready no later than January 1999. The sludge consolidation may actually be completed earlier pending development of this schedule.

This Plan assumes that all but 75,000 gallons of the Tank 42 inventory can be transferred to Tank 51. However, given the known cleaning radii of the Tank 42 slurry pumps, as much as 125,000 gallons of sludge could be left behind. If the Tank 42 heel exceeds the planned 75,000 gallons, Sludge Batch 1B will necessarily be smaller and will complete processing earlier. Sludge Batch 2A would need to be accelerated to maintain continuous feed to DWPF.

After the Tank 42 bulk sludge has been removed, other activities will begin to prepare Tank 42 for service as an ITP feed tank. Additional washing of the tank and sludge heel removal may be required. Old aluminum dissolution equipment will be removed.

Tank 40 currently houses 3 failed slurry pumps from Tank 51. A fourth pump from the Tank 51 B4 riser may be added. Procurement is complete for four quad-volute slurry pumps to prepare Tank 40 for sludge washing service. In FY99, the failed pumps must be removed and disposed, and the replacement pumps must be run in at TNX, installed and tested in order to support the start of Sludge Batch #2A processing in October 1999. Tank 40 already contains about 170,000 gallons of unwashed sludge and about 700,000 gallons of concentrated supernate. Sludge from Tank 8 will be washed in-situ and consolidated in Tank 40 in October 2000. Sludge Batch #2A must be ready to feed to DWPF in April 2001. Design and installation of aluminum dissolution equipment for Tank 40 will occur in FY03.

8.5.2 In-Tank Precipitation

The ITP facility uses chemical precipitation/adsorption and filtration to separate the supernate and dissolved salt streams into a low-volume, high radioactivity waste stream known as "precipitate," and a high-volume, low radioactivity waste stream known as "filtrate."

ITP Cycle 1 Batch 1

Processing of the first batch has been completed. Approximately 130,000 gallons of concentrated salt supernate from Tank 38 and 37,300 gallons of sodium tetraphenylborate were added to the 252,000 gallon heel of precipitate left in Tank 48 from the 1983 demonstration. Sufficient dilution water was added to bring the sodium molarity to 5.0. This material was filtered and concentrated to 154,000 gallons (about 3 wt % solids) thus producing 383,000 gallons of filtrate. The filter performance, stripper performance and Cs-137 decontamination factor met acceptance criteria.

Tests conducted after Batch 1 processing revealed benzene release into the Tank 48 vapor space that 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 post-Batch 1 testing indicates that chemical catalysts, high temperature, and other unknown factors caused the rapid decomposition of the soluble tetraphenylborate thus generating more benzene than expected.

Benzene releases during Batch 1 were observed to be low when the slurry pumps were not operating. Benzene release rates increased dramatically after Tank 48 was heated for testing, and after the pumps were down for several days or weeks and then restarted. This indicated that some sort of benzene retention phenomenon was occurring, which also was not expected. Laboratory testing indicates that small droplets of liquid benzene are being retained by tetraphenylborate solids.

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 which discussed 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. The Implementation Plan was transmitted to and accepted by the DNFSB.

ITP Flowsheet/Plant Configuration

Tank 48 will continue to be the reaction vessel, filter feed tank and precipitate sodium washing tank. Tank 49 will continue to be the storage and feed tank to Late Wash for sodium washed precipitate. The role of Tank 50 is changing. At the time of this Plan, Tank 50 continues to receive and store ETF evaporator concentrate for periodic transfers to Saltstone. Prior to the ITP Cycle 1 precipitate wash, Tank 50 will be deinventoried to Saltstone and prepared for its new role. A new Tank 50 Valve Box, currently under construction, will allow Tank 50 to collect and store the ITP spent wash water and the Late Wash spent wash water, and recycle these streams to Tank 48 for use as dilution water. In the future, the ETF concentrate will bypass Tank 50 and be transferred directly to Saltstone. Tank 22 is no longer in the ITP flowsheet.

Removing Tank 50 from its former service has the effect of close-coupling ITP filtrate production to Saltstone operation. ITP will generate ~600,000 gallons of filtrate over a 10 day period about 5 or 6 times per year. The filtrate will be transferred in individual 10,000 gallon batches to Saltstone every 5 hours during these 10 day periods. This schedule greatly exceeds Saltstone's current straight day shift capability. Saltstone is currently developing alternatives to reconfigure their manpower to provide the needed support. Shift realignment and use of overtime during these 10 day periods is one possible solution.

The above close-coupling is further complicated by ETF's need to send about four 1,200 gallon transfers each weekend to Saltstone. Each transfer must cool in the line to Saltstone for about 12 hours to meet the Saltstone Salt Solution Hold Tank temperature limit. One solution currently being evaluated is to install a small tank and pump system at ETF to collect and cool a week's production of evaporator concentrate and make transfers to Saltstone once per week. FY98 funding has been set aside to implement a solution to this problem.

The above plant configuration enables ITP to provide sodium washed precipitate feed to Late Wash that meets the historical flowsheet values for sodium 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 consistency thus making the precipitate easier to pump (see also Section 8.5.3). 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 112,000 gallons (the minimum level at which the Tank 49 slurry pumps can be operated at full speed) to a high of ~300,000 gallons. The objective of the 300,000 gallon 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. Special testing and sampling requirements for the first three batches after operations resume are expected to result in a 37 day batch duration. This will be followed by 27 days to de-inventory Tank 50. The precipitate will then be washed which is expected to take 41 days. The precipitate will be sampled and analyzed over a period of 22 days before transfer to Tank 49. Cycle 1 therefore takes 201 days. This cycle time is based on Saltstone employing a two shift operation during filtrate production and no interference from ETF transfers.

The batch duration for Cycles 2-3 is increased from 37 to 45 days because of interference with ETF transfers. No time is required to de-inventory Tank 50 to Saltstone since ITP filtrate will be transferred directly after Cycle 1. The 41 day wash and 22 day precipitate sample and analysis durations remain the same; thus, the cycle time for Cycle 2 is 198 days.

The cycle time after Cycle 3 is expected to improve to 176 days based on eliminating the need for the 22 day sample and analysis. This activity may still be performed, but it will not be on the critical path (e.g., it will be performed concurrently with the wash). This cycle time is used for the remainder of the Plan although the general consensus is that it can be improved. When actual data is available, ITP cycle time will be re-evaluated.

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 planned outage time is 30 days. Given the 176 day cycle time and the 30 day outage, ITP could complete 1.8 cycles per year. Each cycle will produce an average of about 140,000 gallons of 10 wt% solids precipitate. ITP is therefore thought to be capable of producing about 250,000 gallons of precipitate per year which can support DWPF production of about 250 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.

Production Plan and Schedule

The ITP Production Plan is shown in Appendix G.1. The next three ITP batches (Cycle 1, Batches 2-4) work off the wash water heel in Tank 49 that remains from the 1983 ITP Demonstration. This waste is blended with concentrated supernate from Tanks 25, 32 and 39. Batch size is planned to increase in 50,000 gallon increments from ~600,000 gallons for Cycle 1, Batch 2 to the flowsheet average of ~800,000 gallons. 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 is sorely needed.

ITP plans to process three batches (Cycle 1, Batches 2-4) followed by a wash starting 4/98. This is a schedule delay of approximately six months from that predicted in System Plan, Revision 7. The delay is attributable to emergent needs for additional testing, the inclusion of readiness reviews prior to resumption of operations, and shortfalls in FY97 and FY98 operating funds. Completion of Cycle 1, Batches 2-4 is expected to require a minimum of 201 days (3 batches at 37 days/batch, 27 days to empty Tank 50, 41 days to complete the wash, and 22 days to sample and analyze the washed precipitate prior to transferring it to Tank 49.) This will be followed by a 30 day outage. Cycle 2 will then start with batch times of 45 days/batch. One batch (Cycle 2, Batch 1) will be completed before the end of FY98. Cycle 2, Batches 2-3 will then be completed followed by a 41 day wash and 22 days for sample and analysis. Per this plan, a sufficient quantity of precipitate will be available in Tank 49 to sustain feed to Late Wash starting 8/99. Late Wash will not start up at that time due to funding constraints.

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 Cs-137. The feeds planned in Cycles 1-2 are expected to produce precipitate in Tank 49 at about 32 Ci/gal.

ITP production is planned until FY21. The amount of potassium in the waste drives the amount of precipitate produced. Historical essential materials purchase records were recently re-examined to derive the total quantity of potassium in the Tank Farms. Additional sources of potassium were identified in this review that were not accounted for previously, which increased the total known potassium in the Tank Farms from ~170,000 kg to ~200,000 kg. This should represent the sum total of potassium in the Tank Farms, since only small quantities of potassium are present in the Tank Farm's current influent streams. Given the current planning bases and assumptions, the precipitate processing schedule is in balance with the sludge processing schedule (see Appendices G.2 and G.3). If future saltcake and supernate waste sample analyses provide new information affecting precipitate production, planning bases will be adjusted as needed to keep the sludge and precipitate processing schedules in balance.

8.5.3 Late Wash

The function of the Late Wash facility is to reduce the nitrite concentration of precipitate feed from ITP Tank 49 from 0.15 M NO_2 to 0.01 M NO_2. The lower NO_2 concentration reduces the formation of organic compounds and ammonium nitrate in the DWPF melter off-gas system to safe and manageable levels.

Startup Schedule

Late Wash achieved its milestone to be Ready for Radioactive Operations February 28, 1997 per the original design. Late Wash Facility has completed water runs with the original design intact, and the Late Wash portion of the Approval For Acceptance has been submitted to DOE for approval. This will enable the DWPF/Late Wash project to be closed.

The higher than expected benzene generation at ITP and subsequent improved understanding of tetraphenylborate chemistry will impact the Late Wash design. Probable changes to the facility include new jumpers to facilitate pumping wash water and filter cleaning solutions directly to ITP Tank 50, and a chiller to maintain liquid temperatures below 45°C. Process Vessel Vent modifications may also be required. The Late Wash facility will essentially be dormant during FY98 due to funding constraints and also because ITP will not have the feed ready. Late Wash benzene modifications will be completed in FY99. Final facility testing, including Simulant Runs, will be completed and Radioactive Operations initiated in FY00.

Starting Feed

Under the proposed new ITP flowsheet, the ITP precipitate is expected to meet historical average feed specifications of 0.2M Na, 0.15M NO_2, and 10 wt% solids. The only property of the precipitate which may differ is shear stress. Under conditions of high cesium 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 less than 100 dynes/cm^2. Under the planned ITP flowsheet, the cesium content of the precipitate will be less than the assumed 39 Ci/gal, the residence time will be less than 2 years, and the precipitate volume will be less than 1 million gallons. 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/cm^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 and 91 hours with filter cleaning. The best estimate is that the crossflow filters will need to be cleaned after every third batch. Less cleaning may be required, particularly as precipitate absorbed dose is reduced; however, this conservative assumption is used until actual radioactive operating data is available. The batch size will be 4,200 gallons, of which 3,500 gallons is precipitate feed from Tank 49. Two Late Wash batches will eventually go into each melter feed tank which is expected to make 6.6 canisters. The utility of the Late Wash facility was designed to be 75%. Late Wash should therefore be capable producing 93 batches/year which would support production of 305 canisters/year. This is still highly theoretical, since Late Wash has yet to process one batch and interferences caused by upstream and downstream facilities are not considered (see below).

If planned canister production is 200 cans/year, then Late Wash will need to produce 62 batches/year, which is well below the theoretical capacity of 93 batches/year. This Plan assumes that Late Wash will be able to process at a rate of 62 batches/year starting FY00.

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 may become the rate limiting process in the HLW System. Current projections indicate that the maximum production rate Late Wash can consistently support is about 200 canisters per year. 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, $27 million is set aside in FY03-04 in the "Accelerating Cleanup: Focus 2006, Discussion Draft" for attainment enhancements at Late Wash and DWPF. This project would likely contain a second Late Wash filtrate hold tank.

8.6 Defense Waste Processing Facility (DWPF)

DWPF is currently in "sludge-only" Radioactive Operations. At the time of this Plan, DWPF has poured a total of 142 canisters (64 in FY96 and 78 in FY97, to date). This represents completion of approximately 2.7% of the total number of canisters to be produced over the life of the facility.

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, around the clock. Canister fill height was originally intended to be 91". At the 91" fill height, each canister contained 3,705 lbs of glass, and the design capacity of DWPF (i.e., 100% attainment) was calculated as follows:

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

Improvements in glass pour height monitoring technology and the desire to put more glass in each canister have enabled DWPF to increase the canister fill height. In recent radioactive operations, DWPF has succeeded in filling canisters to an average height of 96", which puts 4,000 lbs of glass in each canister. Therefore, while the glass processing rate remains the same at 228 lbs/hour, the maximum number of canisters that could be produced in a year becomes:

$$\frac{228 \text{ lbs glass}}{\text{hr}} \times \frac{\text{canister}}{4{,}000 \text{ lbs glass}} \times \frac{24 \text{ hr}}{\text{day}} \times \frac{365.25 \text{ day}}{\text{yr}} = 500 \frac{\text{canisters}}{\text{yr}}$$

Past System Plans calculated DWPF attainment using the 540 canisters per year basis. However, starting with this System Plan, DWPF attainment will be calculated using the 500 canister per year basis. This is consistent with actual plant production experience.

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)*(500) = 375 canisters/year. This value is referred to as 75% attainment.

Recent Operating Experience

Two events that occurred recently in DWPF impacted attainment this fiscal year.. In March, the **Slurry Mix Evaporator (SME) cooling coil** failed. Sixty eight jumpers had to be removed to access the SME coil. Inspection of the coil revealed high erosion areas on the elbow and a small section of pipe, the saddles, and lower support brackets. Repairs were made using a combination of special materials. Hastelloy was used to replace the base metal. Ultimet overlays were used to protect the Hastelloy, and Stellite 6 overlays were used to protect the welds. In addition, non-laminar flow paths had accelerated erosion of the back sides of the SME agitator blades. Corrective actions included removing the balance weights and compensating by building up the base metal with a Stellite-6 overlay. The Structural Integrity Baseline for the Sludge Receipt and Adjustment Tank (SRAT), SME and Melter Feed Tank (MFT) established by Startup Test FA-04 was reviewed in light of these findings, but no change in predicted life is expected.

Melter pouring problems also slowed production. The molten glass pour stream frequently wavered as it dropped from the melter pour spout through the bellows and into the canister below. This caused the glass to contact, cool and solidify on the inside surfaces of the bellows liner. This was commonly referred to as "wicking." After repeated instances of wicking, pouring was interrupted while the glass was remotely removed from the affected surfaces. A number of process variables (particularly waste chemistry) and operating parameters (particularly feed rate and melter to pour spout differential pressure control) were evaluated and adjusted. In addition, an SRTC-designed "insert" was installed inside the pour spout in May. The original intent of the insert was to prevent wicking by increasing the distance between the pour stream and the pour spout wall, and to decrease the distance the glass had to fall. However, the insert's greatest benefit may be providing a new "knife edge." The knife edge is the last surface that the molten glass contacts before it free falls through the bellows and into the canister. Apparently, glass pouring had eroded the original knife edge, leaving a ragged surface that caused the glass pour stream to waver. The fresh, sharp edge provided by the new insert allows the glass to flow smoothly and drop cleanly. DWPF successfully poured 11 canisters in the first 9 days after the insert was installed. Replacement inserts will be fabricated and installed as needed to support melter pouring.

Production Plan
DWPF will continue sludge-only processing until precipitate feed is available from ITP and Late Wash. At the time of this Plan, the ITP flowsheet remains under evaluation. This Plan assumes that ITP will resume processing in April 1998, with precipitate available to feed Late Wash in April 2000. Therefore, coupled operations with both sludge and precipitate feed to DWPF could begin in May 2000.

In the near term, the average attainment of DWPF, and therefore the HLW System, will be limited by Late Wash. As it is currently configured, the Late Wash facility is expected to limit DWPF attainment to ~40%, or ~200 canisters per year. However, funding has been set aside in "Accelerating Cleanup: Focus 2006, Discussion Draft" to improve Late Wash attainment rates. For more information, refer to Section 8.5.3.

Periodic melter replacement outages are expected to occur approximately every two years, and may last from 3-6 months. However, because of a Site Treatment Plan commitment to produce an average of 200 canisters per year (refer to Section 5.3 for more details), DWPF's annual production rate targets will not be decreased during years in which melter outages occur. Therefore, DWPF's instantaneous canister production rate must be increased to compensate for production downtime associated with a melter replacement outage.

Production will escalate as follows:

FY96	64 canisters (actual)
FY97	150 canisters (98 poured to date)
FY98-04	200 canisters per year
FY05	225 canisters
FY06-20	250 canisters per year

This represents a slight lengthening of the HLW Program relative to the previous DOE-SR Ten Year Plan (July 1996) and HLW System Plan, Revision 7. Those plans projected that DWPF production would peak at 300 canisters per year, starting in FY06, which would have allowed all HLW to be vitrified by FY18. However, the additional outyear funding required to achieve those production rates is no longer expected to be available. New outyear funding targets necessarily limit DWPF production to a maximum of 250 canisters per year, thus extending the HLW program until FY20. 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 Ten Year Plan Project "Waste Removal and Upgrade Projects."

The current planning basis indicates that all waste will be vitrified in approximately 5,978 canisters by 2021. 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. This Plan assumes that operating experience will improve waste processing performance, such that the program end date can be achieved by the end of 2020. New Canyon missions, such as reprocessing of Spent Nuclear Fuel or Foreign Research Reactor Fuel, and new DWPF missions, such as can-in-canister Plutonium disposal, are not included in this Plan. Therefore, the total number of canisters to be produced is subject to change as missions and processes evolve.

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.

Melter #1 is already installed. It began operating in June 1994, was used for DWPF startup testing, and is currently in radioactive service. At the time of this Plan, Melter #1 has already reached 150% of its nominal two-year life expectancy. Melter #1 will be allowed to remain in service as long as it operates normally.

Melter #2 is on site and construction modifications are complete. Activities are in progress to prepare for the outage, whenever it occurs. These include fabrication of the Melter #1 Storage Box, railroad car refurbishments, Failed Equipment Storage Vault modifications, and preparation of procedures. All supporting activities are expected to complete in June 1997.

The **Melter #3** vessel and frame and most major components are on site. Assembly began, but is currently on hold. The melter refractory has been installed, dried, and laid up inside the 105-P Reactor building. The subcontract for assembly of the pour spout is on hold; SRS now plans to do the final modifications in-house, based on lessons learned from Melter #1 pouring experience. All components are expected to be on-site by December 31, 1997. Overall lead time for a replacement melter project, from project inception through actual installation in the DWPF, is ~5 years.

Recycle Handling

As part of normal operations, DWPF generates an aqueous recycle waste stream which originates from three sources in the DWPF process: the primary (or back-up) Melter Off-Gas Condensate Tank, the Slurry Mix Evaporator Condensate Tank, and the Decon Waste Treatment Tank. These streams are collected in the Recycle Collection Tank for transfer to the Tank Farm.

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 glass 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 and the steam atomized scrubbers, use steam to cool and decontaminate the offgas before release to the Vitrification building exhaust system. Together, these components generate an aqueous waste stream which is collected in the primary (or back-up) MOGCT. Although the film coolers can be turned off while melter pouring is suspended, the steam atomized scrubbers operate all the time. Therefore, a portion of the recycle stream volume is generated at all times, regardless of waste processing rates.

During melter feeding and pouring, additional recycle volume is generated. The slurry feed into the melter is 45-55 wt% water, which flashes to steam upon entering the melter. This portion of the recycle stream is directly proportional to DWPF attainment rate; at higher attainment rates, feeding and pouring are increased, so recycle volume increases.

Slurry Mix Evaporator Condensate Tank (SMECT): The SMECT collects contaminated condensate from the Slurry Mix Evaporator (SME) condenser, the Sludge Receipt and Adjustment Tank (SRAT) 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 and the solids content of the feed streams. In general, at higher attainment rates, more recycle waste will be produced.

Decon Waste Treatment Tank (DWTT): Contaminated aqueous waste from equipment decontamination operations is collected in the DWTT. 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 variable, and depends upon the frequency of decontamination operations.

Recycle Collection Tank (RCT): The primary (and backup) MOGCT, the SMECT, and the DWPF Analytical Laboratory sample waste streams are pumped to the RCT, which has a working capacity of 8,200 gallons. DWPF has no other capacity to store the recycle stream.

Transfer to H-Tank Farm: To support DWPF production, daily recycle transfers to the Tank Farm must occur. The normal 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. After the RHLWE starts up, 50% of the DWPF recycle volume will be diverted to 2H, and 50% will be diverted to the RHLWE.

Recycle Forecast

DWPF Engineering has developed an algorithm for predicting recycle generation rate. This algorithm was recently evaluated against Radioactive Operations experience, and revised accordingly. The current algorithm for sludge-only radioactive operations is as follows:

$$\text{recycle gpm} = 2.15 + (M)(ATT) + (0.18)(n)$$

<u>where:</u>

recycle gpm = the rate of recycle generation, on a continuous basis, in gallons per minute
2.15 = minimum input to MOGCT
M = 6.62 for sludge-only feed
M = 8.07 for coupled feed
ATT = DWPF operating rate, expressed as a fractional attainment
0.18 = factor applied to equipment decon wastes
n = the calendar year minus 1996, up to a maximum value of 4

Note that even at zero attainment, recycle waste continues to be generated at a minimum rate of:
= 2.33 gpm
= 1,224,648 gallons per year

At the FY97 production rate of 30% attainment (150 canisters), the recycle forecast is:
= 4.32 gpm
= 2,286,000 gallons in FY97

At the FY98 production rate of 40% attainment (200 canisters), the recycle forecast is:
= 5.19 gpm
= 2,728,000 gallons in FY98

Organic Waste Storage Tank (OWST)
Washed precipitate transferred from Late Wash to DWPF contains cesium tetraphenylborate and potassium tetraphenylborate. DWPF uses a precipitate hydrolysis process to destroy the tetraphenylborate, because tetraphenylborate cannot be processed through the melter. The precipitate hydrolysis process yields a side stream nominally referred to as "benzene," although it also contains approximately 15% other aromatic organic compounds and very low levels of radioactivity. The benzene is then steam-stripped in the Precipitate Reactor (PR), further decontaminated in the Organic Evaporator (OE), sampled in the Organic Evaporator Condensate Tank (OECT), 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 south-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 reduces evaporation of the organic liquid. The roof begins to float when the tank inventory reaches approximately 13,800 gallons. 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 padded with nitrogen gas, and ventilated through a HEPA filter. 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 is approximately 10,000 gallons.

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 8.9.

Mercury Disposal
The sludge contains mercury, which must be removed prior to vitrification. Originally, the mercury was supposed 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. After a sufficient quantity of radioactive mercury has been recovered, samples will be collected and tested to verify which disposal options are technically feasible. 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 a disposition plan is finalized.

8.7 Glass Waste Storage
The canisters of vitrified HLW glass produced by DWPF are stored on-site in dedicated interim storage buildings called **Glass Waste Storage Buildings** (GWSBs). **GWSB#1** consists of a below-grade, seismically-qualified concrete vault which contains support frames for vertical storage of 2,286 canisters. The storage vault is equipped with forced ventilation cooling to remove radioactive decay heat from the canisters. A standard construction building encloses the operating area directly above the storage vault. A 5-foot thick concrete floor separates the storage vault from the operating area. The **Sheilded Canister Transporter (SCT)** moves one canister at time from the Vitrification Building to the Glass Waste Storage Building. It drives into the operating area, removes the shielding plug of a pre-selected storage location, lowers the canister into the storage vault, and replaces the shielding plug.

Of the 2,286 canister storage positions nominally available, 572 positions are currently unusable because the plugs are out of round relative to the floor liner. This poses the problem of potentially jamming a plug during removal or replacement. Of the 572, DWPF Engineering estimates that 450 plugs can be repaired, but the remaining 122 will be abandoned in place. In addition, 5 positions are occupied by test canisters strategically located to monitor for possible corrosion. This leaves GWSB#1 with a working capacity of 2,159 usable storage locations.

GWSB #1 is currently in Radioactive Operation. At the time of this Plan, GWSB#1 was storing 126 radioactive canisters. Given the DWPF canister production rates projected in the "Accelerating Cleanup: Focus 2006, Discussion Draft", GWSB#1 will reach capacity in FY06, as shown in Appendix G.5. (Note that this Plan does not address potential storage of 300 canisters from West Valley. For additional information on potential storage of West Valley canisters at SRS, refer to Section 6.4.)

The project to design and construct **Glass Waste Storage Building (GWSB) #2** will begin in FY02 and will be funded over a four year period. The project could be completed more quickly, but the four year period levelizes the funding requirement. GWSB #2 design will be similar to GWSB#1, but the capacity of GWSB#2 will be sized to accommodate the number of canisters that will be produced between FY06 and FY15.

A **Glass Waste Storage Building #2 Expansion Project** may be required in FY10-12, depending upon projections of total canister production and availability of the Federal Repository.

In accordance with the "Accelerating Cleanup: Focus 2006, Discussion Draft," this Plan assumes that the **Federal Repository** will be ready to receive canisters starting in FY15. Therefore, SRS plans to ship 500 canisters per year to the Federal Repository starting in FY15. DWPF canister production will continue through FY20 at the rate of 250 canisters per year. Additional storage capacity for the canisters produced between FY15 and FY20 need not be designed into GWSB#2, since shipment of older canisters to the Repository will free up storage space. SRS canister shipments to the Repository will be completed in FY26.

<u>*8.8 Effluent Treatment Facility (ETF)*</u>

The ETF treats the low level aqueous wastes from the F- and H-Canyons and the F- and H-Tank Farms, which used to be disposed to seepage basins. After treatment at ETF, the waste water is discharged to a permitted outfall at Upper Three Runs Creek.

Production Capacity: The ETF Facility includes process waste water collection tanks, treated water tanks, and basins to collect contaminated cooling water and storm water run-off. Treatment processes include pH adjustment, filtration, organic removal, reverse osmosis, mercury removal and ion exchange. Recent operating experience indicates that average through-put is approximately 110 gpm, with a peak rate of 170 gpm for short periods of time.

Production Plan: ETF plans to treat 18 million gallons of waste water in FY97. At the time of this Plan, the facility has already treated 14.7 million gallons, or 28% more than planned to date. The additional influent is largely due to accelerated processing of some materials in F-Canyon earlier this year.

The ETF process flowsheet has been impacted by benzene concerns in ITP. The ITP flowsheet changes to Tank 50 will eventually preclude ETF's use of Tank 50 to receive the **ETF evaporator concentrate.** In the near term, the destination of the concentrate will be determined by the status of the Tank 50 Valve Box installation and the status of Tank 50, as follows:

1) At the time of this Plan, ETF concentrate is being pumped directly to Tank 50.

2) There will be a brief period in valve box construction when the transfer line from ETF will be tied in to the Tank 50 Valve Box. During that time, the line from ETF to Tank 50 will be unavailable for concentrate transfers, so the concentrate will be pumped to Tank 43. (At the time of this Plan, prerequisite activities are underway, including preparing a waste compliance plan, obtaining approval from SCDHEC, conducting a jacket test of the transfer line from ETF to H-DB8, and successfully completing a trial run to demonstrate that the ETF concentrate can be pumped to Tank 43.)

3) Once the tie-in is complete, the ETF concentrate again will be transferred to Tank 50, this time via the new valve box. This will continue until shortly before ITP is ready to wash the Cycle 1 precipitate. By that time, ETF transfers into Tank 50 must stop so that Tank 50 can be deinventoried and prepared for ITP wash water service.

4) Ultimately, the ETF concentrate will be transferred via the Tank 50 valve box to Saltstone, bypassing Tank 50 itself. This is expected to be the final flow path for the ETF concentrate. For more information on the changes to Tank 50, refer to Section 8.5.2.

The **H-Area Retention Basin liner** will be repaired in FY98, pending availability of funding. This liner has been in service for 21 years, far in excess of its predicted 10 year life. A subcontractor will install a new liner over the old one. No facility downtime is anticipated during the liner repair work.

ETF Facility Operations and Maintenance personnel are involved in the startup testing of two new **groundwater remediation units** for the Environmental Restoration Division. Approximately 24 people will be required to operate and maintain the two facilities.

8.9 Saltstone Facility

The Saltstone Facility treats the ITP filtrate stream and the ETF concentrate stream (both with low levels of radioactivity) by mixing the wastes with cement, flyash and slag. The resulting grout is disposed by pumping it to engineered concrete vaults and allowing it to harden in place. The solidified waste form is known as saltstone.

Production Capacity: The Saltstone facility is currently staffed one ten-hour shift per day, four days per week. About seven hours each day are available for salt solution processing at a rate of up to 110 gpm. The other three hours each day are required for startup preparations in the morning and process shutdown 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 average ~23,100 gallons of salt solution processed per day or ~4,805,000 gallons of salt solution processed per year.

Since ITP began its CLFL outage, less feed has been available to Saltstone, so waste receipt and processing operations have been reduced to twice per month. The new ITP flowsheet, in which ITP filtrate bypasses Tank 50 and is sent directly to Saltstone, close-couples ITP filtrate production with Saltstone operations. During peak periods of ITP processing, ITP will produce more filtrate than Saltstone can process at its current operating rate. The Saltstone Facility will realign its shift schedule to support ITP production during those peak periods.

Attainment Modifications: Some facility modifications are proposed to support Saltstone's close-coupling with ITP. A grout delivery manifold and special valves may be added to enable Saltstone to pump grout into multiple vault cells simultaneously. Upgraded cameras may be installed in the vault cells to monitor pouring in progress.

Benzene Modifications: As a result of the benzene concerns in ITP, some modifications are planned for the Saltstone Facility. These modifications are expected to include nitrogen inerting systems for the Salt Solution Hold Tank (SSHT) and the Flush Water Receipt Tank (FWRT); a portable benzene analyzer for the SSHT; a gear box or variable speed drive for the SSHT agitator; a flow indicator of the SSHT ventilation system; and removal of the SSHT insulation. Operations will be required to monitor the SSHT ventilation flow indicator every 12 hours to ensure adequate ventilation is maintained. An administrative procedure will be implemented to maintain the SSHT level at less than 45,000 gallons. This combination of measures will ensure that the time to reach LFL in either tank is greater than one day, thereby providing personnel with sufficient time to respond with mitigating measures, rather than relying on installed, engineering equipment.

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 (refer to Appendix G.2).

Currently, construction of **Vault #1** is complete and the vault is in service. Vault #1 has 6 cells, three of which are now filled. Recent inspection of the RWPC revealed contamination on the surfaces of the roof girders. Much of the contamination has already been removed, but the remaining contamination must be fixed in place before the RWPC can be moved over the next cell. Therefore, grout filling in Vault #1 has been suspended pending completion of work on the RWPC.

Vault #4 grout filling is now in progress, in lieu of filling Vault #1. Eleven of Vault #4's twelve cells are available for grout disposal (one cell was filled in 1989 when 1100 Naval Fuels waste drums were disposed and grouted in place.) Construction of the Vault #4 permanent roof was completed in January 1997. 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; and the need to dispose of the RWPC as radioactive waste is eliminated.

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 SRS chooses to continue building this type of disposal unit. (See the Saltstone Vault Alternatives discussion below for more details.) However, to maximize budget efficiencies, this Plan assumes that 6-cell vaults will be used until such time as a better planning basis is available.

Saltstone Vault Alternatives: 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), has been identified as a potential area for improvement. The "Saltstone Vault Alternatives Study" identified grout disposal in a Z-Area landfill as a possible option. The subsequent "Pre-Conceptual Design Study for Z-Area Saltstone Waste Disposal Alternatives," dated October 1996, briefly described the design and construction of Geosynthetic Lined Waste Disposal Cells, which would be similar to municipal landfills. Based upon pre-conceptual design information, a cost comparison concluded that the landfill option could provide cost savings of up to $9M per 12-cell vault equivalent. However, feasibility studies of this option are on hold until the DOE Order 5820.2A requirement to conduct a Performance Assessment can be completed. Further design work will be done as funding is available.

8.10 Consolidated Incineration Facility (CIF)

The Consolidated Incineration Facility (CIF) treats and volume-reduces 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 reduces the waste volumes by approximately 90%, reduces the chemical toxicity of the wastes, converts the residual ash to an environmentally immobile form, and eliminates off-site shipments of incinerable wastes. CIF incinerates 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, see below) 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 off-gas system. Prior to storage or disposal, these two waste streams will be stabilized as required by Land Disposal Restriction (LDR) treatment standards. LDR-compliant ash and blowdown derived from the incineration of low-level radioactive waste or characteristic mixed waste currently is being disposed at SRS in the E-Area Vaults. Other more cost-effective options for treatment and disposal of CIF secondary wastes are also being investigated.

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 8.6). 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 conducted its Trial Burn from April 14-20, 1997. Radioactive Operations began on April 24, 1997, when the CIF initiated treatment of the M-Area Filter Paper Take Up Rolls.

Appendix A - Acronyms

ADS	Activity Data Sheet
AOP	Annual Operating Plan
BA	Budget Authority
BO	Budget Outlay
CAB	Citizen's Advisory Board
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
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	Environmental 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
LIMS	Laboratory Information Management System
LLW	Low Level Waste
NEPA	National Environmental Policy Act
NMS&S	Nuclear Materials Stabilization and Storage
NRC	Nuclear Regulatory Commission
ORR	Operational Readiness Review
PCCS	Product Composition Control System
PIMS	Process Information Management System
PISA	Potential Inadequacy in Safety Analysis
RBOF	Receiving Basin for Off-site Fuels
RCRA	Resource Conservation and Recovery Act
RHLWE	Replacement High Level Waste Evaporator
SAR	Safety Analysis Report
SCDHEC	South Carolina Department of Health and Environmental Control
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
WMS	Works Management System
WSRC	Westinghouse Savannah River Company

Appendix B - HLW System Priorities

1. Maintain operating facilities in a safe and production-ready condition:
   - 1a. Health and safety of workers and 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 (i.e., DNFSB 94-1)
   - 2a. Evaporator operations as necessary to receive Canyon waste

3. Comply with the FFA Waste Removal Plan and Schedule (i.e., empty all old-style tanks by 2028)

4. Comply with the Site Treatment Plan (i.e., maintain an average production of 200 canisters per year)
   - 4a. DWPF materials and analytical support as required to produce 200 canisters per year
   - 4b. DWPF attainment improvement initiatives as required to attain a production rate of 200 canisters per year
   - 4c. Continuous evaporator operation as necessary to volume reduce DWPF recycle
   - 4d. Waste removal for future sludge tanks as necessary to provide sludge feed to ESP
   - 4e. ESP operations to remove aluminum and wash sludge as necessary to provide sludge feed to DWPF
   - 4f. Salt removal as necessary to store saltcake and concentrated supernate resulting from evaporation of DWPF recycle and sludge washwater

5. Initiate DWPF coupled operations
   - 5a. ITP benzene modifications
   - 5b. Saltstone benzene modifications
   - 5c. ITP continuity of operations
   - 5d. Salt removal as necessary to provide ITP feed
   - 5e. Late Wash benzene modifications
   - 5f. DWPF Salt Cell benzene modifications
   - 5g. Late Wash operations
   - 5h. DWPF Salt Cell operations

6. Develop new technologies that have a strong potential to reduce cost

7. Accelerate operation of the HLW System and thereby reduce program duration and life cycle cost

8. Develop and implement tank and facility closure methods

9. Perform engineering, technical and planning activities that reduce programmatic risk

Appendix C - HLW Funding

Project #	Project Title	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06
SR-HL01	H-Tank Farm	90,751	81,080	74,298	76,548	81,457	84,243	86,636	88,867	91,778
SR-HL02	F-Tank Farm	48,796	47,062	47,523	48,003	51,474	53,234	54,747	56,157	57,996
SR-HL03	Waste Removal	23,432	44,769	35,374	38,026	40,844	43,029	46,616	76,663	77,518
SR-HL04	ITP/ESP	85,044	87,770	91,931	97,910	107,853	98,556	103,981	97,795	98,796
SR-HL05	Vitrification	125,968	159,811	160,588	170,899	177,082	191,338	196,795	182,817	200,927
SR-HL06	Glass Waste Storage	923	956	965	994	1025	13306	38913	46515	34580
SR-HL07	Effluent Treatment Facility	21,605	22,404	23,764	21,341	21,711	22,454	23,092	23,686	24,462
SR-HL08	Saltstone	9,335	11,523	21,518	21,515	22,654	27,206	25,508	22,386	26,005
SR-HL09	Tank Farm Safety Projects	7,941	15,783	9,700	11,200	10,445	0	0	0	0
	Total	413,795	471,158	465,661	486,436	514,545	533,366	576,288	594,886	612,062

Notes:
* FY98 based on SR allocation of the President's Budget
* FY99-06 based on SR allocation of funding guidance in "Accelerating Cleanup: Focus on 2006 - Discussion Draft"
* Escalation assumed to be 3% per year
* All SR Projects include Capital Equipment, General Plant Projects, Division and Site overhead
* H-Tank Farm includes RHLWE Line Item project
* Waste Removal includes all tank closure scope
* ITP/ESP includes ITP upgrade Line Item projects per Appendix D
* Vitrification includes replacement melters and Failed Equipment Storage Vault Line Item projects
* Glass Waste Storage includes GWSB #2 and GWSB #2 Expansion Line Item projects
* Saltstone includes future Saltstone Vault Line Item projects
* Tank Farm Safety Projects include the Tank Farm Safety Upgrades and Storm Water Upgrades Line Item projects and pre-project planning for future safety related projects
* Expenses for Late Wash and HLW System Modifications (benzene mods and attainment upgrades) are included in the Vitrification project from FY99-06. In FY98 only, Late Wash is included in ITP/ESP and HLW System Modifications are included in Waste Removal. This inconsistency will be fixed in the next revision of the Ten Year Plan.

Appendix C - HLW Funding

FY98 Funding Summary ($ K)

Programs	President's Budget	Incremental Work Packages	Needed Funding
High Level Waste	413,800	17,823	431,623
CIF	8,300	13,000	21,300
Solid Waste	26,189	12,000	38,189
LETF	21,686	0	21,686
DOE	1,480	0	1,480
EW-31 Total	**471,454**	**42,823**	**514,277**

High Level Waste & CIF Scope Included in the President's Budget

- o Tank Farms will be safely operated, and Tank Farm Safety Projects will support the necessary infrastructure maintenance for Tank Farm operations.
- o 3.2 million gallons of space gain will be recovered by evaporation
- o Effluent Treatment Facility will be operated to process Canyon and HLW Evaporator streams.
- o Waste Removal activities required to support future production of canisters (i.e., future sludge batch preparation) will continue.
- o 200 sludge canisters will be produced at DWPF.
- o RHLWE startup activities will be continued to support a 6/99 startup.
- o In-Tank Precipitation will resume operations and process a single batch of feed.
- o Saltstone will process the ITP filtrate.
- o CIF will be placed in standby.

High Level Waste & CIF Incremental Packages	$ K
1) CIF would resume operations by burning low level, hazardous and mixed combustible waste:	13,000
2) In-Tank Precipitation would complete 3 batches instead of just one:	4,175
3) Saltstone would process the additional ITP filtrate consistent with 2) above:	848
4) Prepare HLW System (upgrades at Late Wash and Salt Process Cell) to support Precipitate Operations in mid-FY99:	500
(Note: The President's Budget includes Line Item TEC funding of $3,800 K for waste removal, but the OPC funding is not available)	
5) Tank Farm and DWPF Deferred Capital Equipment Projects:	3,500
6) Complete modifications to improve overall HLW System attainment, including upgrades for laboratory, frit handling, etc.:	200
(Note: The President's Budget includes Line Item funding of $65 K for Waste Removal)	
7) Demonstrate Alternative Salt Waste Removal Methods:	1,000
8) Complete Conceptual Design and seek approval from DHEC on Alternative Saltstone Vaults:	400
9) Complete Waste Removal from Tank 19:	3,700
(Note: The President's Budget includes $25K for Waste Removal)	
10) Close Tank 19:	3,500
Total:	30,823

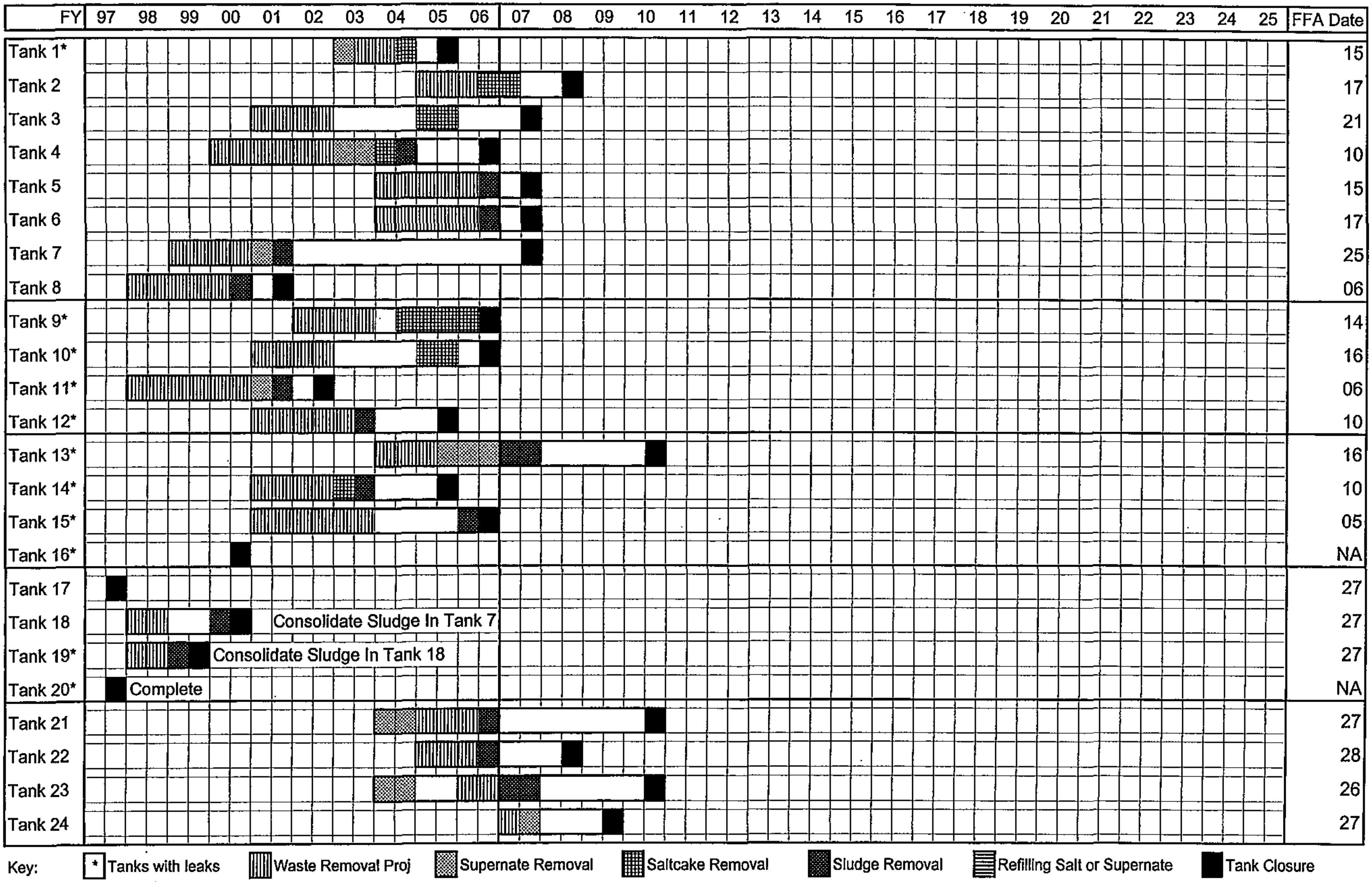
Appendix D - HLW Projects

New Start FY	Project Number	Project Title	TEC ($ x 1,000)	Project Notes
		Approved Projects		
79	S-2081	Waste Removal	305,520	(Tanks 1-24 & ESP)
82	S-1780	Defense Waste Processing Facility	1,276,470	
84	S-3781	In-Tank Precipitation	144,227	
87	S-2787	Consolidated Incinerator Facility	93,141	
87	S-3291	Type III Tanks Salt Removal, Phase I	48,429	(Tanks 25, 28, 29)
89	S-3420	DWPF Glass Melter #3	19,000	
89	S-2860	Type III Tanks Salt Removal, Phase II	106,445	(241-2H, Tanks 31, 47)
89	S-4062	Replacement High Level Waste Evaporator	118,200	
93	S-4516	Effluent Monitor Upgrades for Type III & IIIA Tanks	16,249	
93	S-3025	Waste Removal Facilities, Phase III	97,656	(Tanks 26, 30, 35-38)
96	S-6046	Melter #2	7,686	
96	S-4558	Tank Farm Services Upgrade	13,370	(Primarily H-Tank Farm)
98	S-4881	Tank Farm Storm Water Upgrades	8,934	
99	S-5785	Tank Farm Support Services, Phase II	22,073	
00	S-3898	Saltstone Vault #2	11,919	(6 cells)
00	S-2048	Failed Equipment Storage Vaults #3-6	5,140	
01	S-4397	Saltstone Vault #3	13,588	(6 cells)
03	S-2045	Glass Waste Storage Building #2	91,993	(~2,300 canister capacity)
		Planned Projects		
99	TBD	Late Wash Benzene Modifications	4,000	(future HLW System Attainment Upgrades Line Item)
00	TBD	Effluent Treatment Facility DCS Replacement	5,500	
00	W-5006	In-Tank Precipitation Upgrades	15,000	(future HLW System Attainment Upgrades Line Item)
00	W-6008	DWPF Infrastructure Upgrades	13,500	(DCS replacement)
03	TBD	DWPF Infrastructure Upgrades	27,463	(future HLW System Attainment Upgrades Line Item)
06	TBD	DWPF Infrastructure Upgrades	23,116	(future HLW System Attainment Upgrades Line Item)
10	TBD	DWPF Infrastructure Upgrades	26,018	(future HLW System Attainment Upgrades Line Item)
10	TBD	Glass Waste Storage Building #2 Expansion	36,720	(future HLW System Attainment Upgrades Line Item)
10	TBD	In-Tank Precipitation Upgrades	19,000	(future HLW System Attainment Upgrades Line Item)
11	TBD	Failed Equipment Storage Vaults #7-10	6,642	

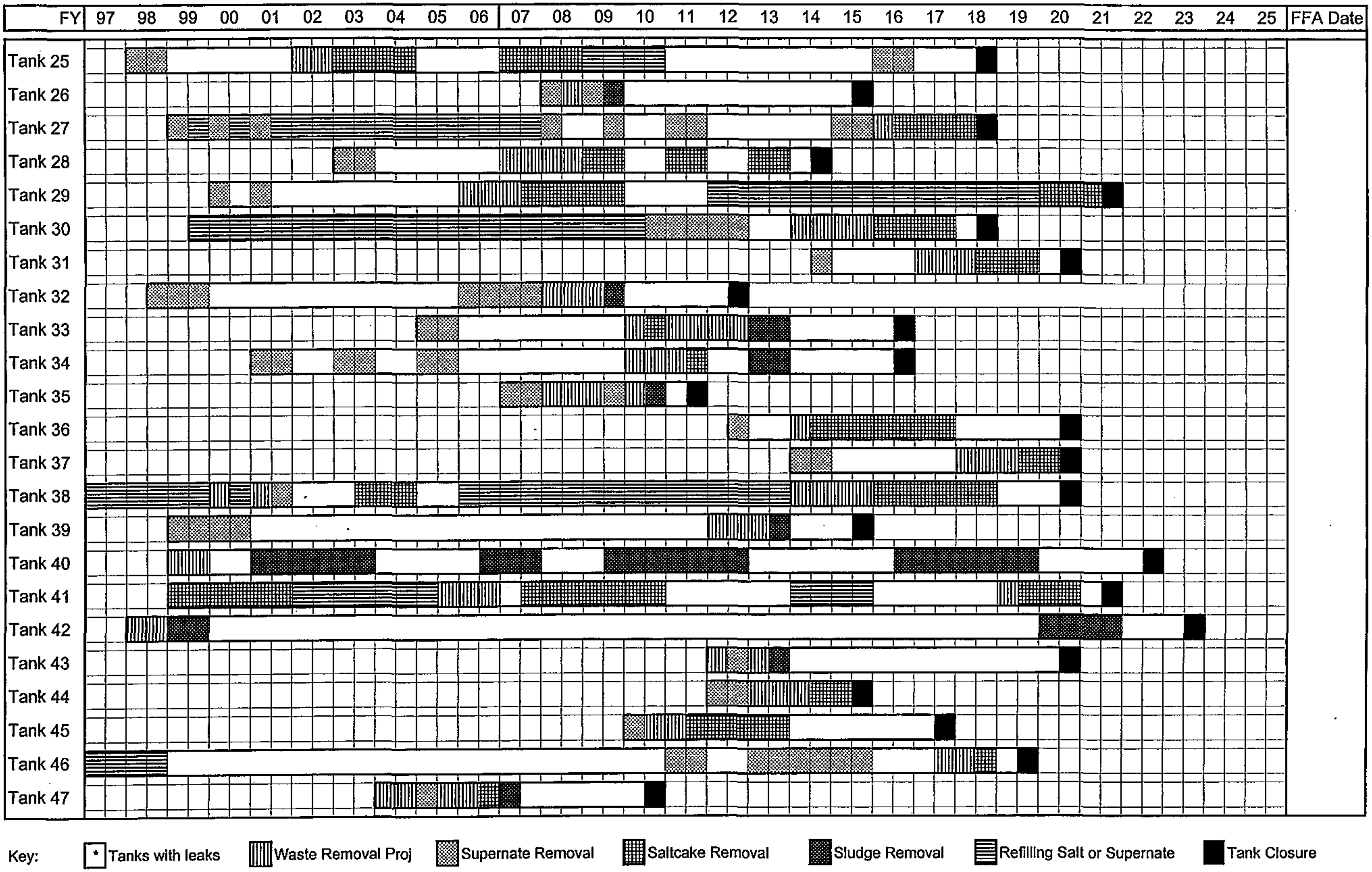
Appendix D - HLW Projects

Notes:
* Only projects with TEC greater than $5,000,000 are shown.
* Only projects that are currently open or planned are shown.
* Only the next two melter replacement projects are shown; others are included in the Appendix C funding table.
* Only the next two Saltstone Vault projects are shown; others are included in the Appendix C funding table.
* "Planned Projects" do not have detailed estimates or scopes; estimates shown are placeholders in the outyear budget.

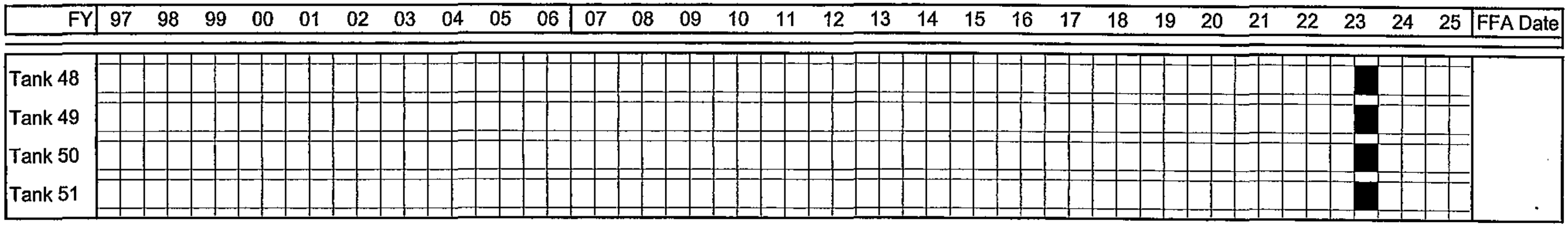
Appendix E - Waste Removal and Tank Closure Schedule



Appendix E - Waste Removal and Tank Closure Schedule

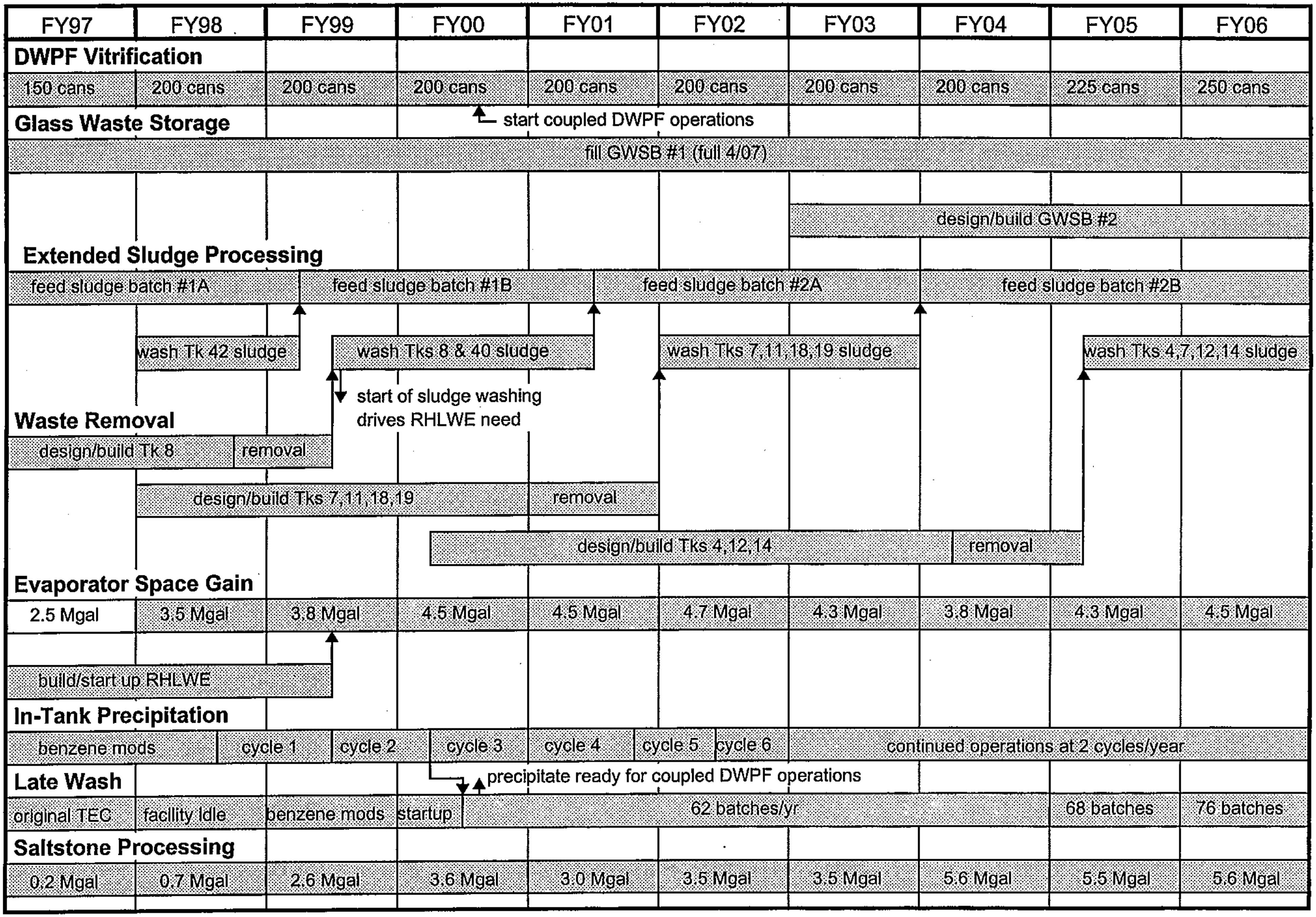


Appendix E - Waste Removal and Tank Closure Schedule



FY	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	FFA Date
# Tks Closed Each Year	2	0	1	2	1	1	0	0	3	4	3	3	2	4	1	0	1	2	3	2	1	3	1	5	2	1	5			
Cum Tks Closed	2	2	3	5	6	7	7	7	10	14	17	20	22	24	25	25	26	28	31	33	34	37	38	43	45	46	51			

Key: * Tanks with leaks | Waste Removal Proj | Supernate Removal | Saltcake Removal | Sludge Removal | Refilling Salt or Supernate | Tank Closure


FY97
FY98
FY99
FY00
FY01
FY02
FY03
FY04
FY05
FY06
DWPF Vitrification
150 cans
200 cans
200 cans
200 cans
200 cans
200 cans
200 cans
200 cans
225 cans
250 cans
start coupled DWPF operations
Glass Waste Storage
fill GWSB #1 (full 4/07)
design/build GWSB #2
Extended Sludge Processing
feed sludge batch #1A
feed sludge batch #1B
feed sludge batch #2A
feed sludge batch #2B
wash Tk 42 sludge
wash Tks 8 & 40 sludge
wash Tks 7,11,18,19 sludge
wash Tks 4,7,12,14 sludge
start of sludge washing
drives RHLWE need
Waste Removal
design/build Tk 8
removal
design/build Tks 7,11,18,19
removal
design/build Tks 4,12,14
removal
Evaporator Space Gain
2.5 Mgal
3.5 Mgal
3.8 Mgal
4.5 Mgal
4.5 Mgal
4.7 Mgal
4.3 Mgal
3.8 Mgal
4.3 Mgal
4.5 Mgal
build/start up RHLWE
In-Tank Precipitation
benzene mods
cycle 1
cycle 2
cycle 3
cycle 4
cycle 5
cycle 6
continued operations at 2 cycles/year
precipitate ready for coupled DWPF operations
Late Wash
original TEC
facility idle
benzene mods
startup
62 batches/yr
68 batches
76 batches
Saltstone Processing
0.2 Mgal
0.7 Mgal
2.6 Mgal
3.6 Mgal
3.0 Mgal
3.5 Mgal
3.5 Mgal
5.6 Mgal
5.5 Mgal
5.6 Mgal

Appendix G.1 - Tank Farm Material Balance Data

End of	Influents							Backlog		Effluents				Working	
Mo/Yr	F-LHW	F-HHW	H-LHW	H-HHW	DWPF	ESP	Tank WW	Tk	Volume	2F Evap	2H Evap	RHLWE	ITP	Inventory	Notes
May 5th														1,751,000	actual 5/5/97
BO May	25,000	7,000	0	0	123,000	0	0			22,720	110,700	0	0	1,729,420	calculated for bal. of May
Jun-97	6,000	500	0	267,500	189,000	0	0			4,615	170,100	0	0	1,441,135	267.5=34->39 xfer
Jul-97	23,000	500	0	0	189,000	0	0			16,685	170,100	0	0	1,415,420	
Aug-97	23,000	500	1,000	0	189,000	0	0			16,685	170,810	0	0	1,389,415	
Sep-97	23,000	500	5,000	0	189,000	0	0			16,685	173,650	0	0	1,362,250	
Oct-97	42,000	500	48,000	0	226,000	0	0			30,175	237,480	0	0	1,313,405	
Nov-97	23,000	500	48,000	0	226,000	0	0			16,685	237,480	0	0	1,270,070	
Dec-97	23,000	500	28,000	0	226,000	0	0			16,685	223,280	0	0	1,232,535	
Jan-98	23,000	500	28,000	0	226,000	0	0	35	351,000	265,895	223,280	0	0	1,444,210	Evap Tank 35 waste in 2F Eva
Feb-98	23,000	500	28,000	0	226,000	150,000	0			62,585	304,880	0	0	1,384,175	
Mar-98	23,000	500	23,000	0	226,000	0	0			16,685	219,730	0	0	1,348,090	
Apr-98	23,000	500	28,000	0	226,000	0	0			16,685	223,280	0	170,000	1,480,555	Tank 25-170 kgal to ITP
May-98	23,000	500	28,000	0	226,000	0	0			16,685	223,280	0	0	1,443,020	
Jun-98	23,000	500	24,000	0	226,000	0	0			16,685	220,440	0	0	1,406,645	
Jul-98	23,000	500	10,000	14,000	226,000	0	0	35	351,000	265,895	220,440	0	0	1,619,480	Evap Tank 35 waste in 2F Eva
Aug-98	23,000	500	10,000	14,000	226,000	0	0			16,685	220,440	0	0	1,583,105	
Sep-98	23,000	500	10,000	14,000	226,000	0	0			16,685	220,440	0	0	1,546,730	
FY98	295,000	6,000	313,000	42,000	2,712,000	150,000	0		702,000	758,030	2,774,450	0	170,000		
Oct-98	23,000	500	10,000	14,000	234,000	0	0			16,685	227,640	0	410,000	1,919,555	32-240,39-170 to ITP
Nov-98	23,000	500	10,000	14,000	234,000	0	0			16,685	227,640	0	420,000	2,302,380	32-210,39-210 to ITP
Dec-98	23,000	500	10,000	14,000	234,000	0	0			16,685	227,640	0	0	2,265,205	
Jan-99	23,000	500	10,000	14,000	234,000	0	0			16,685	227,640	0	0	2,228,030	
Feb-99	23,000	500	10,000	14,000	234,000	0	0			16,685	227,640	0	0	2,190,855	
Mar-99	23,000	500	10,000	14,000	234,000	0	0			16,685	227,640	0	0	2,153,680	
Apr-99	23,000	500	10,000	14,000	234,000	0	0			16,685	227,640	0	0	2,116,505	
May-99	23,000	500	10,000	14,000	259,000	0	0			16,685	250,140	0	0	2,076,830	
Jun-99	23,000	500	10,000	14,000	259,000	0	0	30	200,000	16,685	123,650	268,490	0	1,979,155	RHLWE startup
Jul-99	23,000	500	10,000	14,000	259,000	91,600	0	30	200,000	44,715	123,650	318,320	310,000	2,177,740	27-140,32-100,40-70 to ITP
Aug-99	23,000	500	10,000	14,000	259,000	91,600	0	30	200,000	44,715	123,650	318,320	385,000	2,451,325	32-60,39-200,40-125 to ITP
Sep-99	23,000	500	10,000	14,000	259,000	91,600	0	30	200,000	44,715	123,650	318,320	0	2,339,910	
FY99	276,000	6,000	120,000	168,000	2,933,000	274,800	0		800,000	284,309	2,338,220	1,223,451	1,525,000		

Appendix G.1 - Tank Farm Material Balance Data

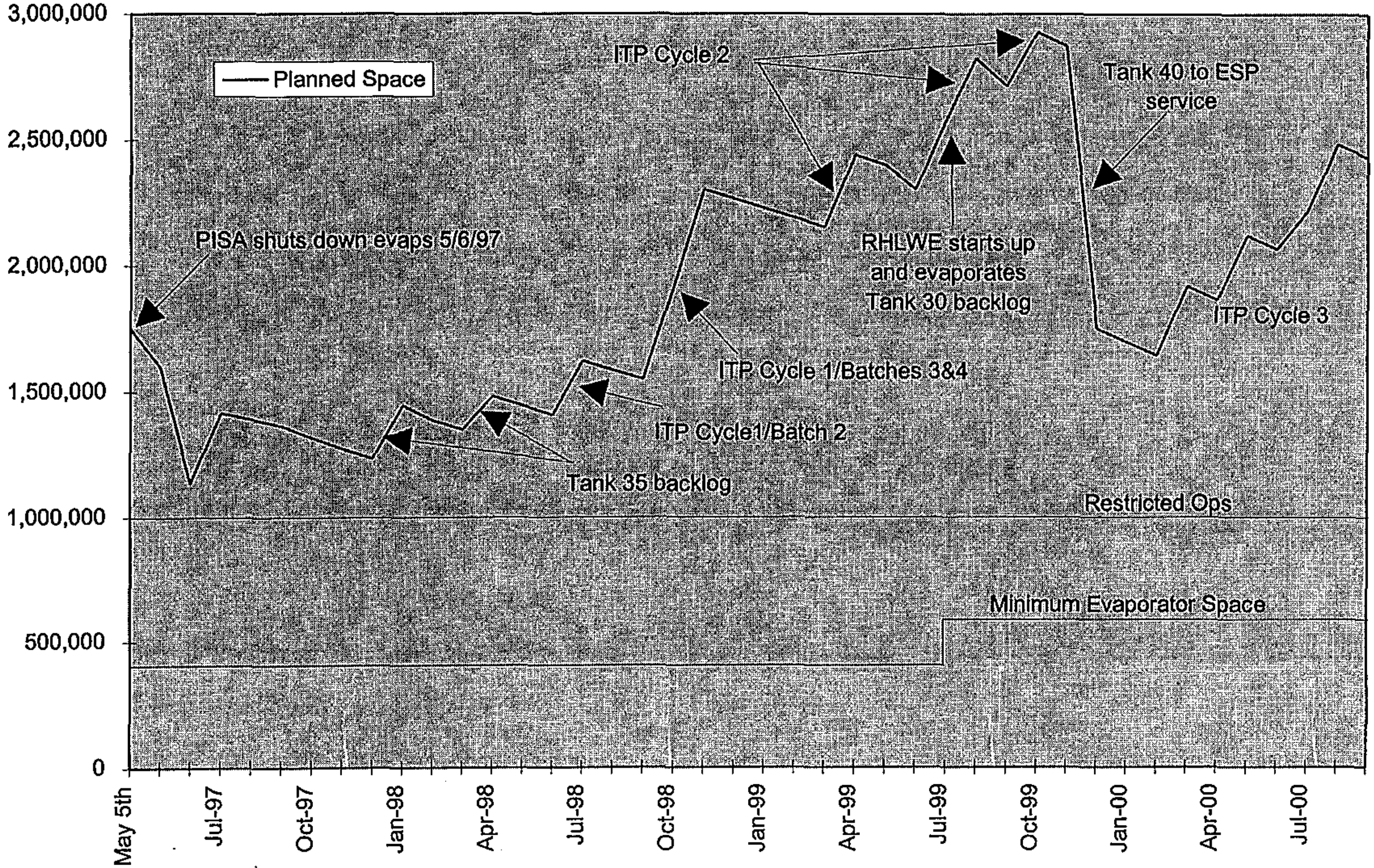
End of	Influents							Backlog		Effluents				Working	
Mo/Yr	F-LHW	F-HHW	H-LHW	H-HHW	DWPF	ESP	Tank WW	Tk	Volume	2F Evap	2H Evap	RHLWE	ITP	Inventory	Notes
Oct-99	23,000	500	10,000	14,000	264,000	91,600	0	30	300,000	44,715	125,900	391,570	375,000	2,573,995	39-200,40-175 to ITP
Nov-99	23,000	500	10,000	14,000	264,000	91,600	0		0	44,715	125,900	178,570	0	2,520,080	
Dec-99	23,000	500	10,000	14,000	264,000	91,600	0		0	44,715	125,900	178,570	0	1,395,165	T40 to ESP use -1,071 kgal
Jan-00	23,000	500	10,000	14,000	264,000	91,600	0		0	44,715	125,900	178,570	0	1,341,250	
Feb-00	23,000	500	10,000	14,000	264,000	91,600	0		0	44,715	125,900	178,570	0	1,287,335	
Mar-00	23,000	500	10,000	14,000	264,000	91,600	0		0	44,715	125,900	178,570	0	1,233,420	
Apr-00	23,000	500	10,000	14,000	264,000	91,600	0		0	44,715	125,900	178,570	357,000	1,536,505	27-75,39-150,40-100,41-32
May-00	23,000	500	10,000	14,000	264,000	91,600	0		0	44,715	125,900	178,570	339,000	1,821,590	39-150,40-125,41-64 to ITP
Jun-00	23,000	500	10,000	14,000	264,000	91,600	0		0	44,715	125,900	178,570	0	1,767,675	
Jul-00	23,000	500	10,300	15,000	264,000	91,600	140,000		0	111,215	126,113	245,780	267,000	1,973,383	40-200,41-67 to ITP
Aug-00	23,000	500	10,300	15,000	264,000	91,600	0		0	44,715	126,113	179,280	250,000	2,169,091	40-150,41-100 to ITP
Sep-00	23,000	500	10,300	15,000	264,000	91,600	0		0	44,715	126,113	179,280	0	2,114,799	
FY00	276,000	6,000	120,900	171,000	3,168,000	1,099,200	140,000		300,000	603,075	1,511,439	2,424,475	1,213,000		
FY01	276,000	6,000	57,900	45,000	3,163,000	274,800	140,000		0	350,809	1,464,459	1,671,291	813,000	2,451,658	
FY02	276,000	6,000	36,000	0	3,163,000	1,884,000	0		0	776,724	1,448,910	2,448,246	691,000	2,451,538	
FY03	91,500	6,000	36,000	0	3,163,000	1,632,000	0		0	568,617	1,448,910	2,311,158	1,218,000	3,069,723	
FY04	30,000	6,000	36,000	0	3,163,000	876,000	190,000		0	383,866	1,448,910	1,990,144	493,000	3,084,643	
FY05	30,000	6,000	36,000	0	3,375,000	828,000	570,000		0	549,678	1,544,310	2,239,932	639,000	3,212,563	
FY06	30,000	6,000	36,000	0	3,587,000	684,000	660,000		0	548,364	1,639,710	2,299,746	958,000	3,655,383	
FY07	30,000	6,000	36,000	0	3,587,000	768,000	420,000		0	460,068	1,639,710	2,231,442	1,172,000	4,311,603	
FY08	30,000	6,000	36,000	0	3,587,000	1,020,000	470,000		0	560,930	1,639,710	2,392,280	1,832,000	5,587,523	
FY09	30,000	6,000	36,000	0	3,587,000	510,000	330,000		0	338,370	1,639,710	2,048,340	1,831,000	6,945,943	
FY10	30,000	6,000	36,000	0	3,587,000	801,000	280,000		0	403,666	1,639,710	2,182,894	1,779,000	8,211,213	
FY11	30,000	6,000	36,000	0	3,587,000	1,068,000	0		0	352,368	1,639,710	2,195,142	1,694,000	9,365,433	
FY12	30,000	6,000	36,000	0	3,587,000	356,000	0		0	134,496	1,639,710	1,807,814	1,613,000	10,545,453	
FY13	30,000	6,000	36,000	0	3,587,000	345,000	0		0	131,130	1,639,710	1,801,830	2,270,000	12,384,123	
FY14	30,000	6,000	36,000	0	3,587,000	828,000	0		0	278,928	1,639,710	2,064,582	1,636,000	13,516,343	
FY15	30,000	6,000	36,000	0	3,587,000	552,000	0		0	194,472	1,639,710	1,914,438	1,474,000	14,527,963	
FY16	30,000	6,000	36,000	0	3,587,000	0	0		0	25,560	1,639,710	1,614,150	1,241,000	15,389,383	

Appendix G.1 - Tank Farm Material Balance Data

End of Mo/Yr	Influents F-LHW	Influents F-HHW	Influents H-LHW	Influents H-HHW	Influents DWPF	Influents ESP	Influents Tank WW	Backlog Tk	Backlog Volume	Effluents 2F Evap	Effluents 2H Evap	Effluents RHLWE	Effluents ITP	Working Inventory	Notes
FY17	30,000	6,000	36,000	0	3,587,000	0	0		0	25,560	1,639,710	1,614;150	1,167,000	16,176,803	
FY18	30,000	6,000	36,000	0	3,587,000	0	0		0	25,560	1,639,710	1,614,150	1,238,000	17,035,223	
FY19	30,000	6,000	36,000	0	3,587,000	0	0		0	25,560	1,639,710	1,614,150	605,000	17,260,643	
FY20	30,000	6,000	36,000	0	3,587,000	0	0		0	25,560	1,639,710	1,614,150	1,562,000	18,443,063	
FY21	30,000	6,000	36,000	0	3,587,000	0	0		0	25,560	1,639,710	1,614,150	1,154,000	19,217,483	

Notes:
* F-LHW and F-HHW volumes per NMS-ESE-97-0003, T. G. Campbell to N. R. Davis, F-Canyon Waste Generation Forecast, March 11, 1997.
* H-LHW and H-HHW volumes per NMP-EHA-97-0270, T. M. Fleck to M. C. Chandler, et. al., H-Canyon Waste Forecast for 1997 updated for June 1997, June 2, 1997.
and NMS-EHA-97-0033, T. M. Fleck to Distribution, H-Canyon Waste Generation Forecast, February 26, 1997.
* DWPF recycle volumes per OPS-DTD-96-0010, J. M. Gillam to M. N. Wells, DWPF Recycle Waste Generation, November 26, 1996.
* ESP washwater volumes per individual CPES runs for each batch of sludge per Alex Choi performed during June and July of 1997.
* Tank Washwater based on 140,000 gal for non-leaking tanks and 190,000 gal for tanks with a leakage history.
* Backlog waste is unevaporated H-HHW that has been stored due to the 1H Evaporator shutdown.
* Space Gain for the 2F, 2H and RHLWE Evaporators is based on the expected chemical properties of the influent streams and the allocation thereof to the three evaporators as explained in Section 8.2.2.
* ITP planning is based on specific plans for Cycles 1-3 (HLW-HLE-97-0046, G. A. Taylor to D. B. Amerine, Feed Stocks for Remainder of ITP Cycle 1, February 12, 1997) and ProdMod runs for the balance of the program by P. K. Paul during Sept 1997 (see Appendix G.2).
* Working Inventory consists of the empty space in Type III tanks excluding Tanks 48-51 (Tank 40 is also excluded after 10/99) based on 362" of operating volume for all tanks except Tanks 26 and 43 at 350".
* Data on salt formation due to evaporation and salt depletion due to feeding ITP available upon request.

Appendix G.1 - Working Inventory of Tank Space



Appendix G.2 - Salt Processing

Cycle/ Batch	Start Date	Duration (Days)	IN-TANK PRECIPITATION FACILITY: Source Tank	Waste Removed (Kgal)	Feed Type	Feed to ITP (Kgal)	10 wt% ppt in Tank 48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)	SALT SOLUTION PRODUCED: ITP Filtrate (Kgal)	ETF Conc (Kgal)	Total (Kgal)	SALTSTONE FACILITY: Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
FY96																
c1/b1	9/2/95	128	48	252	supr	252	105	10	0	0	345	63	408	722	2.91	2.50 cells filled at start
			38	130	supr	130										
					stpb	30										
			sg=	130	total:	412										
CLFL Outage	1/8/96	267					105	10	0	0	0	132	132	233	3.04	
FY97																
CLFL Outage	10/1/96	15					105	10	0	0	0	7	7	13	3.04	
PVT-1	10/16/96	60	48		heel	154	105	10	0	0	0	30	30	52	3.07	
					stpb	0.3										
			sg=	0	total	154										
CLFL Outage	12/15/96	290	---	---	---	---	105	10	0	0	0	143	143	253	3.21	
FY98																
CLFL Outage	10/1/97	196									0	97	97	171	3.31	
C1/B2	4/15/98	169	48		heel	105	144		0	0	489	83	572	1,013	3.88	
			25	170	supr	170										
			49	140	ww	140										
					iw	193										
					stpb	23										
			sg=	170	total	631										

Appendix G.2 - Salt Processing

IN-TANK PRECIPITATION FACILITY											SALT SOLUTION PRODUCED			SALTSTONE FACILITY		
Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to ITP (Kgal)	10 wt% ppt in Tank 48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)	ITP Filtrate (Kgal)	ETF Conc (Kgal)	Total (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
FY99																
C1/B3	10/1/98	37	48		heel	144	166		0	0	599	18	617	1,093	4.49	
			32	240	supr	240										
			39	170	supr	170										
					dw	196										
					stpb	13										
			sg=	410	total	763										
C1/B4	11/7/98	37	48		heel	166	190		0	0	614	18	632	1,119	5.12	
			32	210	supr	210										
			39	210	supr	210										
					dw	202										
					stpb	14										
			sg=	420	total	802										
Empty Tk 50	12/15/98	27					190		0	0		13	13	24	5.13	
wash	1/11/99	41					190		0	0		20	20	36	5.15	
sample	2/21/99	21					190		0	0		10	10	18	5.16	
xfer to Tk 49	3/14/99	1					100	24	0	100		0	0	1	5.16	
process outage	3/15/99	30					90		0	100		15	15	26	5.18	
$ outage	4/14/99	80					90		0	100		39	39	70	5.22	
C2/B1	7/3/99	45	48		heel	90	127		0	100	615	22	637	1,128	5.85	
			27	140	supr	140										
			32	100	supr	100										
			40	70	supr	70										
					dw	317										
					stpb	22										
			sg=	310	total	739										
C2/B2	8/17/99	45	48		heel	127	146		0	100	647	22	669	1,184	6.52	
			32	60	supr	60										
			39	200	supr	200										
			40	125	supr	125										
					dw	268										
					stpb	10										
			sg=	385	total	790										

Appendix G.2 - Salt Processing

Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to ITP (Kgal)	10 wt% ppt in Tank 48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)	ITP Filtrate (Kgal)	ETF Conc (Kgal)	Total (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
IN-TANK PRECIPITATION FACILITY											SALT SOLUTION PRODUCED			SALTSTONE FACILITY		
FY00																
C2/B3	10/1/99	45	48		heel	146	162		0	100	654	22	676	1,197	7.19	
			39	200	supr	200										
			40	175	supr	175										
					dw	284										
					stpb	9										
			sg=	375	total	814										
wash	11/15/99	41					162		0	100		20	20	36	7.21	
sample	12/26/99	21					162		0	100		10	10	18	7.22	
xfer to Tk 49	1/16/00	1					72	34	0	172		0	0	1	7.22	
process outage	1/17/00	30					90		0	172		15	15	26	7.23	
$ outage	2/16/00	48					90		0	172		24	24	42	7.26	
C3/B1	4/4/00	45	48		heel	90	123		0	172	704	22	726	1,285	7.98	
			27	75	supr	75										
			39	150	supr	150										
			40	100	supr	100										
			41	32	ds	85										
					dw	305										
					stpb	19										
			sg=	357	total	824										
C3/B2	5/19/00	45	48		heel	123	141		0	172	705	22	727	1,287	8.70	
			39	150	supr	150										
			40	125	supr	125										
			41	64	ds	160										
					dw	276										
					stpb	10										
			sg=	339	total	844										
C3/B3	7/3/00	45	48		heel	141	151		0	172	658	22	680	1,204	9.38	
			40	200	supr	200										
			41	67	ds	180										
					dw	280										
					stpb	5										
			sg=	267	total	806										
C3/B4	8/17/00	45	48		heel	151	163		0	172	704	22	726	1,285	10.10	
			40	150	supr	150										
			41	100	ds	270										
					dw	288										
					stpb	7										
			sg=	250	total	866										

Appendix G.2 - Salt Processing

IN-TANK PRECIPITATION FACILITY											SALT SOLUTION PRODUCED			SALTSTONE FACILITY		
Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to ITP (Kgal)	10 wt% ppt in Tank 48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)	ITP Filtrate (Kgal)	ETF Conc (Kgal)	Total (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
FY01																
wash	10/1/00	41					163		24	148		20	20	36	10.12	
sample	11/11/00	21					163		12	136		10	10	18	10.13	
xfer to Tk49	12/2/00	1					73	32	1	208		0	0	1	10.13	
process outage	12/3/00	30					90		17	191		15	15	26	10.14	
$ outage	1/2/01	38					90		22	169		19	19	33	10.16	
C4/B1	2/9/01	45	48		heel	90	124		26	143	724	22	746	1,321	10.90	
			27	45	supr	45										
			29	80	supr	80										
			41	100	ds	270										
					dw	341										
					stpb	20										
			sg=	225	total	846										
C4/B2	3/26/01	45	48		heel	124	145		26	117	697	22	719	1,273	11.62	
			11	100	supr	100										
			29	80	supr	80										
			41	74	ds	200										
					dw	324										
					stpb	12										
			sg=	154	total	840										
C4/B3	3/26/01	45	48		heel	145	177		26	91	669	22	691	1,223	12.30	
			34	75	supr	75										
			38	100	supr	100										
			41	74	ds	200										
					dw	305										
					stpb	19										
			sg=	249	total	844										
wash	5/10/01	41					177		24	67		20	20	36	12.32	
xfer to Tk49	6/20/01	1					87	24	1	153		0	0	1	12.32	
process outage	6/21/01	30					90		17	136		15	15	26	12.34	
$ outage	7/21/01	27					90		16	120		13	13	24	12.35	
C5/B1	8/17/01	45	48		heel	90	116		26	94	694	22	716	1,268	13.06	
			7	75	supr	75										
			38	111	supr	111										
			41	74	ds	200										
					dw	316										
					stpb	15										
			sg=	185	total	807										

Appendix G.2 - Salt Processing

IN-TANK PRECIPITATION FACILITY											SALT SOLUTION PRODUCED			SALTSTONE FACILITY		
Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to ITP (Kgal)	10 wt% ppt in Tank 48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)	ITP Filtrate (Kgal)	ETF Conc (Kgal)	Total (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
FY02																
C5/B2	10/1/01	45	48		heel	116	133		26	68	631	22	653	1,156	13.71	
			7	84	supr	84										
			29	50	supr	50										
			41	81	ds	220										
					dw	282										
					stpb	10										
			sg=	131	total	762										
C5/B3	11/15/01	45	48		heel	133	156		26	42	657	22	679	1,202	14.39	
			11	106	supr	106										
			27	45	supr	45										
			29	49	supr	49										
			41	44	ds	120										
					dw	344										
					stpb	14										
			sg=	138	total	811										
wash	12/30/01	41					156		24	18		20	20	36	14.41	
xfer to Tk 49	2/9/02	1					66	22	1	83		0	0	1	14.41	
process outage	2/10/02	30					90		17	66		15	15	26	14.42	
$ outage	3/12/02	0					90		0	66		0	0	0	14.42	
C6/B1	3/12/02	45	48		heel	90	115		26	40	701	22	723	1,280	15.14	
			25	74	ds	200										
			38	74	ds	200										
					dw	310										
					stpb	14										
			sg=	148		814										
C6/B2	4/26/02	45	48		heel	115	139		26	13	666	22	688	1,218	15.82	
			25	70	ds	190										
			38	70	ds	190										
					dw	294										
					stpb	14										
			sg=	141		803										
C6/B3	6/10/02	40	48		heel	139	161		23	-10	631	20	651	1,152	16.47	
			25	67	ds	180										
			38	67	ds	180										
					dw	279										
					stpb	13										
			sg=	133		791										
wash	7/20/02	41					161		24	-34		20	20	36	16.49	
xfer to Tk 49	8/30/02	1					71	13	1	37		0	0	1	16.49	
process outage	8/31/02	30					90		17	19		15	15	26	16.51	
$ outage	9/30/02	1					90		1	19		0	0	1	16.51	At 18.00 cells, start filling Vault #2.

Appendix G.2 - Salt Processing

IN-TANK PRECIPITATION FACILITY											SALT SOLUTION PRODUCED			SALTSTONE FACILITY		
Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to ITP (Kgal)	10 wt% ppt in Tank 48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)	ITP Filtrate (Kgal)	ETF Conc (Kgal)	Total (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
FY03	10/1/02	365	1	19	supr	19	221	10	212	67	5,419	180	5,599	9,910	22.07	
			4	100	supr	100										
			14	153	ds	412										
			25	481	ds	1,300										
			28	183	supr	183										
			34	100	supr	100										
			38	453	ds	1,224										
					dw	2,163										
					stpb	134										
			sg=	1,218	total	5,635										
FY04	10/1/03	366	1	470	ds	1,270	180	14	213	66	5,359	180	5,539	9,805	27.57	At 24.00 cells, start filling Vault #3.
			4	250	supr	250										
			4	33	ds	89										
			9	148	ds	400										
			21	119	supr	119										
			22	473	supr	473										
			25	160	ds	431										
			38	333	ds	900										
					dw	1,494										
					stpb	108										
			sg=	493	total	5,534										
FY05	10/1/04	365	3	525	ds	1,418	199	14	239	62	5,303	180	5,483	9,705	33.02	At 30.00 cells, start filling Vault #5.
			9	222	ds	600										
			10	209	ds	563										
			13	157	supr	157										
			33	365	supr	365										
			34	100	supr	100										
			47	105	supr	105										
			47	74	ds	200										
					dw	1,869										
					stpb	120										
			sg=	644	total	5,497										
FY06	10/1/05	365	2	185	ds	500	224	34	265	60	5,396	180	5,576	9,869	38.55	At 36.00 cells, start filling Vault #6.
			9	194	ds	523										
			13	500	supr	500										
			32	429	supr	429										
			47	529	ds	1427										
					dw	2,100										
					stpb	136										
			sg=	958	total	5,615										
FY07	10/1/06	365	2	340	ds	918	197	28	265	27	5,270	180	5,450	9,646	43.97	At 42.00 cells, start filling Vault #7.
			24	272	supr	272										
			25	370	ds	1000										
			29	148	ds	400										
			35	459	supr	459										
			41	195	ds	526										
					dw	1,769										
					stpb	119										
			sg=	1,172	total	5,463										

Appendix G.2 - Salt Processing

IN-TANK PRECIPITATION FACILITY											SALT SOLUTION PRODUCED			SALTSTONE FACILITY		
Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to ITP (Kgal)	10 wt% ppt in Tank 48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)	ITP Filtrate (Kgal)	ETF Conc (Kgal)	Total (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
FY08	10/1/07	366	25	74	ds	200	210	18	266	8	5,282	180	5,462	9,669	49.39	At 48.00 cells, start filling Vault #8.
			26	500	supr	500										
			27	295	supr	295										
			29	481	ds	1300										
			38	74	ds	200										
			41	407	ds	1,100										
					dw	2,164										
					stpb	127										
				1,832	total	5,886										
FY09	10/1/08	365	26	525	supr	525	203	25	265	-18	5,399	180	5,579	9,875	54.93	At 54.00 cells, start filling Vault #9.
			28	370	ds	1000										
			29	350	ds	946										
			35	400	supr	400										
			41	185	ds	500										
					dw	2,102										
					stpb	123										
			sg=	1,831	total	5,596										
FY10	10/1/09	365	30	487	supr	487	170	39	265	-83	5,289	180	5,469	9,680	60.37	At 60.00 cells, start filling Vault #10.
			33	222	ds	600										
			35	300	supr	300										
			41	696	ds	1879										
			45	74	ds	200										
					dw	1,885										
					stpb	102										
			sg=	1,779	total	5,453										
FY11	10/1/10	365	28	370	ds	1000	252	27	265	-51	5,287	180	5,467	9,676	65.80	
			30	350	supr	350										
			34	208	ds	561										
			45	133	supr	133										
			45	333	ds	900										
			46	300	supr	300										
					dw	2,135										
					stpb	153										
			sg=	1,694	total	5,532										
FY12	10/1/11	366	30	300	supr	300	200	26	266	-82	5,154	180	5,334	9,442	71.09	At 66.00 cells, start filling Vault #11.
			36	182	supr	182										
			38	407	ds	1,100										
			44	279	supr	279										
			45	444	ds	1,200										
					dw	2,167										
					stpb	121										
			sg=	1,613	total	5,349										
FY13	10/1/12	365	28	270	ds	730	265	13	265	-35	5,237	180	5,417	9,588	76.47	At 72.00 cells, start filling Vault #12.
			38	370	ds	1000										
			43	1,107	supr	1,107										
			45	222	ds	600										
			46	300	supr	300										
					dw	1,598										
					stpb	161										
			sg=	2,270	total	5,496										

Appendix G.2 - Salt Processing

IN-TANK PRECIPITATION FACILITY											SALT SOLUTION PRODUCED			SALTSTONE FACILITY		
Cycle/ Batch	Start Date	Duration (Days)	Source Tank	Waste Removed (Kgal)	Feed Type	Feed to ITP (Kgal)	10 wt% ppt in Tank 48 (Kgal)	Ppt Cs Conc (Ci/Gal)	Ppt Fed to Late Wash (Kgal)	Tank 49 Inventory (Kgal)	ITP Filtrate (Kgal)	ETF Conc (Kgal)	Total (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled (Each)	Notes:
FY14	10/1/13	365	31	245	supr	245	217	18	265	-45	5,110	180	5,290	9,363	81.73	At 78.00 cells, start filling Vault #13.
			36	222	ds	600										
			37	276	supr	276										
			38	111	ds	300										
			44	481	ds	1300										
			46	300	ds	300										
					dw	2,169										
					stpb	131										
			sg=	1,636	total	5,321										
FY15	10/1/14	365	27	200	supr	200	221	13	265	-50	5,320	180	5,500	9,735	87.19	At 84.00 cells, start filling Vault #14.
			36	222	ds	600										
			38	316	ds	853										
			44	487	ds	1316										
			46	248	supr	248										
					dw	2,185										
					stpb	134										
			sg=	1,474	total	5,536										
FY16	10/1/15	366	27	185	ds	500	143	14	266	-147	5,296	180	5,476	9,693	92.63	At 90.00 cells, start filling Vault #15.
			30	667	ds	1,800										
			36	389	supr	1,050										
					dw	1,998										
					stpb	85										
			sg=	1,241	total	5,433										
FY17	10/1/16	365	27	630	ds	1,700	187	9	265	-192	4,975	180	5,155	9,124	97.75	At 96.00 cells, start filling Vault #16.
			30	299	ds	808										
			36	239	ds	644										
					dw	1,892										
					stpb	113										
			sg=	1,167	total	5,157										
FY18	10/1/17	365	27	413	ds	1,114	187	7	265	-237	5,272	180	5,452	9,650	103.17	At 102.00 cells, start filling Vault #17.
			31	667	ds	1,800										
			46	159	ds	429										
					dw	1,998										
					stpb	113										
			sg=	1,238	total	5,454										
FY19	10/1/18	365	31	327	ds	883	127	7	265	-353	5,291	180	5,471	9,684	108.60	At 108.00 cells, start filling Vault #18.
			41	278	ds	750										
					dw	2,004										
					stpb	75										
			sg=	605	total	3,712										
FY20	10/1/19	366	29	370	ds	1,000	132	6	266	-463	5,355	180	5,535	9,798	114.10	At 114.00 cells, start filling Vault #19
			37	630	ds	1,700										
			41	562	ds	1,517										
					dw	2,012										
					stpb	78										
			sg=	1,662	total	6,307										
FY21	10/1/20	365	29	830	ds	2,242	93	8	265	-619	3,700	180	3,880	6,868	117.95	
			37	324	ds	874										
					dw	1,491										
					stpb	55										
			sg=	1,154	total	4,662										

Appendix G.3 - Sludge Processing

	Waste Removal		ESP Pretreatment						DWPF Vitrification						
Sludge Batch	Source Tanks	Volume (kgal)	Wash Start Date	Wash Duration (months)	Wash Wtr Volume (kgal)	Na (wt %)	Alum. Rem'd (wt %)	Volume After Pretreat (kgal)	Feed Volume (kgal)	Start Feed	Feed Duration (years)	Finish Feed	Feed Tank	Canister Yield	Waste Loading (wt %)[4]
1A [1]	17F	NA	NA	NA	NA	8.7	NA	491	491	Mar-96	2.90	Dec-98	51	466	27.3
	18F								-88 [2]						
	21H								403						
	22H														
	51H heel														
1B	15H	495	Jul-98	3	150	8.3	75	409	409	Jan-99	2.25	Mar-01	51	450	27.8
	17F								-75 [3]						
	18F								334						
	21H														
	22H														
	42H heel														
2A	8F	164	Jul-99	12	1,740	7.6	75	602	602	Apr-01	2.45	Sept-03	40	490	26.5
	40H	173	Oct-99	15					-88						
		337							514						
2B	7F	209	Oct-01	12	3,300	8.5	75	1,048	1,048	Oct-03	2.90	Dec-05	51	617	29.3
	11H	140	Dec-01	16											
	18F	42	Oct-01	12											
	19F	20	Oct-01	12											
		411													
3A [5]	4F	128	Jan-04	12	TBD [6]	TBD	TBD	128	380	Jan-06	1.65	Aug-07	40	413	TBD
	12H	215						108							
	14H	34						17							
		377						253							

Appendix G.3 - Sludge Processing

	Waste Removal		ESP Pretreatment						DWPF Vitrification						
Sludge Batch	Source Tanks	Volume (kgal)	Wash Start Date	Wash Duration (months)	Wash Wtr Volume (kgal)	Na (wt %)	Alum. Rem'd (wt %)	Volume After Pretreat (kgal)	Feed Volume (kgal)	Start Feed	Feed Duration (years)	Finish Feed	Feed Tank	Canister Yield	Waste Loading (wt %)[4]
3B	5F	34	Sept-05	12	TBD	TBD	TBD	34	434	Sept-07	1.88	Jul-09	51	471	TBD
	6F	25						25							
	15H	312						156							
	21H	14						14							
	22H	60						60							
		445						289							
4	13H	223	Aug-07	12	TBD	TBD	TBD	167	687	Aug-09	2.99	Jul-12	40	747	TBD
	23H	43						43							
	47F	248						248							
		514						458							
5	26F	328	Aug-10	12	TBD	TBD	TBD	328	834	Aug-12	3.63	Mar-16	51	907	TBD
	32H	176						176							
	35H	52						52							
		556						556							
6A	33F	77	Apr-14	12	TBD	TBD	TBD	77	777	Apr-16	3.38	Aug-19	40	845	TBD
	34F	25						25							
	39H	77						77							
	43H	251						251							
	40H heel	88						88							
		518						518							
6B	42H heel *	264	Sept-17	12	TBD	TBD	TBD	352	528	Sept-19	2.30	Dec-21	51	574	TBD
	51H heel	88													
		352											Total:	5,978	

Appendix G.3 - Sludge Processing

	Waste Removal		ESP Pretreatment						DWPF Vitrification						
Sludge Batch	Source Tanks	Volume (kgal)	Wash Start Date	Wash Duration (months)	Wash Wtr Volume (kgal)	Na (wt %)	Alum. Rem'd (wt %)	Volume After Pretreat (kgal)	Feed Volume (kgal)	Start Feed	Feed Duration (years)	Finish Feed	Feed Tank	Canister Yield	Waste Loading (wt %)[4]
* 42H heel	1F	10													
includes:	2F	11													
[7]	3F	11													
	9H	11													
	10H	4													
	25F	22													
	27F	9													
	28F	21													
	29H	20													
	31H	20													
	36H	22													
	37H	19													
	38H	16													
	41H	25													
	44F	20													
	45F	23													
		264													

Notes:

[1] For Sludge Batches 1A - 2B, process data are calculated by CPES analyses.

[2] 88 kgal are left behind in Tank 51 due to pump suction heel.

[3] 75 kgal are left behind in Tank 42 after consolidation with Tank 51.

[4] wt % sludge oxides in final glass waste form.

[5] For Sludge Batches 3A - 6B, process data are estimated as follows:

Feed Volume = Volume After Pretreatment x 1.5 (This reflects the 150% volume increase that occurs during first ESP wash.)

Start Feed date is one day after the Finish Feed date for the previous Sludge Batch.

Canister Yield = [Feed Volume (Kgal) x 1000 gal/Kgal)] / 920 gal sludge per canister.

Feed Duration = Canister Yield / 250 canisters per year.

Start Wash date is 24 months prior to the Start Feed date.

[6] TBD (To Be Determined) - All process data marked TBD will be calculated during the next CPES analyses.

[7] The Tank 42 heel is comprised of the ~2 wt% insoluble solids entrained in salt cake which will settle out in Tank 42, while Tank 42 is in service as an ITP feed tank.

[8] The amount of precipitate to be produced could exceed the precipitate demand for DWPF coupled operations by approx. 2 years, in FY23-24. (See also Appendix G.2). This Plan assumes that operating experience will improve waste processing performance, such that the projected excess precipitate can be eliminated over time.

[9] Sludge sources include bulk sludge in storage, 2 wt% sludge in salt cake, small sludge heels, and the current F-Canyon and H-Canyon waste forecasts.

Appendix G.4 - Canister Storage

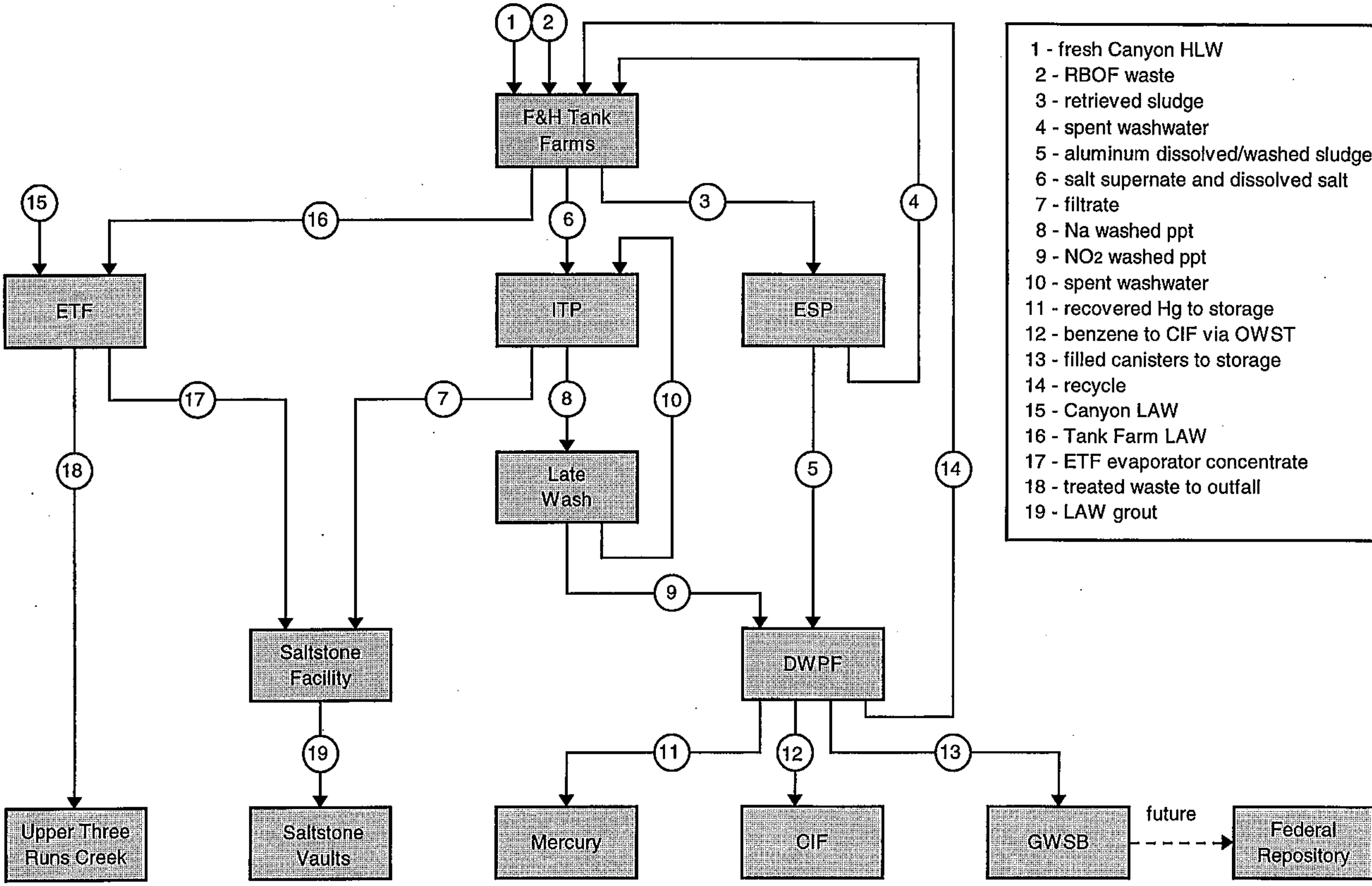
End of Year	SRS Cans Produced Each Year	Cumulative SRS Cans Produced	Cumulative SRS Cans In GWSB#1	Cumulative SRS Cans In GWSB#2	SRS Cans Shipped to Fed Repository Each Year	Cum SRS Cans Shipped to Fed Repository	Net Cans Stored at SRS Each Year
1996	64	64	64				64
1997	150	214	214				214
1998	200	414	414				414
1999	200	614	614				614
2000	200	814	814				814
2001	200	1,014	1,014				1,014
2002	200	1,214	1,214				1,214
2003	200	1,414	1,414				1,414
2004	200	1,614	1,614				1,614
2005	225	1,839	1,839				1,839
2006	250	2,089	2,089				2,089
2007	250	2,339	2,159	180			2,339
2008	250	2,589		430			2,589
2009	250	2,839		680			2,839
2010	250	3,089		930			3,089
2011	250	3,339		1,180			3,339
2012	250	3,589		1,430			3,589
2013	250	3,839		1,680			3,839
2014	250	4,089		1,930			4,089
2015	250	4,339		1,680	500	500	3,839
2016	250	4,589		1,430	500	1,000	3,589
2017	250	4,839		1,180	500	1,500	3,339
2018	250	5,089		930	500	2,000	3,089
2019	250	5,339		680	500	2,500	2,839
2020	250	5,589		430	500	3,000	2,589
2021	250	5,839		180	500	3,500	2,339
2022	139	5,978	1,978	0	500	4,000	1,978
2023			1,478		500	4,500	1,478
2024			978		500	5,000	978
2025			478		500	5,500	478
2026			0		478	5,978	0

Appendix G.4 - Canister Storage

Notes:

1) GWSB #1 filling began in April 1996. It has 2,286 canister storage locations, less 121 locations for which the plugs cannot be repaired, less 5 positions being used for storage of non-radioactive test canisters = 2,159 usable storage locations. However, of the 2,159, 450 locations are currently abandoned in place and will need replacement plugs before they will be available for use.
2) GWSB #1 is expected to reach maximum capacity in FY07. Therefore, GWSB#2 must be ready to start operations in FY07.
3) GWSB #2 maximum capacity should be sufficient to minimize close-coupling of DWPF canister production and Repository availability.
4) Per the "Accelerating Cleanup: Focus 2006, Discussion Draft," this Plan assumes that canisters can be transported to the Federal Repository at a rate of 500 per year, starting in 2015.
5) A canister load-out facility will be required to move the canisters from the GWSBs to a truck or rail car. Assume one year for design (FY12) and two years for construction (FY13-14).
6) GWSB #1 will be emptied and available for D&D in FY26.
7) GWSB #2 will be emptied and available for D&D in FY22.
8) This Plan does not include possible can-in-canister disposition of excess plutonium.
9) This Plan does not include possible storage of 300 West Valley canisters at SRS.

Appendix H - Simplified HLW System Flowsheet



1 - fresh Canyon HLW
2 - RBOF waste
3 - retrieved sludge
4 - spent washwater
5 - aluminum dissolved/washed sludge
6 - salt supernate and dissolved salt
7 - filtrate
8 - Na washed ppt
9 - NO_2 washed ppt
10 - spent washwater
11 - recovered Hg to storage
12 - benzene to CIF via OWST
13 - filled canisters to storage
14 - recycle
15 - Canyon LAW
16 - Tank Farm LAW
17 - ETF evaporator concentrate
18 - treated waste to outfall
19 - LAW grout

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