HLW-2001-00040
Revision A

Converting Waste to Glass

Savannah River Site High Level Waste System Plan

An Integrated System at the Savannah River Site

Revision 12

March 2001

HLW-2001-00040
Revision A

High Level Waste Division

High Level Waste System Plan Revision 12 (U)

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Errata

The original issue of this document had several minor inconsistencies. They were corrected for the final printing. Those consisted of:

- The "Curies in High Risk Tanks" chart on page 2 incorrectly depicted the year the curies would be removed. The chart was updated to precisely depict the removal of waste.
- Appendix J.9 had an error that inflated the sludge volumes by two million gallons. The chart was corrected.
- The Appendices dealing with Material Balance (Appendix H.3, I.3, J.3, and K.1) did not reflect proper October through December 2000 actual values. The data was corrected

Table of Contents

Appendices

Attachments


Saltstone Facility
DWPF Facility
H Tank Farm Facility

Executive Summary

The Savannah River Site (SRS) in South Carolina is a 300-square-mile Department of Energy (DOE) complex that has produced nuclear materials for national defense, research, and medical programs since it became operational in 1951. As a waste by-product of this production, there are approximately 37 million gallons of liquid, high-level radioactive waste currently stored on an interim basis in 49 underground waste storage tanks. Continued, long-term storage of these liquid, high-level wastes in underground tanks poses an environmental risk (ten of the SRS tanks have a waste leakage history). Therefore, the High Level Waste (HLW) Division at SRS has, since FY96, been removing waste from tanks; pre-treating it; vitrifying it; and pouring the vitrified waste into canisters for long-term disposal. From FY96 to the end of FY01, over 1,200 canisters of waste will have been vitrified. The canisters vitrified to date have all contained sludge waste. Salt waste processing was suspended in FY98 because the facility could not cost effectively meet both the safety and production requirements of the HLW System. DOE selection of an alternative salt processing technology is expected in FY01, with construction of a salt processing facility scheduled to be completed by FY10.

This HLW System Plan (hereinafter referred to as the Plan) documents the operating strategy of the HLW System at SRS to receive, store, treat, and dispose of high level waste.

This Executive Summary will:

- Compare scope and funding for the different production cases
- Review SRS's proven HLW track record
- Discuss key process issues facing the HLW system
- Recognize the newly issued DNFSB Recommendation 2001-1 (issued March 23, 2001).

Production Case Comparison

Three different production cases are described in this plan. The information from these cases has also been compared to the Target case of the previous HLW System Plan, Rev. 11. The three cases in Rev. 12 – Base, Stretch, and Super Stretch – represent the scope and funding (without projected savings incorporated) as specified in the FY01-FY06 contract extension between WSRC and DOE. Per this contract extension, the Base case is fully funded and represents minimum acceptable contractor performance. The Stretch and Super Stretch cases (which include scope above and beyond the Base case) can only be accomplished

- by finding ways to do the Base scope for less funding, then using those savings to fund this additional scope, or
- by obtaining additional congressional funding .

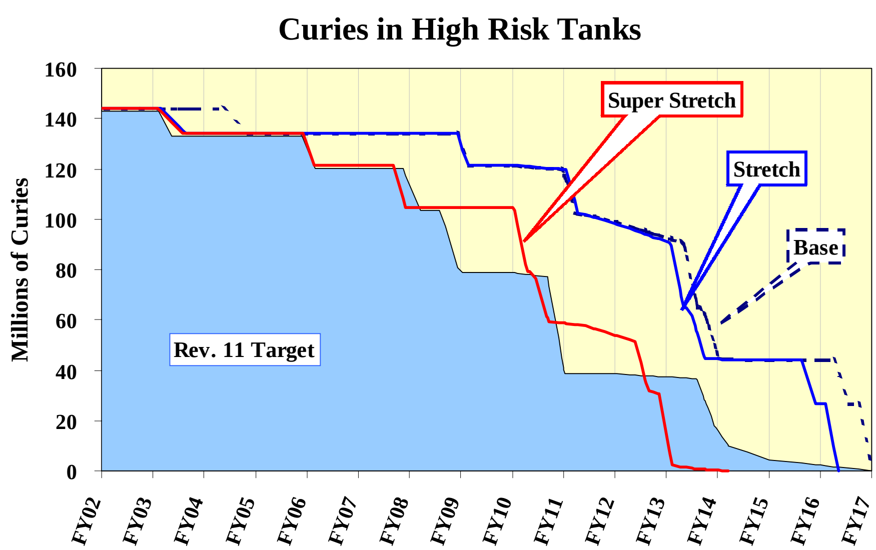
The table below summarizes key comparison data for these cases as compared to the Target Case in the last revision of the HLW System Plan. The HLW System performance and risk reduction is significantly improved as movement is made from the Base Case to the Super Stretch Case.

- Base Case:
  1. Provides the slowest risk reduction for waste removal from "high risk" tanks,
  2. Does not meet the FFA or STP regulatory commitments,
  3. Starts salt processing activities by mid 2010, and
  4. Processes an average of 200 canisters per year after salt processing becomes operational.
- Stretch Case:
  1. Provides acceptable risk reduction for waste removal from "high risk" tanks,
  2. Meets the Site Treatment Plan regulatory commitments,
  3. Meets final Federal Facility Agreement commitment, however, it fails to meet individual tank closure schedule,
  4. Starts salt processing activities by mid 2010, and
  5. Processes an average of 225 canisters per year after salt processing becomes operational.
- Super Stretch Case:
  1. Provides excellent risk reduction by expediting waste removal from "high risk" tanks,
  2. Meets all regulatory commitments,
  3. Starts salt processing activities by mid 2010, and
  4. Processes an average of 250 canisters per year after salt processing becomes operational.

In Revision 12, the Plan no longer assumes that aluminum dissolution will be completed on sludge batches. While this does increase the number of canisters produced by approximately 200 canisters, it does reduce the technical risk to the program. In the Stretch case, 300 more canisters are produced at DWPF by the end of FY06, however, the increased production rate translates into a three year feed break from FY07 through FY09 because the rate of feed preparation is not correspondingly increased. In the Super Stretch case, feed preparation is accelerated to avoid this feed break.

Comparison of Cases	Rev 11 Target	Base	Stretch	Super Stretch
Total Number of Canisters Produced	5,649	5,914	5,914	5,871
DWPF Sludge Production Rate:				
• FY01 to FY06	1,150	850	1,150	1,150
• FY07 to FY10	800	457	100	750
• FY11 to End of Program	225/yr.	200 / yr.	230 / yr.	250 / yr.
Date when all "High Risk" Tanks (Type I & II) are Emptied	FY16	FY16	FY16	FY14
Date when all "Non-Compliant" Tanks are Emptied	FY19	FY19	FY17	FY15
Date when all "Non-Compliant" Tanks are Closed	FY21	FY21	FY20	FY18
Date Salt Processing becomes Operational	FY10	FY10	FY10	FY10
Date by which Salt Processing is Completed	2023	2024	2022	2022
Date by which Sludge Processing is Completed	2022	2029	2027	2023
Are the Site Treatment Plan Regulatory Commitments met?	Yes	No	Yes	Yes
Are the Federal Facilities Plan Regulatory Commitments met?	Yes	No	No	Yes
Life Cycle Costs in escalated dollars ($ in billions)	$17.3	$20.8	$19.2	$17.6
Life Cycle Costs in constant dollars (99$ in billions)	$12.1	$13.6	$12.9	$12.3

Super Stretch Case Minimizes the Environmental Risks of Continuing to Store HLW in "High Risk" Tanks



In the Base and Stretch Cases, waste is removed from all the Type I and II "high-risk" tanks by FY16. However, in the Super Stretch Case, this waste is removed 2 years earlier. The Type I and Type II tanks are described as being "high risk" because they do not meet current secondary containment and leak detection standards, sit near or at the water table, and together store 6.4 million gallons of waste and 146 million curies of radioactivity. (NOTE: This is down from 152 million curies due to sludge removal from Tank 8 in early FY01.) Removing waste from these tanks as soon as possible is important, given the environmental risks posed by continuing to store HLW in these aging tanks.

The age and condition of the 16 Type I and II waste storage tanks at SRS is of increasing concern. They were placed in service between 1954 and 1964. Over the years, ten of these tanks have leaked waste from the primary tank into the secondary containment (annulus pan). In one case, some waste leaked from the secondary containment into the environment. In early FY01, some small, previously undiscovered leak sites were found in Tank 6. Approximately 90 gallons of low curie content waste leaked into the secondary containment (annulus pan). Tank 6 is now stabilized (not leaking), the waste in the annulus is drying, and it is being maintained under an enhanced monitoring program.

Tank Annulus showing High Level Waste that has leaked from the Primary Tank in the past and has solidified

In order to reduce the overall risk to the environment, however, we must continue to use some of these older tanks for the temporary storage of low curie content waste to permit continued preparation of feed for and operation of DWPF. This allows DWPF to continue immobilization of high curie content waste, thereby reducing overall risk.

Only the Super Stretch Case fully Meets all Regulatory Commitments

There are two primary regulatory drivers for waste removal: the Site Treatment Plan (STP) and the Federal Facilities Agreement (FFA).

- The STP requires that the processing of all high-level waste (both existing and future) be completed by FY28. The Stretch and Super Stretch cases both meet all of the STP requirements. The Base Case does not meet the STP since processing of sludge waste will continue into FY29.
- The FFA requires that the 22 non-compliant tanks be emptied and closed on an approved tank-by-tank schedule. While all three cases complete the closure of all 22 non-compliant tanks prior to 2022, only the Super Stretch Case fully meets the requirements on a tank by tank schedule. In both the Base and Stretch Cases, there are five years (2010 through 2014) when the number of closed tanks falls behind required number in the FFA. The number of tanks behind schedule ranges between 1-3 tanks in these years. However, in Stretch and Base Cases all FFA tanks are closed by 2020 and 2021 respectively, one to two years ahead of the overall schedule of 2022.

The Super Stretch case fully meets the regulatory commitments, the Stretch Case comes close to meeting the regulatory commitments and the Base Case does not meet the regulatory commitments.

All Cases fund the Salt Processing Project on schedule for a FY10 Startup

All three cases assume that the Salt Processing facility will be in operation by mid FY10. Since all parts of the waste removal process at SRS are operational except the salt processing plant, it is critical that focus and funding levels be maintained.

Small Incremental Funding Levels Significantly improves Performance and Lowers Life Cycle Costs

On average the difference in funding levels required to accomplish the Super Stretch case over the Base Case is an approximate 6% increase in up front dollars in the FY02 – FY06 timeframe. The table below summaries the funding requirements for each case and highlights the incremental funding needs between the Base Case and the Super Stretch Case for each year.

Case	Funding Levels in Millions of Dollars (Escalated Dollars)					
	FY02	FY03	FY04	FY05	FY06	Cumulative
Base	427	495	556	587	585	2,651
Stretch	433	491	571	599	589	2,683
Super Stretch	437	499	585	620	630	2,771
Incremental Funding (Base to Super Stretch)	11	4	28	32	45	120

High Level Waste Program a Proven Success

The High Level Waste System at SRS has been successful over the last several years as it has transitioned from a safe storage operation to a waste removal and canister production operation. During the same time period, substantial cost reductions have been identified and incorporated into the program.

DWPF Production Successes

The number of canisters filled at DWPF has exceeded the goal each year since startup in FY96:

- FY96 64 canisters filled (goal was 60)
- FY97 169 canisters filled (goal was 150)
- FY98 250 canisters filled (goal was 200)
- FY99 236 canisters filled (goal was 200)
- FY00 231 canisters filled (goal was 200)

First HLW Tank Closures in the DOE Complex

SRS met the challenge of emptying and closing the first two high-level waste tanks in the DOE complex. This required the site to:

- Work effectively with regulators, the public and industry to reach agreement on the closure method
- Develop closure plans and criteria based on waste characterization, analysis and modeling
- Design, build, test and deploy new technology and tools to remove waste from the tanks
- Remove residual waste material from the tanks
- Isolate and the tanks from operating Tank Farm processes
- Fill the tanks with a cement-like grout to complete closure

Maximizing Accomplishments while Focusing on Cost Reductions

The estimated costs for the High Level Waste Program at SRS have been reduced significantly over the last several years. Prior cost reductions have accomplished more than a 35 % reduction in overall cost to accomplish the program.

Benchmarking results confirm Competitive Position and Well-run Condition

In early FY00, DOE commissioned the Logistics Management Institute, Inc. (LMI) to conduct a site-wide cost effectiveness review of SRS. LMI conducted several External Independent Reviews (EIRs) across the site, one of which focused on DWPF. LMI stated the following:

> *"…the DWPF has continued to increase production in an environment of declining budgets. …the team observed no significant opportunities for cost savings or reductions within the DWPF budget at this time."*
>
> *"The EIR team believes the organization and management of DWPF is a model that might be applicable for comparable operations at other DOE sites."*

Continuing Drive for Cost Efficiencies

The cost reductions that have been completed place the HLW Program in an extremely cost competitive position, however, this program will continue its strong drive for cost efficiencies. It will be critical to find additional cost savings to allow the execution of the Stretch Case scope, since it is expected that funding will only be provided to accomplish the scope in the Base Case. Some of the areas where continued cost improvements will be expected are: consolidation and streamlining of support organizations, simplification of Authorization Basis controls, implementation of Tank Focus area improvements and waste removal technology improvements.

Key Process Issues

Work is currently underway to address several key process issues that have significant impacts on HLW's ability to implement the HLW System Plan. A more detailed explanation of these issues is contained in Sections 7 and 8.

Tank Farm Usable Tank Storage Space

The amount of usable tank storage space in the Tank Farms continues to decrease. This is a result of:

- On-going receipts of Canyon wastes and DWPF recycle
- The continued generation of ESP wash water from the preparation of feed for DWPF
- Significant reduction in ability to evaporate waste
  - 2H Evaporator has been shut down since January 2000 due to a problem with unexpected solids build up. Resolution of this issue including the cleaning of the 2H Evaporator and its return to service in August 2001.
  - 3H Evaporator has been restricted to very limited operations since November 2000 due to failure of the cooling coils in the drop tank (Tank 30). This limited operation will continue until FY03 when modifications are completed to use Tank 37 as the primary drop tank.

Even when all evaporators are back in full operation, the lack of usable tank storage is not expected to ease significantly until the startup of Salt Processing in FY10. The non-compliant Type I, II and IV tanks (Tanks 1-24) are excluded from the calculation of "usable tank space" since they do not meet current requirements for secondary containment and leak detection. However, as an interim measure, some of these older tanks are being used for the storage of low curie content waste.

Due to the urgency of space management, a HLW Space Management Team (Space Team) was chartered to recommend space gain initiatives. The Space Team issued a final report in August 1999. Since that time additional space management initiatives have been developed. The current group of space management initiatives that will be required to provide adequate space until the Salt Processing Facility becomes operational in FY10 is listed below:

- Continue to evaporate liquid waste, including the backlog of liquid waste that is waiting to be fully concentrated.
- Continue to use Tank 21-24 and some of the Type I Tanks as interim storage for low curie content waste.
- Return Tank 49 to High Level Waste Service, previously used as a salt processing tank
- Return Tank 50 to High Level Waste Service, previously used as a salt processing tank (manage ETF bottoms without the use of Tank 50 as a temporary storage location)
- Reduce the DWPF Recycle Stream sent to the Tank Farm.
- Retrofit 3 additional tanks as concentrate receipt tanks (Tanks 27, 37 & 42)
- Process Tank 26 sludge prior to FY10 to provide additional space
- Implement the small volume gain ideas to achieve small incremental storage volumes.
- Reduce the minimum Contingency Transfer Space (presently set at 2,600 kgal for the F & H Tank Farms) to the Authorization Basis (AB) minimum requirement of 1,300 kgal.

Uncertainties in Tank Space Assumptions

The Tank Farm space management strategy is based on a set of key assumptions involving canister production rates, influent stream volumes, Tank Farm evaporator performance, and space gain initiative implementation. Significant changes in any of these key assumptions will impact HLW's ability to successfully support planned processing commitments due to a lack of Tank Farm waste storage space.

For example, the different DWPF canister production rates for the Base Case and Super Stretch Case result in the implementation of different Tank Farm space management strategies. This is because the yearly forecast DWPF recycle streams will be less for the Base Case than it is for the Super Stretch Case. In addition, the timing of ESP sludge preparation batches and the resulting washwater decants to the Tank Farm will be different. Therefore, the timing and need for the space gain initiatives is different for the three cases.

The impact on Tank Space from changes in Canyon waste forecasts involving existing missions or from potential new Canyon missions must be continually assessed. The Canyon forecasts have changed significantly over the past two years as planned processing campaigns are better defined. NMS&S will continue to refine their waste stream forecasts based on processing experience gained over the next few years. To ensure clear and timely communications, weekly interface meetings continue between HLW and NMS&S.

Due to the uncertainties in key Tank Farm space assumptions, the space management strategy must be continually evaluated. This is necessary to balance limited resources between the risk reduction gained from removing waste from tanks and the implementation of space gain initiatives required to maintain adequate space. Both the DNFSB 2000-1 Nuclear Materials Stabilization Missions and the HLW processing activities must be accommodated in the space available.

Salt Processing

Salt waste processing was suspended in FY98 because the facility could not cost effectively meet both the safety and production requirements for the High Level Waste System. A final DOE selection of the preferred salt processing technology is expected in FY01. The start up of the selected salt processing facility is scheduled for FY10. Conclusions and recommendations made in this Plan can be significantly impacted depending on the final alternative selected and its associated startup date. The successful resolution of this issue is critical to the overall success of the HLW System.

Age of the HLW Facilities

The material condition of many HLW facilities constructed from the early 1950s to the late 1970s has deteriorated. Routine repairs to service systems in the Tank Farms have escalated into weeks of unplanned downtime due to poor condition of the service piping and obsolete instrumentation. The Tank Farm cannot be shut down as it contains approximately 37 million gallons of highly radioactive waste, much of it in a mobile form. Planned infrastructure improvements must continue to be funded to ensure facility conditions are maintained to continue safe storage of waste. This plan includes provision for normal maintenance, some long-term service piping upgrades in the Tank Farms, and specific failures such as DWPF melters. However, unforeseen failures such as a major tank leak, etc., could have a significant impact on the operation of the HLW System.

DNFSB 2001-1 Recommendation

On March 23, 2001, less than one week prior to the issuance of this Plan, the DNFSB issued Recommendation 2001-1. Therefore, this revision of the Plan has not incorporated any information from that document. Any changes that are deemed appropriate after review of the recommendation will be incorporated into the next revision of the Plan.

Introduction

Revision 12 of the High Level Waste System Plan (hereinafter referred to as the Plan) documents the current operating strategy of the HLW System at SRS to receive, store, treat and dispose of high-level waste. The HLW System is a fully integrated operation. It involves safely storing high-level waste in underground storage tanks, removing, pre-treating, and vitrifying this high-level waste; and storing the vitrified waste until it can be permanently disposed of in a Federal Repository.

By the end of this fiscal year, over 1,200 vitrified waste canisters will have been produced. Two waste tanks were closed by the end of FY98. This will leave the Tank Farms with an estimated 37 million gallons of waste containing over 426 million curies of radioactivity to be disposed of over the next 20 to 30 years. Revision 12 of the Plan analyzes and compares the programmatic and funding requirements to support three cases, a Base Case, a Stretch Case:, and a Super Stretch Case:

- **Base Case** – DWPF production of 850 canisters in FY01 through FY06; Salt Processing startup in FY10.
- **Stretch Case –** DWPF production of 1,150 canisters in FY01 through FY06, with a three year feed break from FY07 through FY09 because the rate of feed preparation is not correspondingly increased
- **Super Stretch Case –** DWPF production of 1,150 canisters in FY01 through FY06, with an increase in the rate of feed preparation.

The three cases in this Plan represent the scope and funding (without projected savings incorporated) as specified in the FY01-FY06 contract extension between WSRC and DOE. Per this contract extension, the Base case is fully funded and represents minimum acceptable contractor performance. The Stretch and Super Stretch cases (which include scope above and beyond the Base case) can only be accomplished by finding ways to do the Base scope for less funding, then using those savings to fund this additional scope, or obtaining additional congressional funding.

Other assumptions used in the development of this plan are detailed throughout the document.

State of the HLW System

The status of each key HLW facility is summarized below.

H-Tank Farm: The **2H Evaporator system** continues to be impacted by resolution of the Potential Inadequacy in Safety Analysis (PISA) which was declared in January 2000. The 2H system did achieve some minimal space gain for FY00 prior to shutting down in January, but has since given up that space gain due to cleaning efforts. A dedicated multidiscipline team has been assembled to resolve the technical issues dealing with the 2H cleaning and restart efforts. This has required the addition of a neutralization tank and the resolution of numerous technical issues, resulting in significant delays in the cleaning and restart efforts. The 2H Evaporator restart is scheduled for August 2001. Once restart has been achieved, the material currently in the evaporator system will be concentrated and removed from the system. Then the 2H Evaporator will focus on evaporating DWPF recycle material only. This method of operation should provide the most efficient operation of this system while minimizing future re-cleaning requirements and operational constraints. (See Section 7.10)

The **3H Evaporator system** received DOE approval for operation in December 1999. During hot runs testing, operational issues with the Tank 30 and 32 back flush valves were discovered requiring modification and repair. These modifications and subsequent testing took until July 2000. The 3H evaporator ran at a better than expected rate for the remainder of FY00, achieving greater than 650 kgal of space gain in 2.3 months of operation. The 3H system continued to run well during the early part of November before Tank 30 experienced cooling coil failures. As a result the 3H system cannot run for extended periods without reaching the temperature limits established for Tank 30. A dedicated multidiscipline team prepared a path forward to maximize the 3H Evaporator operation in both the short and long term, including short “sprint” runs over the next year and modifications to Tank 37, the systems new drop tank in the long term (See Section 7.11)

The “Usable Space” (**see Appendix B – Glossary, and Section 8.1.1** for a full definition of “Useable Space”) in HTF has been reduced to approximately 462,000 gallons (as of March 1, 2001) due to the current 2H and 3H Evaporator issues and the preparation of Sludge Batch 2 for future feed to DWPF.

Several major transfers took place in H- Tank Farm during FY00. These transfers were targeted to remove concentrated waste, commonly called "liquor", from the 2H and 2F evaporator systems into a storage tank (Tank 35) to hold for future processing.

In order to maintain usable space in the Tank Farms until the Salt Processing Facility startup, the evaporators (in F & H Tank Farms) must evaporate 7,000,000 gallons of supernate (backlog) from Type III tanks. This is expected to recover approximately 3,800,000 gallons of actual space over the period FY01-FY06.

F-Tank Farm: The **2F Evaporator system** experienced a number of technical issues and physical challenges during FY00. Due to these problems, the 2F system ran approximately 50 % of its available time. This resulted in space gain of greater than 377 kgal for FY00. In FY01, the 2F Evaporator problems have been resolved and modifications to the system were completed in FY00. In FY01 through March 1, 2001, the 2F Evaporator has recovered over 240,000 gallons of space gain. Currently the system is operating over 74% of its available time.

The "Usable Space" in FTF is currently 191,000 gallons (as of March 1, 2001). It has fluctuated between 90,000 – 570,000 gallons during the past year due to several major transfers into and out of F-Tank Farm.

Waste Removal: Construction of waste removal equipment is complete on Tanks 8 and 19. Bulk waste removal is complete on Tank 8. Heel removal is in progress on Tank 19 and is scheduled for completion in FY01. Design activities were initiated on Tank 18. Construction of waste removal equipment continues on Tanks 7. Routing all signals and controls from Tanks 29-32, 35-37 and associated West Hill facilities to the 3H Evaporator Control Room was completed. Significant Lessons Learned obtained from Tank 8 project work and operations are being factored into plans for future waste removal tanks. Low funding levels are projected for the FY01 to FY06 period. As such, a comprehensive re-engineering program has been initiated to streamline the waste removal operation and implementation of the Authorization Basis as well as to develop more cost effective equipment and processes. Aluminum dissolution will not be completed on SRS sludge prior to vitrification. While this slightly increases the number of canisters produced during the life of the program it does not have a negative affect on glass durability and it reduces the technical risk to the program.

Tank Closure: Tanks 17 and 20 operational closure is complete. The next tanks scheduled for closure are Tank 19 in FY03 and Tank 18 in FY04.

Salt Waste Processing: A HLW salt solution processing evaluation is currently underway. An extensive list of potential treatment options has been pared down to three alternatives. These alternatives are Small Tank Tetraphenylborate (TPB) Precipitation, Crystalline Silicotitanate (CST) Non-Elutable Ion Exchange, and Caustic Side Solvent Extraction. Science and Technology activities are continuing on these three alternatives with a final DOE technology selection expected in FY01.

Defense Waste Processing Facility (DWPF): At the time of this Plan (March 1, 2001), DWPF had poured 123 canisters in FY01, this rate would correlate to approximately 300 canisters a year. Processing of Sludge Batch 1B sludge began in October 1998 and has currently produced 581 canisters of vitrified waste (with a total of up to 738 canisters expected depending on the amount of Tank 51 heel used).

Glass Waste Storage Building (GWSB): At the time of this System Plan, 1,073 glass canisters are stored in GWSB #1. This represents approximately 49% of the available 2,159-canister capacity at GWSB #1.

Effluent Treatment Facility (ETF): In FY00, the ETF treated over 14 million gallons of low-level wastewater, and transferred 99,633 gallons of waste concentrate to Tank 50 for storage. These values were below forecasts due to low FY00 rainfall and HLW evaporator downtime (i.e. less evaporator overheads were sent to ETF). For FY01 and beyond, the estimated annual volume of wastewater to be treated is 20 million gallons and the estimated waste concentrate produced is approximately 180 kgal per year.

Saltstone: In FY98, Saltstone entered an extended planned lay-up, having processed approximately 300 kgal of Tank 50 waste inventory. This Plan assumes that the ETF concentrate stored in Tank 50 will be treated at Saltstone starting in FY02. This will allow Tank 50 to be de-inventoried in preparation for its use as a HLW storage tank. Saltstone will operate on a periodic basis until the start of Salt Processing in 2010. When Salt Processing begins, Saltstone will return to continuous operations.

1. Description of the HLW System Plan

This Plan describes four different production strategies for the integrated operation of the HLW System:

Base Case

The first strategy is the Base Case which:

1. Provides the slowest risk reduction for waste removal from "high risk" tanks,
2. Does not meet the FFA or STP regulatory commitments,
3. Starts salt processing activities by mid 2010, and
4. Processes an average of 200 canisters per year after salt processing becomes operational.

The Base Case represents the scope and funding levels that was used to develop the FY01-FY06 contract extension between WSRC and DOE. The contract is based on fully funding the Base Case scope and the scope defined in the Base Case is defined as the minimum acceptable contractor performance as long as the funding for this case is provided. Appendix H provides the detailed production planning information for the Base Case.

Stretch Case

In the contract extension, WSRC committed to attempt to implement savings, which would be used to execute additional scope. DOE defined the additional scope requested and placed incentives on these items. These scope items added to the Base Case becomes the second strategy — the Stretch Case — which:

1. Provides acceptable risk reduction for waste removal from "high risk" tanks,
2. Meets the Site Treatment Plan regulatory commitments,
3. Meets final Federal Facility Agreement commitment, however, it fails to meet individual tank closure schedule,
4. Starts salt processing activities by mid 2010, and
5. Processes an average of 230 canisters per year after salt processing becomes operational.

Appendix I provides the detailed production planning information for the Stretch Case.

Super Stretch Case

During the contract extension, additional scope was identified that would significantly improve the HLW program performance. The execution of these items would have to be funded by implementing additional savings or by obtaining additional funding from Congress. The additional scope is not currently authorized for execution. It would have to be change controlled into the contract prior to execution. This additional scope was included in the third strategy -- the Super Stretch Case -- which:

1. Provides excellent risk reduction by expediting waste removal from "high risk" tanks,
2. Meets all regulatory commitments,
3. Starts salt processing activities by mid 2010, and
4. Processes an average of 250 canisters per year after salt processing becomes operational.

Appendix J provides the detailed production planning information for the Super Stretch Case.

Execution Strategy

The fourth strategy is a short term Execution Strategy. It includes information for the contract period FY01 – FY06. This strategy is a success oriented strategy in the early years of the contract which will best position the program for future success if funding can be made available to move to the Super Stretch Case. The reader should not expect that the performance of the HLW System will be able to fully achieve this case; however, it describes the best short term execution strategy that can be envisioned at this time. This information should be used by the employees in the HLW System facilities as a benchmark for expected performance and a reference to the work scope that is authorized for implementation under the contract. Appendix K provides the detailed production planning information for the Execution Case. Since the Execution Case is similar to the Stretch and Super Stretch Cases it will not be discussed in detail in the rest of the plan.

The HLW System planning bases are described in Sections 1 through 6. Key issues and assumptions are described in Section 7. The production plan and its associated Tank Farm space management strategy are described in Section 8. Sections 9 and 10 highlight technology development needs and potential future missions for the HLW System, respectively. Section 11 provides historical information for the High Level Waste System while Section 12 briefly describes various components and processes of the HLW System. The Appendices include supporting tables and figures. Appendix A provides a list of acronyms and Appendix B provides a glossary of terms. Appendix C is a listing of the HLW System Priorities, the basis upon which major funding decisions are made. Appendix D is a simplified HLW process flowsheet. Appendix E depicts the Approved FFA Waste Removal Plan and Schedule. These appendices should be particularly useful to those who are not familiar with this Plan. Appendix F provides perspective on changes in Tank Farm influents and effluents from 1954 to the present. Appendix G illustrates the High Level Waste Tank Usage and depicts the Tank Farm space availability. An attachment is available which shows, in graphical format, the activities required from FY96 to the end of the plan. Its large format (36" x 108") preclude its being published with the plan. Appendices H – K provide detailed production planning information for each of the cases described above.

One goal of the planning process is to continuously improve the Plan to better serve the needs of stakeholders. Revision 12 of this Plan incorporates the results from several improvements in the planning process implemented since Revision 11 was issued:

- An intense effort was made to develop and obtain buy-in on an integrated processing schedule for the remainder of 2001. With the numerous issues (See Sections 7.3, 7.10, & 7.11) associated with Type I tank storage and evaporator operations, it was imperative to obtain input and understanding of all key players from FTF, HTF and DWPF on the processing plans for the next year. The 2001 processing plan then became the building block for the Plan out-year planning. The result of this process is that the Facility Managers, Engineering, Transfer Team, Schedulers and Planners have a good understanding and knowledge of the important bases, assumptions and issues associated with Revision 12 of the System Plan.
- Significant efforts were made to improve our modeling of the blending of salt with sludge after the Salt Processing Facility becomes operational. This Plan has set up individual batches of salt solution (approximately one million gallon macro batches) for salt processing. This was done to ensure that adequate blending of materials could be executed in the timeframes necessary to support efficient processing of salt materials. A new **SaltMaker Module** was added to the GlassMaker Model. This section of the model used the individual salt macro batches with the specific sludge batches to ensure that good glass would be made when the salt and sludge streams were coupled into DWPF canisters. In previous plans the GlassMaker Model used average salt compositions. While this work significantly improves our planning basis, it is expected that the next several issues of the plan will continue to focus on optimizing the salt batches once the salt processing technology has been selected in late FY01.
- The successful suspension and transfer of the Tank 8 sludge in January 2001 provided many lessons learned and operating information for waste removal. This was the first transfer of sludge since the 1980’s. The lessons learned on Tank 8 have been incorporated into future waste removal planning.

It should also be noted that HLW personnel are also supporting activities that could lead to new missions for SRS. DOE-Material Disposition (MD) program activities include possible implementation of a can-in-canister program at DWPF and the Mixed Oxide (MOX) Fuel Facility for disposition of surplus plutonium. See Section 10 for further discussions on the impacts of potential new site missions on the High Level Waste Program.

2. Mission

The mission of the High Level Waste System is to:

- Safely store the existing inventory of DOE high level waste
- Support Nuclear Materials Stabilization and other site missions by providing tank space to receive new waste
- Volume reduce 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 of it 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
- Empty and close HLW tanks and support systems per regulatory-approved approach
- Ensure that risks to the environment and to human health and safety posed by high level waste operations are either eliminated or reduced to acceptable levels

That part of the HLW Mission that supports other Site Missions remains a high priority.

3. Purpose

The purpose of this Plan is to document currently planned HLW operations. These operations begin with the receipt of fresh waste, continue with storage, volume reduction, and pretreatment of the waste, and end with the operation of the DWPF and Saltstone. The program will end when all HLW has been vitrified, all HLW facilities have been closed, and all glass canisters have been shipped to the Federal Repository. This document is a summary of the key planning bases, assumptions, limitations, strategy, and schedules for facility operations. This Plan will also be used as a base document for:

- Developing future budgets
- Adjusting individual project baselines to match projected funding
- Projecting the Site’s ability to support the approved Federal Facilities Agreement (FFA) Waste Removal Plan and Schedule and the Site Treatment Plan requirements.
- Document the detailed baseline for the FY01 – FY06 contract extension.

4. High Level Waste System Scope

Key HLW facilities and supporting projects are grouped by function in the "Path to Closure" and FY03 Outyear Budget documents as shown below. This includes deactivation and long term surveillance and maintenance of all facilities. The Effluent Treatment Facility and the Saltstone Facility are included because of the supporting roles they play for the HLW System. The grouping have changed since Revision 11 of the system plan reflecting the consolidation of the Waste Pretreatment Facility with H Tank Farms and the completion of two Line Item projects, Tank Farm Service Upgrades and H-Tank Farm Storm Water Systems Upgrades. The Consolidated Incinerator Facility was removed as it is no longer assumed to be needed in the process of vitrifying salt waste.

- SR-HL01: H-Tank Farm
  - *H-Area Tank Farm (East Hill and West Hill)*
  - *2H Evaporator*
  - *3H Evaporator*
  - *Extended Sludge Processing*
  - *DWPF Feed Storage*
- SR-HL02: F-Tank Farm
  - *F-Area Tank Farm*
  - *2F Evaporator*
  - *F/H Interarea Line*
- SR-HL03: Waste Removal Operations and Tank Closure
  - *Waste Removal Operations*
  - *Waste Removal Demonstrations*
  - *Tank Closure Projects*
- SR-HL05: Vitrification
  - *Defense Waste Processing Facility Operations*
  - *Replacement Melter Projects*
  - *Failed Equipment Storage Vault Projects*
- SR-HL06: Glass Waste Storage
  - *Glass Waste Storage Building Operations*
  - *Glass Waste Shipping Facility*
- SR-HL07: Effluent Treatment Facility
- SR-HL08: Saltstone
  - *Saltstone Facility Operations*
  - *Saltstone Vault Projects*
- SR-HL11: Tank Farm Support Services F Area
- SR-HL12: HLW Removal
  - *Waste Removal from Tanks*
  - *Processing Facility Upgrades (including Vitrification)*
  - *Space Management Upgrades*
  - *Piping Upgrades (H-Tank Farm East Hill)*
- SR-HL13: Salt Processing
- SR-FA24: High Level Waste Facility Disposition

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

5. 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. Actual operating experience in the new processes, emergent budget issues, changes to Canyon missions and 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 this 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 Business Review Board** is a WSRC committee that provides oversight and approval of the Plan and its schedules. These form the schedule and cost "baseline" for the overall program. Maintenance of the baseline is controlled via a formal change control process.

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

Waste Acceptance Criteria (WAC) 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.

The **High Level Waste Management / Nuclear Materials Interface meetings** ensure clear communication of needs between NMS&S and HLW to improve communication of processing plans and their associated impacts on Tank Farm space and DWPF canister production. These meetings are held on a weekly basis between the working level planners and waste forecasters. Upper level management meets on a quarterly basis to discuss major planning assumptions and issues.

5.2 Modeling Tools

WSRC uses a suite 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 Characterization System (WCS)** documents the composition of the waste in each of the 49 HLW tanks. Sludge, salt, and supernate are characterized separately. The data encompass 41 radionuclides, 38 chemical species, and 23 other waste characteristics, and come from a multitude of monthly reports, waste sampling results, Canyon process records, and solubility studies. The Waste Characterization System represents the best compilation of SRS HLW characterization to date, and provides a sound basis for production planning analyses. The data for use in this Plan was the WCS datafile of January 2, 2001.

The **Space Management Model (SpaceMan)** is a PC-based Visual Basic program used to track available tank space. Two input files are needed to run the program. The data file provides the chemistry source data from the WCS. The strategy for controlling tank farm space is provided by a separate management file. This file inputs

- tank farm activities, such as:
  - external receipts (from Canyons, RBOF, ETF, flush water, and inhibitor additions)
  - waste transfers
  - evaporation

   - waste removal (including salt dissolution and sludge removal)
   - ESP
- tank status (fill limits, jet heights, closure, reuse, etc.)
- receipt chemistry.

The program automatically steps through each week and tracks available space, inventory movement, and tank chemistry. The evaporation simulation (salt space generation and ETF overheads production) is based on current supernate thermodynamic models. The outputs include a graphical tank farm display depicting individual tanks grouped by system. Within each tank, supernate, saltcake, and sludge are depicted graphically by different colored regions whose sizes are adjusted to indicate the relative contents of each within the tank. Calculated inventory values are placed in output files to develop material balance tables and charts. . SpaceMan was used to develop the salt batches used to determine glass composition (See GlassMaker, below).

The **GlassMaker Model, which has been updated to include a SaltMaker module** is a program which takes its compositions from the WCS for Sludge and SpaceMan for Salt. The SaltMaker module first confirms that the individual salt macro-batches provided by SpaceMan can be processed through the Salt Processing Facility. Then the output for each salt macro-batch is added to the scheduled sludge macro-batch. The model then runs the resulting compositions through the PCCS algorithms, with statistics, to determine if an acceptable glass blend can be made. The model runs each batch, dilutes the supernate, washes the sludge, blends in product from salt processing (PHA - Precipitate Hydrolysis Aqueous) and glass forming chemicals ("frit"), and then determines the glass acceptability for that batch of sludge. Since its purpose is to determine glass acceptability and other parameters associated with a batch, it is a time independent model. It was written to be an easy to use, quick running program so that different sludge and PHA (Salt) batch blends can be tested expeditiously.

The **HLW System Plan Financial 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 Financial Model is used to determine the long-term cost impacts of accelerating or delaying HLW production schedules. The Financial Model data define the cost baseline for the program.

The WCS, SpaceMan, GlassMaker with the SaltMaker module, and the Financial Model were used to generate the production planning and financial data contained in the Appendices H thorough K of this Plan.

Several additional models are available but were not used to provide input into this Plan.

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 183 chemical compounds in 1,750 process streams connecting over 700 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 batches. Sludge composition varies widely from tank to tank, so CPES uses tank-specific sludge composition data, as defined by WCS. Salt composition, however, is relatively uniform so CPES assumes all salt wastes are blended into an "average salt" composition. CPES reads waste composition data directly from the Waste Characterization System. This allows planners to easily determine how changes in waste composition data will impact sludge batches and subsequent processing in DWPF.

The **Product Composition Control System (PCCS)** has as its main role the on-line prediction of glass quality in DWPF. It is also used off-line to verify that the Tank Farm waste blends modeled 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 thereby minimizing canister production for each sludge batch. ESP sludge washing and aluminum dissolution endpoints are established based on CPES and PCCS analyses. GlassMaker incorporates the PCCS algorithms.

The **Production Model (ProdMod)** is a linear equation model that uses Speedup® software. The linear equations used in ProdMod enable it to calculate the entire program in monthly and annual increments, with an approximate one minute run time. This enables planners to quickly evaluate different operating scenarios while still tracking key parameters. ProdMod tracks three key waste constituents:

- Sodium, because it drives the sludge washing operation in ESP
- Potassium, because it determines the amount of precipitate produced by salt processing
- Cesium, because many source term limits are based on cesium concentrations.

ProdMod uses the Waste Characterization System as its source of waste data. The ProdMod data define the programmatic scope in the baseline.

The **HLW Integrated Flowsheet Model (HLWIFM)** is a non-linear, dynamic simulation, in the same Speedup® software as ProdMod, 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 ESP, the evaporators, and DWPF. HLWIFM also uses the Waste Characterization System as its source of waste data.

These four models have been superceded, for Plan purposes, by SpaceMan and GlassMaker (with the SaltMaker module) because of the latter's flexibility and speed.

5.3 Regulatory Constraints

Numerous regulatory laws, constraints, and commitments impact HLW System planning. The most important are described below.

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.

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. SRS committed that:

> *"Upon the beginning of full operations, DWPF will maintain canister production sufficient to meet the commitment for the removal of the backlogged and currently generated waste inventory by 2028."*

The production plans for the Super Stretch and Stretch Cases meet this commitment, however the Base Case does not meet this commitment.

The SRS **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). The FFA, which became effective August 16, 1993, 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 are scheduled to be removed from service may continue to be used, but must adhere to a schedule for removal from service and closure. A revised "F/H Area High Level Waste Removal Plan and Schedule (WRP&S)" was submitted to EPA and SCDHEC on January 15, 1998. The WRP&S provides start and end dates for the removal from service and operational closure of each non-compliant tank and commits SRS to remove from service and close the last non-compliant tank no later than FY22. The WRP&S also provides for the possibility that Tanks 4-8 could be used to store concentrated supernate after the completion of bulk waste removal. The reuse of Tanks 4-8 is planned in this revision of the System Plan.

The WRP&S was approved by SCDHEC on February 26, 1998 and by EPA on June 22, 1998. The approved WRP&S is an enforceable commitment from DOE to SCDHEC and EPA. Refer to Appendix E to see the approved schedule.

The production plans for the Super Stretch Case as depicted in Appendix J fully meets and exceeds these requirements. The Base and Stretch Cases as depicted in Appendix H & I of this Plan do not fully meet this commitment. In these cases, there are five years (2010 through 2014) when the number of closed tanks falls behind the required number in the FFA. The number of tanks behind schedule ranges between 1-3 tanks in these years. However, in both of these cases all FFA tanks are closed by 2019, three years ahead of the overall schedule commitment of 2022.

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 existing NEPA documents directly affect the HLW System and support the operating scenario described in this Plan:

- DWPF Supplemental Environmental Impact Statement (SEIS)
- Waste Management Environmental Impact Statement (EIS)
- 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 draft HLW Tank Closure EIS was distributed in Washington D.C. and DOE Headquarters November 17, 2000. Public scoping meetings to accept comment on the EIS were held in North Augusta and Columbia on January 9 and 11, 2001. The final EIS is due out in late summer 2001.

The draft Supplemental Salt Processing Alternatives Supplemental EIS was distributed in Washington, D.C., and DOE Headquarters March 22, 2001. Public scoping meetings to accept comment on the EIS are set up for May 1and 3, 2001, in North Augusta and Columbia. The final supplemental EIS is due out in late June 2001.

6. Planning Bases

6.1 Reference Date

The reference date for the mathematical modeling SpaceMan and GlassMaker) of this Plan is January 2, 2001. All other data is current as of March 1, 2001. 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 is shown in Appendix H.1, I.1 and J.1 for the Base, Stretch and Super Stretch Cases respectively, by individual projects. Key milestone dates required to remove waste from storage, process it into glass or saltstone grout, and close HLW facilities shown in Table 6-A are supported by the budget as described in the Appendixes.

Table 6–A Key Milestones

Key Milestone	Rev 11 Target Case	Rev 12 Base Case	Rev 12 Stretch Case	Rev 12 Super Stretch Case
Total Number of Canisters Produced	5,649	5,914	5,914	5,871
DWPF Sludge Production (in average canisters per year)				
• FY01	200	163	220	255
• FY02	200	111	150	150
• FY03	200	155	210	240
• FY04	200	163	220	240
• FY05	200	111	150	150
• FY06	200	147	200	115
• FY07	200	200	Outage	200
• FY08	200	107	Outage	200
• FY09	200	Outage	Outage	200
• FY10	200	150	100	150
• FY11 to End of Program	225	200	230	250
Key Risk Reduction Dates				
Date when all “high risk” tanks are emptied	FY16	FY16	FY16	FY14
Date when all “non-compliant” tanks are emptied	FY19	FY19	FY17	FY15
Date when all “Non-Compliant” Tanks are Closed	FY19	FY21	FY20	FY18
Date Salt Processing Becomes Operational	FY10	FY10	FY10	FY10
Date by which salt processing is completed	FY23	FY24	FY22	FY22
Date by which sludge processing is completed	FY22	FY29	FY27	FY23
Regulatory Commitments				
Are all STP commitments met?	Yes	No	Yes	Yes
Are all FFA regulatory commitments met?	Yes	No	No	Yes
Estimated Life-Cycle Costs				
• Costs in escalated dollars ($ in billions)	$17.3	$20.8	$19.2	$17.6
• Costs in constant 1999 dollars ($ in billions)	$12.1	$13.6	$12.9	$12.3
Canister Storage Locations				
• Make additional 450 GWSB #1 locations usable	FY02-04	FY05-07	FY03-05	FY03-05
• Begin work on additional Canister Storage locations (GWSB #2 or Privatized Modules)	GWSB #2 6/02	Module #1 FY07	Module #1 FY10	Module #1 FY04 Module #2 FY07
• Place GWSB #2 or Privatized Modules into Radioactive Operations	GWSB #2 FY07	Module #1 FY10	Module #1 FY13	Module #1 FY07 Module #2 FY10

Key Milestone	Rev 11 Target Case	Rev 12 Base Case	Rev 12 Stretch Case	Rev 12 Super Stretch Case
Waste Removal				
• Tank 7 ready for sludge removal	7/02	10/03	7/02	7/02
• Tank 11 ready for sludge removal	2/05	4/08	4/08	4/05
• Tank 26 ready for sludge removal	1/06	12/10	1/11	9/07
Tank Closures				
• Complete closure of Tank 19	3/02	4/03	4/03	4/03
• Complete closure of Tank 18	3/04	4/04	4/04	4/04
• Complete closure of 5th Tank	FY08	FY10	FY10	FY08
• Complete closure of 6th Tank	FY08	FY11	FY11	FY09
• Complete closure of 7th Tank	FY11	FY13	FY13	FY10
• Complete closure of 24th Tank	FY19	FY21	FY20	FY19
Key Space Management Activities				
• Reuse Tank 49 for waste storage	9/00	7/01	7/01	7/01
• Reuse Tank 50 for waste storage	9/03	9/02	9/02	9/02
• Tank 37 modification completed for 3H Evaporator Drop Tank	—	9/02	9/02	9/02
Repository Activities				
• Start shipping canisters to the Federal Repository	FY10	FY10	FY10	FY10
• Complete shipping canisters to Federal Repository	FY38	FY39	FY39	FY39
Facility Deactivation Complete	FY39	FY40	FY40	FY40

7. Key Issues and Assumptions

Key issues affecting the HLW System are described below. Resolution of each of these issues will have a significant impact on the HLW System for years to come. Each issue has an assumed outcome. Assumptions are therefore listed for each key issue. Potential contingency actions are described, should the assumptions prove to be incorrect.

7.1 Funding Guidance

Issue: The HLW System is especially sensitive to funding levels in the near term (FY02-FY10). The funding levels described in the cases are needed to ensure:

- Safe storage of High Level Waste
- Varying levels of risk reduction based on the case/funding which :
  - Removes waste from high risk tanks
  - Immobilizes HLW by operating the DWPF
- Selection, design, construction and startup of the Salt Processing Facility
- Further reductions in funding levels would jeopardize one or several of the above activities. This would result in a delay in waste removal program and increase life cycle costs by an estimated $420 million dollars per year of delay incurred by the program (constant FY99 dollars).

Assumptions: This Plan provides several cases with different funding levels. The funding guidance will be within the range of the cases described.

Contingency: If funding levels are reduced below the levels specified in the Base Case, the HLW System funding will go first to safe storage of waste, then a choice will be made whether to continue current risk reduction activities of immobilization or to proceed with the Salt Processing Project.

7.2 Age of the HLW Facilities

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

Background: The following are examples:

- A transfer line secondary containment encasement in F-Area failed in one place and is leaking in several others. Because of this encasement failure, sixteen transfer lines to Tanks 1-8 have been taken out of service.
- Numerous carbon steel leak detection systems have failed and had to be repaired before transfers could be made.
- Routine repairs to service systems in the F and H-Area Tank Farms have escalated into weeks of unplanned downtime due to obsolete instrumentation and the poor condition of the service piping.

In many cases, waste cannot be transferred out of tanks unless temporary services or alternative transfer systems are installed. Aging facilities cause excessive unplanned downtime and 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 cannot be “shut down” as it contains approximately 37 million gallons of highly radioactive waste, much of which is in a mobile form.

It should be noted that HLW has made progress during the past year on infrastructure improvement Line Item projects. Both Tank Farm Service Upgrades (HTF West Hill) and Tank Farm Storm Water Upgrades were completed and immediate operational improvements have been seen in H-Tank Farm. Also improvements to transfer readiness in older parts of both F and H Tank Farms have been implemented with the installation of new gang valves. Improvements to many ventilation systems have also been completed with others underway.

Assumptions:

- An H-Area secondary containment encasement (similar in design and vintage to the failed F-Area encasement) will not 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 Support Services (FTF) FY99-FY02
  - Piping Upgrades (HTF East Hill) FY02-FY06
  - Continued smaller improvements will be made with CE/GPP projects
- Leak detection piping and systems will continue to be repaired as needed.

Contingencies:

- 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 infrastructure systems age.
- Obtain additional funding.

7.3 Age of the HLW Tanks

Issue: SRS's 51 underground HLW storage tanks are intended for interim liquid waste storage only. The oldest of these tanks have already been in service for almost 50 years. Twelve of these tanks have a leakage history (ten have evidence of leaks from the primary tank wall and two have evidence of in-leakage at high elevations of ground water). Continued storage of liquid waste in these tanks poses a potential threat to the environment.

Background: The first SRS HLW tanks were put into service in the early 1950s. Twenty-four of the 51 tanks are considered "non-compliant" tanks and do not meet current requirements for secondary containment and leak detection. DOE has enforceable commitments to SCDHEC and the EPA to close these non-compliant tanks (see Appendix E) by FY22. Two of the tanks (Tanks 17 and 20) have already been closed. Many of the tanks are in or near the water table. Approximately 37 million gallons of high level waste are stored in the Tanks Farms, much of it in a mobile form.

Per this Plan, many of these tanks will be well over 50 years old before they are closed. In the last 3 years, three additional tank integrity issues have arisen with these tanks.

- Tank 15 has developed a type of leak site not previously seen: a crack running parallel to a weld seam, above the waste level, approximately 18 inches in length. This type of leak site will make waste removal from this tank much more difficult. If other tanks develop similar cracks, the risk of releases and the complexity and cost of future waste removal will be increased.
- Increased corrosion has been observed in several tank secondary pans. These secondary pans, which represent the last line of defense for this waste, already contain waste from previous leaks in the primary walls of the tanks.
- In January 2001, after a transfer of low source term waste, approximately 90 gallons of waste was detected in the annulus of Tank 6. An extensive exterior wall inspection has since identified six (6) leak sites. At the time of this plan, compensatory measures are in progress to address the continued use of Tank 6 for storage.

Although SRS maintains an aggressive program to monitor the integrity of all waste tanks, these recent findings underscore the need to:

- Fund Tank Farm infrastructure projects
- Continue immobilization of waste in the HLW System that will support the shortest timeframe for the completion of waste removal from these tanks.

Assumptions:

- Successful waste chemistry controls and temperature controls will prevent new leak sites.
- Rigorous tank inspections will monitor known leak sites and detect any new leak sites, if they occur, so that appropriate compensatory actions can be taken.
- Resources will be available to continue to remove and immobilize the waste from underground tanks, thereby significantly reducing the environmental threat posed by storage of high level waste in underground tanks.

Contingency:
- Maintain Contingency Transfer Space capacity in the Tank Farms to accommodate transfer of waste from a leaking tank, if a leak occurs.
- Accept increased environmental risks as tank systems age.
- Obtain additional funding.

7.4 Tank Farm Waste Storage Space

Issue: The Tank Farms' useable waste storage space is continuing to be consumed by the delay of the start of salt processing, planned long term sludge-only DWPF processing, and continued receipts of Canyon wastes. If salt processing is delayed until FY10 and the waste generating facilities perform as planned, then the Tank Farm waste inventory will exceed the storage capacity unless additional modifications are implemented. Modification initiatives have been developed which will support the maintenance of adequate Tank Space until 2010 when the Salt Processing Facility becomes operational.

Background: All parts of the HLW System at SRS are operational except the salt processing plant. Work on salt processing was suspended in January 1998 because the facility could not cost effectively meet both the safety and production requirements for the High Level Waste System. Since January 1998, a rigorous systems evaluation was done on all available salt processing technologies and Research and Development for process selection is currently being completed. The selection process has narrowed the alternative technologies to Small Tank Tetraphenylborate (TPB) Precipitation, Crystalline Silicotitanate (CST) Non-Elutable Ion Exchange, and Caustic Side Solvent Extraction. The final selection of a processing alternative is expected in FY01. The current schedule for startup of the facility is projected for mid FY10.

It must be remembered that minimal space is gained from sludge removal, as it is a minor component of the total space in use in the Tank Farms. In addition, almost all of the sludge processed prior to FY10 is currently stored in non-compliant tanks. Salt and supernate removal is the only process that truly gains space in the Tank Farm. As a result, the Tank Farms must continue to process the significant DWPF recycle and ESP washing streams within existing space limitations. DWPF is expected to continue sludge-only operations until salt processing startup.

A detailed tank space strategy is included in each revision of the Plan starting with the October 1999 update of Revision 10. The Tank Space Management strategy is evaluated, expanded upon, and updated with the development of each revision of the Plan as assumptions are validated or revised and as new process information becomes available. For this revision, the tank space strategy is outlined in Section 8.1.2

As of March 1, 2001 F-Tank Farm has approximately 191 kgal of useable space available, and H-Tank Farm has approximately 462 kgal of useable space available. There is a total of 653 kgal of useable space for both Tank Farms. This is a significant reduction in useable space from the 1,300 kgal that was available in March 2000. The reduction results from continuing issues associated with operation of the 2H and 3H Evaporators (See Sections 7.10 and 7.11) and with the large amounts of washwater associated with the start of Sludge Batch 2 feed preparation.

Working inventory must be maintained in the Tank Farms to receive large volumes of new waste (*e.g.* ESP wash water) or to provide contingency space for unplanned evaporator outages. The current total working inventory level of 653 kgal is at a level where it impacts HLW's ability to support processing. In particular, preparation of Sludge Batch 2 in Tank 40 is impacted. Some washing steps must be delayed until adequate working space is available in the Tank Farm to ensure that canyon receipts and Contingency Transfer Space needs are not challenged.

Assumptions:
- The Canyon's waste stream volumes and the DWPF recycle volumes will be less than or equal to the forecast.
- The current 2H Evaporator issue will be resolved and the 2H and 2F Evaporators will operate as planned and achieve their space gain goals.

- The current 3H Evaporator cooling capacity issue will be resolved and the 3H Evaporator will operate as planned and achieve its space gain goals.
- Significant reductions made in the volume of DWPF Recycle sent to the Tank Farms that resulted from shutting down the steam atomized scrubbers on the melter off-gas system can be maintained until the start of Salt Processing.
- Type I (5,6, 7 and 8) tanks can continue to be used to store low source term (i.e. DWPF recycle or high silicon ESP decants) supernate streams and material from the Tanks 18 & 19 closure efforts.
- The backlog of dilute supernate currently stored in F- and H-Tank Farm Type III tanks can be successfully retrieved and evaporated as a means to recover space in the Tank Farms.
- Tanks 49 and 50 will undergo required modifications to allow their use for concentrated waste storage service.
- Tank 37 and 27 can be modified for use as concentrate receipts tanks to provide salt storage.

Contingencies:

- Implement other recommended new strategies that increase available space.
- Salt processing may resume before FY10.
- HLW System attainment could be decreased, however, this would not meet the goal of reducing the risk in the "high risk" tanks as soon as possible.
- Planned Canyon programs could be slowed down until the Tank Farms are in a better position to support them.

7.5 Uncertainties in Tank Space Assumptions

Issue: The Tank Farm space management strategy is based on a set of key assumptions involving canister production rates, influent stream volumes, Tank Farm evaporator performance and space gain initiative implementation. Significant changes in any of these key assumptions will impact HLW's ability to successfully support planned processing commitments due to a lack of Tank Farm waste storage space.

Background: A HLW Space Team was chartered to recommend the best management practices for safe stewardship of high level waste while maximizing available tank space. The Space Team issued its final report in August 1999. The Tank Space Management strategy is evaluated, expanded upon, and updated with the development of each revision of the Plan as assumptions are validated or revised and as new process information becomes available. For this revision, the tank space strategy is outlined in Section 8.1.2 Several changes have been made from the strategy described in Revision 11.

For example, operation of the Tank Farm evaporators to reduce the volume of waste is key to maximizing space in the Tank Farm. Resolution of the technical issues to return the 2H Evaporator to service (See Section 7.10) have proven to be more difficult than originally forecast. In addition, tank cooling issues have impacted 3H Evaporator operations during FY01 (See Section 7.11) The result is that the space gain from evaporation has been limited from what was assumed in Rev. 11. The near term impact to the Tank Farm space management strategy is that several of the Type I tanks will be used to store low source term waste.

Also, the 3H Evaporator cooling issues have had a secondary affect on planned storage of saltcake formed in the evaporation process in Tank 30. That is, the lack of cooling capability in Tank 30 does not cool the 3H Evaporator concentrate adequately enough for salt to form in the tank. Between now and the startup of Salt Processing, HLW will continue to receive influents, that when evaporated, will form salt. Therefore, additional tanks must be made available to store saltcake. For this revision of the Plan, it is assumed that modifications will be required to allow Tanks 37, 27 and 42 to be used for concentrate receipt service to store saltcake. These tanks are in the 3H, 2F and 2H Evaporator systems, respectively.

The bottom line is that there will continue to be changes to assumptions made involving Tank Farm space management. Due to the uncertainties in assumptions, the Tank Farm space management strategy must continually be evaluated to respond to emerging issues and changing processing scenarios. The allocation of resources must continue to be balanced between reducing the risk from the continued storage of high level waste in underground tanks and the cost to implement space gain initiatives.

Assumptions:

- Waste minimization efforts involving Canyon waste stream volumes and the DWPF recycle volumes will be successful such that the actual volumes will be less than or equal to the forecast.
- Evaporators will operate as planned and achieve their space gain goals.
- Space Gain initiatives can be completed as forecast.

Contingencies:

- Implement other recommended new strategies that increase available space.
- Salt processing may resume before FY10.
- HLW System attainment could be decreased, however, this would not meet the goal of reducing the risk in the "high risk" tanks as soon as possible.
- Planned Canyon programs could be slowed down until the Tank Farms are in a better position to support them.

7.6 Key HLW Processing Parameters Uncertainty

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

Background: This Plan assumes that aluminum dissolution is not performed on any of the sludge batches. This is a change from previous Plans and results in additional canisters being made at DWPF. Aluminum dissolution is no longer assumed due to technical and safety bases uncertainties associated with the process. In particular, impacts on the evaporator operations from the processing of a high aluminum ESP decant are not known at this time (See Section 7.10 on 2H Evaporator operational issues). In addition, it is hypothesized that the aluminum removed during the process converts back to sludge over time and is not removed to Saltstone as originally predicted after the start of Salt Processing. Additional evaluations and analyses must be completed before aluminum dissolution should be assumed.

This Plan assumes that 2 wt% insoluble solids are entrained in saltcake. If the actual amount is higher, then more canisters of glass will be produced. Also, this Plan assumes that the accepted total potassium inventory in the Tank Farms is well defined. An increase in potassium will drive increases in total precipitate production..

This Plan also assumes the accepted weight percent solids in settled sludge are well known. An increase in the weight percent solids will result in more canisters of glass being produced. A change in the weight percent solids variable has already been seen in Sludge Batch 1A and resulted in a revision to the canister yield. The next revision of this Plan will include an updated analysis of all sludge volumes to ensure that all recently received sludge and future mission sludge is being adequately handled in the plan

A Process Engineering group within HLW Engineering has been established to coordinate process interfaces and process chemistry internal to HLW and between HLW and NMS&S. The goal of this group is to ensure that changes to key parameters (waste inventories and composition, modeling tool changes, modeling assumptions, etc.) that impact HLW system planning are agreed upon by all applicable parties before they are implemented. A primary purpose of this new team is to communicate key information so that all facilities are using the same data or assumptions for operating or planning activities.

: Waste sample analyses are being refined to obtain additional needed information without increasing the number of samples. Operating experience in facilities throughout the High Level Waste System will improve our understanding of the relationships among waste composition, waste characteristics, and waste processing. At the time of this Plan, HLW is waiting on sample analyses results from the Tank 8 sludge that was recently slurried and transferred to ESP. When received, a comparison of forecast versus actual sludge composition for Tank 8 can be evaluated. This information may allow better estimation of sludge contents and composition in other older tanks where actual sludge sampling has not taken place.

Also, actual Sludge Batch 1A and 1B processing data has allowed us to better predict production information for future batches.

Assumptions:
- Sample results will confirm the waste composition and characteristics described above.
- Facility processes will be adjusted as necessary.
- Blending of feed to Salt Processing Facility and ESP will compensate for any transient (high or low) conditions in individual waste tanks.

Contingencies:
- Additional waste tank samples could be retrieved and analyzed.
- Additional processing data will provide better information for future System Plans.
- Modifications to some facilities could be required.
- The total number of canisters to be produced may increase or decrease.
- The overall High Level Waste program could be lengthened.

7.7 Maintaining Continuous Sludge Feed to DWPF

Issue: Funding constraints for previous years and continuing from FY02 to FY06 have required difficult decisions in the planned HLW operating strategy, particularly with regard to the process of DWPF feed preparation. Based on current funding guidance, the schedules to maintain continuous sludge feed to DWPF require just-in-time completion dates for preparing sludge batches. In two of the cases in this plan -Base and Stretch- continuous feed is not maintained for DWPF. Therefore, to minimize any immobilization outages, this revision of the Plan, has again rebatched sludge tanks from what was assumed in Revision 11. Waste removal and feed preparation, given the state of legacy high level waste now in the tanks, is a first-of-a-kind process abundant with challenges and uncertainties.

Background: For waste removal work completed on Tank 7 and 8 in FY00 and FY01, there was a large amount of emergent work related to high radiation and contamination rates and the poor condition of the tank, tank-top equipment, and supporting services. There have been significant Lessons Learned obtained from Tank 7 & 8 preparation work that has been factored into future waste removal tanks, where possible. Low funding levels in some previous years for Tank 7 moved much of the construction scope into FY01 and FY02. This leaves minimal schedule contingency time for recovery from unexpected delays as were experienced on Tank 8 (tank riser interferences, high radiation rates, waste characterization issues, etc.).

In addition, Sludge Batch 2 preparation has been impacted by the existence of high silicon waste in Tank 40 and evaporator performance issues. The presence of the slow settling silicon solids after sludge mixing has resulted in a change in the washing and evaporation steps for the sludge washing decants (See Section 7.10). The overall Sludge Batch 2 preparation duration has been extended by several months due to these emergent issues.

The increase in projected canister yield (428 cans to 658 cans) for Sludge Batch 1B has helped to offset the impacts on feed preparation. This increase in canister yield resulted from these factors:

- After slurry pump replacement, a larger amount of sludge solids existed in Tank 51 than was originally forecast
- It was possible to move a greater amount of sludge from Tank 42 to Tank 51 than was originally planned.
- Dilution of the sludge in Tank 51 from slurry pump bearing water results in more sludge being removed from the tank by the time the 40” heel is reached.

However, these projections have already been factored into the schedule used for this Plan and any unexpected delays in feed preparation will impact sludge feed availability.

Assumptions:
- Sludge Batches #1B and 2 will perform as projected.
- There will be no major, unexpected delays in future Sludge Batch feed preparation.

- WSRC will be able to improve subsequent Sludge Batch schedules to sustain the predicted production rates at the available funding levels.(The Base and Stretch Cases will have outages.)
- A melter outage is projected in FY02 and FY05.

Contingencies:
- The DWPF production rate could be reduced.
- Additional extended outages could be planned.

7.8 Return of Tank 49 to Waste Storage Service

Issue: If salt processing is available in FY10 and the waste generating facilities perform as planned, then the Tank Farm waste inventory will exceed the storage capacity in Type III tanks (currently designated for waste storage). The plan is to return Tank 49 to waste concentrate storage starting by the end of FY01. The effectiveness and timeliness of the phenylborate decomposition through the catalyzed reaction with copper nitrate is uncertain. The inability of the reaction to reach a satisfactory end point in a timely manner could delay the return of Tank 49 to waste concentrate storage.

Background: Tank 49 was previously part of the ITP process where it was to be used as a precipitate feed tank for DWPF. It currently contains approximately 200 kgal of benzene bearing solution from ITP demonstration runs that must be removed prior to its return to waste storage service. The decomposition of the benzene producing phenylborate compounds is currently being performed. The first phase was completed in March 2001 when the material in Tank 49 was heated to 40 degrees Celsius. The second phase involves the introduction of copper catalyst to Tank 49. Two of the three copper additions were completed in March 2001 and the last addition and the completion of decomposition is scheduled to be completed by May 2001. Once the decomposition of the phenylborates is complete, the material in Tank 49 will be transferred into Tank 50. Pumps will be removed from the tank and a transfer of HLW into the tank is scheduled for July 2001. Modifications required to tie Tank 49 into HDB7 have been completed.

Assumptions:
- Phenylborates will decompose to acceptable levels to allow movement of material to Tank 50
- Residual material in Tank 49 will not impact planned use of Tank 49 for concentrate waste storage service

Contingencies: None. – Risk level is low at this time.

7.9 Return of Tank 50 to Waste Storage Service

Issue: If salt processing is available in FY10 and the waste generating facilities perform as planned, then the Tank Farm waste inventory will exceed the storage capacity in Type III tanks (including returning Tank 49 to service in FY01). The plan is to add concentrated supernate to Tank 50 starting in FY02.This is 1-2 years earlier than initially planned. Before using Tank 50 for waste storage, a method to process the current material in Tank 50 and the continuing stream from ETF must be provided.

Background: Tank 50 was used as a part of the ITP process where it stored the low activity filtrate stream for feed to the Saltstone Facility. It is currently used to receive and store ETF concentrate that will eventually be fed to Saltstone.

In FY98, Saltstone processed approximately 300 kgal of Tank 50 waste inventory and entered an extended planned lay-up. This Plan assumes that the ETF concentrate stored in Tank 50 can be treated at Saltstone starting in FY02. This will allow Tank 50 to be de-inventoried in preparation for its use as a HLW storage tank.

Since Tank 50 will be required for concentrated waste storage service, processing ETF concentrate at Saltstone must be continued on a periodic basis until the startup of Salt Processing in FY10. At that time, the Saltstone Facility must be continuously operated to support the large volume filtrate stream from Salt Processing and the ETF concentrate can be sent to Saltstone. In the interim, a method must be developed to manage ETF concentrate stream without using Tank 50 as a temporary storage location.

Some physical modifications must also be made to allow Tank 50 to be used for concentrate storage service. They include:

- Modifications at Tank 50 to tie transfer lines back into HDB-7 and to disconnect transfer line tie-ins to ETF and Saltstone
- Shielding upgrades to the Tank 50 valve box.
- Installation of a fixed length transfer jet.

Assumptions:
- ETF concentrate stored in Tank 50 can be treated at Saltstone starting in FY02.
- After processing the Tank 50 material, Saltstone will continue to process the ETF concentrate at a rate of approximately 180 kgal/yr.
- Physical modifications can be made to support concentrated waste storage in Tank 50.

Contingencies:
- Implement other recommended new strategies that increase available space.

7.10 2H Evaporator Operation Constraints

Issue: The 2H Evaporator is currently shutdown because of an accumulation of solids in the evaporator pot. The solids contain uranium and sodium aluminosilicate, including higher than expected quantities of U235. Although preliminary investigations indicate that the solids are critically safe, there is a risk that continued operation of the evaporator could lead to conditions under which a criticality would be credible. If not resolved, the 2H Evaporator solids accumulation issue will impact HLW processing plans.

Background: During a planned outage in October 1999, visual inspection of the 2H Evaporator revealed solids buildup on evaporator internals and in the bottom cone area of the pot. Approximately 18 grams of material was obtained from the bottom cone area for analysis anticipating an end of CY00 chemical cleaning. The 2H Evaporator was restarted in December 1999. Erratic lift rates were experienced and the evaporator was shutdown in January 2000 when attempts to correct the lift rate were unsuccessful. In early January 2000, results from the sample revealed the material consists of sodium aluminosilicate and sodium diuranate (with an average total uranium content of 6.9 wt% and an average 2.3% enrichment). Based on the analysis results, a PISA was issued and all evaporator operations were suspended.

To ensure incoming waste streams from continuing DWPF and Canyon processing could be accepted without immediate tank space impacts, transfer sequences and priorities were changed. These included raising operating limits, reducing the DWPF recycle stream, accelerating Tank 39 organic PISA resolution, and implementing modifications and procedure changes to allow single wall tanks to accept DWPF recycle.

To resolve the 2H problem, immediate compensatory actions were taken. First, Site Criticality Committee concurrence was obtained that the current 2H configuration is safe. Second, multi-disciplinary teams were deployed to:

- Understand and address the chemistry
- Develop a cleaning technique for the evaporator pot
- Develop a strategy for future evaporator operation, including 2F and 3H
- Develop a strategy for tank space management during the resolution of the issue.

Third, an extensive sampling program was performed to characterize the problem.

The 2F and 3H Evaporators have been cleared for operations with some limitations on the types of materials that can be processed through those evaporator systems.

Efforts are underway to complete the cleaning and the restart of the 2H Evaporator System. Current plans are to segregate feed streams to the 2H Evaporator. the 2H Evaporator will be dedicated to processing high silica feed streams. The 2F and 3H will be used to handle other feed streams so as to preclude a similar material deposition problem from affecting their operation.

Assumptions:
- 2H Evaporator cleaning and operation questions will be resolved and the evaporator will restart in August 2001.
- DWPF recycle and existing supernate containing DWPF recycle will be able to be evaporated as planned.
- Compensatory actions to handle incoming waste streams will result in minimal impact to waste generators.
- Type I and IV tanks will be used to store recycle and high silicon wash water in the interim until adequate space can be made by the 2H Evaporator.
- Tank Space management program will ensure sufficient tank space is available to continue processing feed for DWPF.

Contingencies:
- Implement process and equipment modifications that totally segregate high silicate streams (*e.g.* DWPF recycle) from the tank farm.
- HLW System attainment could be decreased, however, this would not meet the goal of reducing the risk in the "high risk" tanks as soon as possible.

7.11 3H Evaporator Operation Constraints

Issue: The 3H Evaporator is operating on a limited basis because of loss of cooling in Tank 30, the concentrate receipt tank. The evaporator is operating in short (approximately 5 day) sprint runs until the Tank 30 temperature limit is reached, and then shut down until the tank cools to an acceptable level for the next sprint run. If not resolved, the 3H Evaporator cooling issue will impact HLW processing plans.

Background: During a routine recycle transfer from Tank 30 to Tank 32 in November 2000, a leak was detected in the H-Tank Farm West chromate cooling water system. Within a week's time, it was determined that all five deployable cooling coils in Tank 30 were leaking. The coils were isolated from the chromate cooling water system to contain the leak. This eliminated the main source of cooling for the tank.

A dedicated multi-discipline team was assembled to determine both the proper short-term approaches to mitigate this issue, and the best overall solution to restore full 3H evaporator capacity. A Stress Analysis determined a high probability of coil failure at the lower strut support plates for deployable coils of this design. Therefore, repair or redeployment of the same coil design was not recommended. Short-term recommendations accepted for implementation are:

- reduce/eliminate steam heating to the annulus (implemented)
- maintain high liquid levels in Tank 30 during evaporator operation (implemented)
- add Tank 40 supernate to Tank 30 to provide cooling (Note: This is a one or two time transfer with limited cooling results)
- deploy stop leak material to restore temporary operation of two Tank 30 coils
- use Tank 49 to cool the 3H evaporator concentrate via transfers to/from Tank 30

The cumulative effect of all the short-term recommendations falls far short of supporting steady-state 3H Evaporator operation. Therefore, to restore full 3H Evaporator capacity, the Team evaluated two options in detail:

- replace Tank 30 coils with an improved design, or
- convert Tank 37 from salt cake storage to evaporator receipt service.

Conversion of Tank 37 to evaporator receipt service was chosen because it provided the most benefit to the 3H system for the given investment. HLW Management has set a goal for Tank 37 operation as 9/02.

Assumptions:
- Without Tank 30 cooling, the 3H evaporator can operate 5 days per month generating 50Kgal per month space gain
- Addition of Tank 40 material to Tank 30 will provide enough cooling/feed to generate an additional 200Kgal of space gain (above the 50Kgal/mo.) over 2 months operation

- Two operating cooling coils in Tank 30 can generate an additional 30 to 50 Kgal per month (above the 50Kgal/mo.) space gain
- Stop leak is only currently approved for a single deployment, and SRTC tests suggest it will last only 3 to 4 weeks, therefore only one month of Tank 30 cooling coil operation is expected (once results from the use of stop leak are evaluated additional usages may be approved.)
- Transfers of hot saturated salt solution from Tank 30 to Tank 49 can be successfully conducted without salting up the transfer line
- Space in Tank 49 is available to receive Tank 30 supernate for cooling
- The 2F evaporator system can receive the Tank 37 dissolved salt required for a 9/02 operation date
- The soil contamination rates around the Tank 37 Gravity Drain Line tie-in are within the requirements for construction work
- A timely approval of the WR Line Item BCP to add this scope of work will be received
- Detailed Tank 37 conversion schedule development maintains a 9/02 Tank 37 operational date

Contingencies:

- HLW System attainment could be decreased, however, this would not meet the goal of reducing the risk in the "high risk" tanks as soon as possible. (This would allow the 2F Evaporator to support sludge washing preparation without the assistance of the 3H Evaporator. Note that the 2H Evaporator is assumed to process only DWPF recycle.)
- Planned Canyon programs could be slowed down until the Tank Farms are in a better position to support them.

7.12 Salt Processing Disposition and Resumption of Operations

Issue: DOE has not made a final decision on the process to treat HLW salt solutions. Conclusions and recommendations made in this Plan can be significantly impacted depending on the final alternative selected and its associated startup date.

Background: All parts of the HLW System at SRS are operational except the salt processing plant. Processing at the In-Tank Precipitation (ITP) Facility was suspended because the facility could not cost effectively and simultaneously meet both the safety and production requirements for the High Level Waste System. An evaluation of alternatives was conducted to pare an extensive list of potential solutions to the problem down to three alternatives. These alternatives are Small Tank Tetraphenylborate (TPB) Precipitation, Crystalline Silicotitanate (CST) Non-Elutable Ion Exchange and Caustic Side Solvent Extraction. The Salt Processing technology selection is expected in FY01. The current projected schedule for Salt Processing Facility operation is mid FY10. DWPF is expected to continue sludge-only operations until salt processing startup.

Assumptions:

- This revision of the Plan does not have the benefit of a final decision by DOE on the process technology to treat HLW salt solutions. Therefore, this Plan uses the values (salt solution feed volumes, precipitate feed rates, etc.) from the Small Tank Tetraphenylborate Precipitate Salt Disposition alternative. This Small Tank alternative is assumed to be representative of the three alternatives still under evaluation. Once a final decision is made on the preferred salt disposition process, a new revision of this Plan will be generated.
- Funding will be available to support the schedule for construction and startup by mid-FY10.

Contingencies:

- Implement other recommended new strategies that increase available space.
- Salt processing may resume before FY10, if the Salt Disposition Facility Project is accelerated.
- HLW System attainment could be decreased, however, this would not meet the goal of reducing the risk in the "high risk" tanks as soon as possible.
- Planned Canyon programs could be slowed down until the Tank Farms are in a better position to support them.

7.13 Authorization Basis Document Upgrades

Issue: The effort to finalize the development and implementation of Authorization Basis (AB) documents that reflect all the requirements of the recently-issued 10CFR830 for CST Facilities is currently scheduled to be complete by October 30, 2003. If it is determined that new systems or significant equipment upgrades are required, current funding levels for implementation are insufficient.

Background: Bringing the CST Facilities into full compliance with 10CFR830 will require significant manpower resources, and may require capital upgrades to these facilities. Completion of analysis to the standards specified in 10CFR830 for the Tank Farms will require significant sustained funding. In addition, equipment upgrades or new systems may be required to meet Evaluation Guides for reduction of risk in each facility. Additional training, procedure, and surveillance revisions will be necessary to comply with 10CFR830.

In order to maximize the efficiency of these upgrades, WSRC has developed a plan and schedule for a consolidated graded approach SAR, as well as facility-specific TSRs. The development effort will focus on those activities that provide the most benefit towards improvement of safety and Conduct of Operations in relation to the effort required, while maintaining compliance with the DOE requirements. The compliant SAR and TSRs previously prepared for the WPT Facility will be used as the basis for the new CST SAR. Included in the scope of the effort are identification of further analytic needs, simplification of controls, reconciliation of facility differences, elimination of non-operational precipitation processes, and simplification of the implementation effort.

AB upgrades will provide an improved safety basis for CST operations. The upgrades for the Tank Farms consist of the following:

a) Update of the hazards analysis is required to incorporate facility worker hazards not previously assessed. New analysis for facility worker hazards and reviews of existing accident analysis are required. This is to ensure that all hazards to the public, facility workers, and the environment associated with facility operations have been identified and assessed for impact. This analysis ensures that safety functions are identified to prevent or mitigate the consequences of each accident.

b) Derivation of controls is required to finalize the selection of systems, structures, and components (SSCs), which are engineered controls, or administrative controls to perform the safety functions that prevent or mitigate the analyzed accidents. Controls can be existing controls or, when existing controls are inadequate or overly burdensome, newly-developed equipment designed to perform the safety function. Development of new equipment can represent a significant cost, due to both the stringent and exacting requirements associated with safety class or safety significant classification and the number of tanks involved. (The current plan would require that any significant equipment upgrades would have to be managed as new scope as described in the assumptions below.)

   Associated with derivation of controls is the completion of uncertainty analysis. This analysis is conducted to ensure that instrumentation utilized for prevention and mitigation of accidents operate in compliance with assumptions in the accident analysis.

c) Final functional classification is required to ensure that the facility SSCs selected to prevent or mitigate the accidents are capable of performing their safety function when needed. For safety class and safety significant equipment, this effort is conducted using the backfit process described in the E7 Manual, Procedure 3.41, “Backfit Analysis Process”. Necessary actions resulting from the backfit process can include replacement, modification, and/or testing of SSCs. In addition, the functional classification of SSCs as safety class or safety significant imposes an additional burden on the operation and maintenance of the equipment.

d) Procedures and training that reflect the revised AB must be developed. These efforts represent a large impact on resources.

Assumptions:
- AB upgrade and implementation will be completed by October 30, 2003 if continued sufficient funding is allocated.
- Statistical Method for Accident Analysis (95%) will used in the preparation of the 830 SAR in order to eliminate unrealistic over conservatism in the analysis. This use of technique supports the use of existing hardware and allows a reduced reliance on administrative controls.
- If existing equipment is acceptable for use as safety equipment, it will be credited.
- New systems or significant equipment upgrades will be treated as new scope and can be only be implemented if additional funding above the Base and Stretch Case funding levels is obtained.

Contingencies:
- CST operations will continue under the revised SAR and TSRs (Interim ABs). This will continue until AB documentation is developed and implemented to achieve full compliance with 10CFR830 in all CST facilities.
- HLW System attainment could be decreased, however, this would not meet the goal of reducing the risk in the "high risk" tanks as soon as possible.

7.14 Potential Delays in Tank Closures (DOE Order 435.1 Lawsuit)

Issue: In January 2000, the Natural Resources Defense Council (NRDC) and the Snake River Alliance (SRA) petitioned the Ninth Circuit US Court of Appeals to review and set aside DOE Order 435.1. The petitioners claim the Order 435.1 is "arbitrary, capricious and contrary to law." The petitioners also claim that DOE's categorical exclusion finding for this Order under National Environmental Policy Act is "arbitrary, capricious and contrary to law." The Court of Appeals review, and potential set aside, of Order 435.1 could delay closing HLW tanks as required by the Federal Facility Agreement.

Background: In July of 1999 DOE issued Order 435.1 "Radioactive Waste Management." Order 435.1 sets forth the requirements for handling all DOE radiological waste, including the residual waste heel that cannot be removed from HLW tanks after bulk waste removal. Before closing an SRS HLW tank, the residual heel that cannot be removed must be able to meet the 435.1 criteria of Waste Incidental to Reprocessing (WIR).

Under Order 435.1, waste resulting from reprocessing spent nuclear fuel that is determined to be incidental to reprocessing is not high-level waste. It is managed under DOE's regulatory authority in accordance with the requirements for transuranic waste (TRU) or low-level waste (LLW), as appropriate.

When determining whether spent nuclear fuel reprocessing plant waste is managed as TRU/LLW or as high-level waste, either the citation or the evaluation process is used:

- **Citation**: Waste incidental to reprocessing by citation includes spent nuclear fuel reprocessing plant wastes such as contaminated job wastes including laboratory items such as clothing, tools, and equipment. The waste heel remaining in HLW tanks clearly does not meet the Citation criteria.
- **Evaluation**: Waste incidental to reprocessing will be managed as TRU or LLW and meet the following criteria:
  - Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and
  - Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*; and
  - Are to be incorporated in a solid physical form at a concentration that does not exceed concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize.

DOE is planning to develop a Waste Incidental to Reprocessing Determination to satisfy the requirements in Order 435.1 for the waste heel remaining in Tank 19.

Assumptions: Closure will proceed as planned with no impact from this appeal.

Contingencies: If the Court of Appeals sets aside 435.1 then DOE could revert back to the previous Radioactive Waste Management Order (5820.2A) that preceded 435.1 and close the remaining tanks under NRC guidance.

Order 5820.2A had no provisions for evaluating the waste heel of a HLW tank in order to manage that heel as low level waste. However, before 435.1 issuance, DOE determined that the material remaining in Tanks 17 and 20, at closure, satisfied criteria for "incidental waste," since it met the NRC guidance available. That is, the waste heel remaining after waste removal:

(*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."*

7.15 Control Systems Obsolescence

Issue: Many of the major process control computer systems in the HLW Division are nearing the end of their planned useful life. Some, especially the distributed control systems at DWPF and HDB-8 which were installed 15 years ago, can be characterized as being technologically obsolete. Therefore, projects to replace the DCSs in DWPF, H and F Tank Farms and WPT are included in the funding requirements over the next five years. Failure of any of these process control computer systems would have a significant impact on meeting process commitments.

Background: There are 52 Mission Essential computer systems in the High Level Waste Division. These include distributed control systems (DCSs), programmable logic controllers (PLCs), and other PC-based and minicomputer-based systems, as well as the network equipment used to link these systems. The systems most in need of replacement are the DWPF production DCS, the H-Area Diversion Box #8 DCS, the F Tank Farm DCS, the waste removal/replacement evaporator DCS, and the WPT HVAC PLC and DCS.

Of these systems, the most urgent is the DWPF DCS replacement. It was installed 15 years ago; vendor software support stopped five years ago; and vendor hardware support stopped four years ago. All current spares are refurbished used parts. Based on current operating trends, the last of the inventory of refurbished spares will be consumed in the FY03 timeframe. This DCS controls all operations of the plant, including melter operations, pouring, valves opening/closing, pumps, transfers and ventilation. It will be replaced at a cost of approximately $15 million from FY01-FY03.

The vision for HLWD process controls is to have a single control system architecture deployed across the division. This architecture would be based upon open systems concepts and use commercial standards for both hardware and software. This combination of a single, consistent division architecture and the use of commercial standards will provide a common user interface between facilities, resulting in a more versatile and flexible workforce. It will also allow better implementation of new technology and process changes, will permit interconnectivity of control rooms, will improve information flow across all division facilities, and will reduce the life cycle costs of these systems.

Assumptions:

- Outages at each affected facility will be scheduled and staffed in order to accomplish the replacements and upgrades.

- Replacements and upgrades to existing facility systems will include replacing or upgrading the associated development and simulator systems.
- Control systems will be equipped with redundant computing components in order to prevent failure of a single component from jeopardizing the integrity of plant systems.
- Continuing training for support personnel will be planned and funded in order to maintain the staff’s technical expertise.
- Control System modifications resulting from future missions will only require extensions, additions, or deletions to the control systems, and not wholesale replacements or upgrades.

Contingencies:

- Failure to adequately maintain the HLWD control systems will result in an overall cost increase to the division. This is due to increased maintenance and engineering costs as well as increasing the potential for production outages due to unplanned control systems failures. Facilities could be shut down until replacements and upgrades can be made.
- Engineering must develop the manual operating capability required to allow removal of automatic control during the replacements and upgrades.

8. Integrated Production Plan

8.1 Overview

The following integrated production plan supports the implementation of all the Cases in this Plan. However, note that successful implementation of this production plan is contingent upon:

- Availability of funding as shown in Appendix J.1 for the Super Stretch Case, Appendix I.1 for the Stretch Case and Appendix H.1 for the Base Case
- Successful management of Tank Farm space
- Successful performance of waste removal projects in the Tank Farms
- Successful sludge batch preparation in ESP
- Successful implementation of the Salt Processing Facility with a startup in FY10.

This section provides a summary discussion of the key constituents of Tank Farm space. It is followed by a detailed description of the current Tank Farm space management strategy. Section 8.1.2 describes the effect of each influent and effluent stream in the Tank Farms, and its impact on Tank Farm operations. Sections 8.2 through 8.10 describe the production requirements for each HLW facility to support this Plan.

8.1.1 Tank Farm Waste Storage Space

Tank space, if not managed properly, could impact the ability to receive influents from the Canyons and DWPF and to store salt concentrate from the evaporators. A review of some terms used to define tank space and a summary of current tank space conditions is outlined below.

Useable Tank Space (or Working Inventory): 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 "Useable Tank Space." The Useable Tank Space has the following distinctives:

For planning purposes, the maximum capacity (**Tank Operating Limit**) of the Type III and Type IIIA tanks is assumed to be 1,270,620 gallons, which is 35,100 gallons less than the TSR limit of 1,305,720 gallons. The only exceptions to this are the 2F and 2H Evaporator feed tanks, Tanks 26 and 43, in which the Operating Limit is 1,263,600 gallons, due to the elevation of the evaporator feed pump motor.

The non-compliant (Types I, II, & IV) tanks (Tanks 1-24) are excluded because they do not meet current requirements for secondary containment and leak detection, with the exception of storage of low source term waste in Tanks 21-24 and Tanks 5-8 (on a limited basis- See Section 8.1.2). The Tank Farm Industrial Wastewater Operating Permit does not allow waste to be added to tanks that currently leak or have leaked.

Tanks 48, 49, and 50 are excluded, at this time, primarily because unplanned additions of large waste volumes would alter the waste composition. This would possibly violate strict process chemistry controls. Tanks 49 and 50 are planned to store concentrated waste, but field modifications will be required and technical issues must be resolved before returning these tanks to waste storage service. As described in Section 8.1.2, work has already been initiated to allow both of these tanks to store concentrated waste.

ESP Tank 51 is excluded from the Useable Tank Space calculation because unplanned additions of waste would alter the washed sludge composition, thus interrupting feed to DWPF while the waste is re-qualified. When Tank 40 begins feeding sludge for Sludge Batch 2 to DWPF in FY02, its volume will be removed from the Useable Tank Space calculation and the Tank 51 volume will be added.

The "Useable Tank Space" is the tank space available to support routine Tank Farm activities, such as inter-tank transfers and evaporator operations, and to store waste received by the Tank Farms. As of March 1, 2001, the F and H-Tank Farms have a combined 655 kgal of Useable Tank Space as is illustrated in Table 8-A. Due to the operational issues discussed in this Plan associated with the 2H and 3H Evaporators, Useable Tank Space decreased from 1,359 kgal at the beginning of FY01 to the 655 kgal as of March 1, 2001. Implementation of the

Tank Space Management Strategy outlined in Section 8.1.2 will allow HLW to increase Useable Tank Space to levels required to continue meeting process commitments.

Table 8-A Useable Tank Space				
	No Tanks	Volume (millions of gallons)		Comments
	51			Total number of tanks
Less	2			Tanks 17 & 20 Closed (filled with grout)
Equals	49	55.2		Total Maximum Capacity (TSR/OSR Limit)
	49	47.3		Total Working Capacity (Tank Operating Limit)
			20.0	*Total Stored Supernate*
			15.3	*Total Stored Salt*
			2.9	*Total Stored Sludge*
Less		38.2		Total Stored Waste (including process tanks 48,49,50,&51)
Equals		9.2		Total Working **Freeboard**
Less	24	2.9		Freeboard in Types I, II, and IV tanks
Less	4	3.0		Freeboard in Processing Tanks (Tanks 48, 49, 50, & 51 – unavailable for reuse)
Less		2.6		Contingency Transfer Space (reserved in the event of a tank leak)
Equals	21	.7		Total **Useable Space**
			0.2	*F Tank Farm Minimum Evaporator Requirement*
			0.4	*H Tank Farm Minimum Evaporator Requirement*
			0.1	*F Tank Farm Minimum Waste Receipt Requirement*
			0.1	*H Tank Farm Minimum Waste Receipt Requirement*
			0.5	*TF Min Waste Receipt required for ESP support*
Less		1.3		**Working Space**
Equals	21	(0.6)		**Available Space** (Useable Space less Working Space)

NOTE: See Appendix B for further tank space terminology definitions.

As can be seen from Table 8-A above, HLW's goal is to always maintain a minimum of 1.3 million gallons of Useable Space in the Type III tanks to support evaporator operations, Canyon receipts and ESP processing. When the Useable Space drops below 1.3 million gallons (note it is currently at the 700 kgal level), it results in HLW having a negative Available Space value (-600 kgal) as shown above. Though no AB requirements are violated, the low working inventory level impacts HLW's ability to support processing plans. For example, preparation of Sludge Batch 2 in Tank 40 is currently being impacted by the lack of adequate Tank Farm space to support sludge washing activities involving several hundred thousand gallons of water. Some washing steps must be delayed until adequate working space is available in the Tank Farm to ensure that Contingency Transfer Space needs are not challenged and to ensure Canyon processing plans are supported. HLW is working diligently to implement the Tank Space Management strategy outlined below to increase the Working Space in the Tank Farm while supporting processing commitments.

Operation of the evaporators is key to obtaining the Tank Farm space needed to support all mission needs. With tank space so tight, the evaporators must, at a minimum, be able to keep pace with influents. In addition to the handling of new influents to the Tank Farm, HLW must also evaporate 7,000,000 gallons of backlogged, supernate stored in Type III tanks to gain additional tank space. The evaporation of the backlogged waste is expected to recover up to 3,800,000 gal of space over the period FY01-FY05. Due to the operational issues associated with the 2H and 3H Evaporators, the backlogged waste increased from 5,000,000 gallons for Revision 11 to the 7,000,000 gallons for this Plan. An additional 4,600,000 gallons of low source term DWPF recycle (in Tanks 21, 22, 24 and 6) and RBOF receipts (in Tank 23) must also be evaporated or used as slurry water for sludge or salt removal.

It must be noted that the Contingency Transfer Space and Useable Space (Working Space and Available Space) are not in one or two convenient tanks but the space is dispersed in tanks across the Tank Farms. A graphic representation of the tanks space in the various tanks is shown in Appendix G (High Level Waste Tank Usage).

8.1.2 Tank Farm Space Management Strategy

As discussed above, the current Useable Space in the Tank Farms is near what is considered to be the minimum to efficiently support planned processing. The amount of useable waste storage space in the Tank Farms is steadily being consumed by continued waste receipts, as is indicated by the following estimated new receipts for FY01:

- DWPF Recycle water 1,600 kgal in 300 receipts
- Sludge Wash Water 1,200 kgal in 3 washwater decants
- Canyon Wastes 750 kgal in 250 receipts
- RBOF 120 kgal in 20receipts.

These receipts are reduced by evaporation (the Tank Farm evaporation systems evaporate approximately 70 - 99% of these receipts depending on the influent source), but the negative impact on available tank storage space is significant. Furthermore, since early sludge removal is conducted from non-compliant tanks, it does not result in an overall net gain in available space in the Type III tanks. In fact, due to the large amounts of sludge processing wash water returned to the Type III tanks, there is an actual overall net space loss in Type III tanks. This is especially true through FY10 when sludge is mainly being removed from high-risk tanks. The overall net waste inventory being stored will begin to be reduced only when salt processing is operational and the salt waste is removed from the tanks.

Based on the assumptions used in the development of this Plan, the Tank Farms will run out of available storage capacity in Type III tanks unless alternative storage options are implemented. HLW System Plan, Rev. 11 outlined a Tank Farm space management strategy. Since the issuance of Rev. 11, there have been changes or updates to several of the assumptions. The updated tank space management initiatives to be implemented are:

1. Continue to evaporate liquid waste, including the backlog of liquid waste that is waiting to be fully concentrated.
2. Continue use of Tanks 21-24 and selected Type I tanks for storage of low source term supernate
3. Convert Tank 49, previously identified as a Salt Processing Tank, back into a HLW Storage Tank.
4. Manage ETF bottoms without the use of Tank 50 as a temporary storage location and convert Tank 50 back into a HLW Storage Tank.
5. Continue DWPF Recycle Stream reduction initiatives.
6. Reduce the minimum Contingency Transfer Space (presently set at 2,600 kgal for the F and H Tank Farms) to the AB minimum requirement of 1,300 kgal.
7. Retrofit additional tanks for use as salt receipt tanks for the Evaporator Systems.
8. Maintain Tank 26 in one of the earlier sludge batches and place the 2F Evaporator in standby.
9. Implement small volume gain ideas to achieve small incremental storage volumes.

These combined actions will adequately manage tank space until the start of Salt Processing in FY10. The Tank Space Management strategy will continue to be evaluated, expanded upon, and updated with the development of each future revision of the Plan as assumptions are validated or revised and as new process information becomes available.

Each of the recommended space gain initiatives listed above is discussed in more detail below. Note that the timing or the need for some of the space gain initiatives is impacted by the processing requirements unique to each of the Cases included in the Plan. A brief summary of any case specific space requirements is included.

1. Evaporate Backlog Waste

At the time of the Plan, ~ 7,000 kgal of supernate waste exists in Type III tanks that can be evaporated to obtain additional Tank Farm space. This unconcentrated supernate can be divided into 4 main categories.

> *Evaporator System Tanks* - The supernate in the evaporator system tanks will be evaporated as part of normal operations. During FY00 some significant progress was made when over 650 kgal of space was recovered through the evaporation of backlog waste that had been stored in Tanks 30 and 32 prior to the 3H Evaporator startup. The evaporator system tanks include:
>
> - 2H Evaporator - Tanks 38 and 43
> - 2F Evaporator – Tanks 26, 46 and 47
> - 3H Evaporator – Tanks 29, 30 and 32
>
> Waste exists in each of these tanks that can be evaporated to obtain additional Tank Farm space.

Canyon Receipt Tanks – The Tank Farms have designated tanks that are dedicated to receive influents from the Canyons. These are Tank 33 in F-Area and Tank 39 in H-Area. Supernate waste from these receipts tanks are periodically transferred into the evaporator systems to recover space to support future receipts. The evaporation of Canyon receipts is considered part of normal operations. However, the plan to evaporate Canyon wastes in the 2F Evaporator to maximize use of salt storage space means that major transfers from Tank 39 through the inter-area line must be coordinated with other process driven transfers.

ESP Sludge Preparation Tank – Large amounts of water are generated as part of preparing sludge feed for feed to DWPF. At the time of this plan, some sludge washwater existed in Tank 40 that will be transferred out to an evaporator system to recover tank space.

Other Tanks – Unconcentrated supernate also exists in Tanks 35 and 42 that can be evaporated further to gain additional tank space. These tanks do not fit into any of the categories listed above. In many cases extensive transfers must be made to support the evaporation of the almost 1.2 million gallons of supernate waste in each of these tanks. To add to the complication of evaporating this waste, the supernate in each of these tanks contains a large quantity of concentrated DWPF recycle waste that is higher in silicon. At this time, it is projected that this waste can only be further evaporated in the 2H Evaporator. Further evaluations and studies will be performed to allow the evaporation of this waste in any of the three evaporators.

The logistics of making the waste transfers required to support both evaporation of backlog waste and DWPF processing will be a major challenge for HLW. The number of annual Tank Farm transfers must increase significantly. For example, the planned FY01 tank-to-tank transfers to evaporate backlog waste and to prepare Sludge Batch 2 for processing are almost triple the number of transfers made over the last three years combined.

The principal risks for this idea relate to the ability of the evaporators and infrastructure to operate on such a demanding schedule. Evidence of this risk has been seen in FY00 and FY01 where evaporator operations have been impacted by the 2H Evaporator solids accumulation issue (See Section 7.10) and the 3H cooling issue (See Section 7.11). The successful resolution of these two major evaporator issues will allow HLW to process off the backlog waste. For the Super Stretch Case, it is anticipated that the full space gain can be achieved from backlog waste evaporation by FY05 except for the waste in Tanks 35 and 42 which can not be evaporated until later due to the issues described above. Evaporation of backlog waste can be performed by essentially the same time for the Base and Stretch Cases. However, the waste in Tanks 35 and 42 would be evaporated earlier than in the Super Stretch Case since other processing (i.e. ESP and DWPF) is generating waste at a slower rate.

2. Continue use of Tanks 21-24 and selected Type I tanks for storage of low source term supernate

Resolution of the technical issues to return the 2H Evaporator to service (See Section 7.10) have proven to be more difficult than originally forecast. The result is that the space gain from evaporation of DWPF recycle has been limited from what was assumed in Rev. 11. The impact to the Tank Farm space management strategy is that non-compliant tanks will continue to be used to store low source term waste in this Plan. Following is a summary of the planned use of non-compliant tanks.

Type IV Tanks

- Tanks 21, 22 and 24 will continue to be used to accept DWPF recycle.
- Tank 23 will be modified and used to store DWPF recycle water in April 2001 if:
  - Tank 6 and 5 remain stable (i.e. no additional leakage of waste into the annulus requiring the movement of waste beyond the currently planned 40,000 gal transfer from Tank 6 to 8), and
  - 2H cleaning is initiated, and
  - Tank 49 catalyst decomposition is initiated

Type I Tanks

- Tank 6 will continue to be used to store the low source term DWPF recycle water transferred from Tank 22 in January 2001. All conditions for continued storage of this material will be met. No further transfers are planned into Tank 6.
- Tanks 5 and 8 will be used to store low source term streams (silica rich heel washwater decants from Sludge Batch 2 and/or DWPF recycle water). Tanks 5 and 8 will be filled in the following manner.

- Recently completed waste removal activities in Tank 8 have demonstrated that no leak sites exist below the 360,000 gallon level. Tank 8 will be maintained exclusively for Tank 6 and 5 Contingency Transfer Space until May '01 and then if:
  - Tank 6 and 5 remain stable (i.e. no additional leakage of waste into the annulus requiring the movement of waste beyond the currently planned 40,000 gal transfer from Tank 6 to 8), and
  - Good progress is being made in cleaning 2H, and
  - Tank 49 catalyst decomposition is nearing completion, and
  - Tank 8 has been placed and maintained in a transfer ready condition, and
  - Visual tank crawler inspections have been completed on the Tank 8 primary wall prior to placing material above the 360,000 gallon level, then

  Tank 8 will be used to receive transfers of DWPF recycle from Tank 22. Any transfers into Tank 8 above the 360,000 gallon level will be controlled in 100,000 gallon increments. A minimum of 30 days will be maintained between transfers to monitor for annulus wetting. Tank 8 can continue to be filled in this manner until the maximum allowable tank level is reached.

- Tank 5 will be used for the storage of DWPF recycle and silica rich heel washwater decants starting in March 2001 if:
  - Tank 6 remains stable (i.e. no additional leakage of waste into the annulus requiring the movement of waste beyond the currently planned 40,000 gal transfer from Tank 6 to 8), and
  - Tank 5 has been placed and maintained in a transfer ready condition, and
  - Visual tank crawler inspections have been completed on the Tank 5 annulus pan and primary exterior wall, and no leak sites have been identified, then

  Tank 5 will be used to receive a ~100,000 gallon transfer of DWPF recycle from Tank 22 in March 2001. After this initial transfer of DWPF recycle, Tank 5 will be used to receive the silica rich heel washwater decants from Sludge Batch 2 washing in Tank 40. A minimum of 30 days will be maintained between each of these transfers to monitor for annulus wetting.

The principal risk with this strategy idea is the risk that leakage will be seen in one of the non-compliant tanks being used for low source term waste storage that requires the waste to be stored elsewhere. With the current tank space conditions, any such situation would result in a significant impact on HLW processing commitments. When the technical issues on the 2H Evaporator are resolved, this Plan does move the low source term material out of the non-compliant tanks over the next several years to be evaporated.

3. Recover Tank 49 for High Level Waste Storage

This idea requires Tank 49, which had previously been allocated as a salt processing tank, to be returned to the Tank Farms for HLW storage. However, Tank 49 currently contains approximately 200 kgal of benzene bearing solution from ITP demonstration runs that must be removed prior to its return to waste storage service.

An aggressive schedule has been implemented to return Tank 49 to waste concentrate storage. The decomposition of the benzene producing phenylborate compounds will be performed in two phases. The first phase was completed in March 2001 when the material in Tank 49 was heated to 40 degrees Celsius. The second phase involves the introduction of copper catalyst to Tank 49. The first copper addition occurred in March 2001 and subsequent additions are scheduled to be completed by May 2001. Once the decomposition of the phenylborates is complete, the material in Tank 49 will be transferred into Tank 50. Modifications required to tie Tank 49 into the H-Tank Farm transfer system (i.e. tie-ins to H Diversion Box 7 (HDB7)) have already been completed.

For all cases, it is assumed that Tank 49 will be available to receive concentrated waste in FY01.

The principal risk with the return of Tank 49 is associated with the effectiveness and timeliness of the phenylborate decomposition through the catalyzed reaction with copper nitrate. The inability of the reaction to reach a satisfactory end point in a timely manner could significantly delay the return of Tank 49 to waste concentrate storage.

4. Recover Tank 50 for High Level Waste Storage

Tank 50 is presently used as a receipt tank for Effluent Treatment Facility (ETF) bottoms, an aqueous waste that is ready for final treatment and disposal as Saltstone or by alternative means. All of the cases described in this

Plan assume that Tank 50 can be returned to HLW waste storage service by the end of FY02. Returning Tank 50 to HLW service requires that the ETF bottoms stored in Tank 50 (an estimated 600 – 700 kgal by FY02) be treated using Saltstone in FY02. This is a change from Revision 11 of the System Plan, where it was assumed that an off-site vendor would be used to process the Tank 50 waste. Since Tank 50 will be required for concentrated waste storage service, the operation of Saltstone for processing newly generated ETF concentrate must be continued on a periodic basis until the startup of Salt Processing in FY10. At that time, the Saltstone Facility must be operated full time to support the large volume filtrate stream from Salt Processing and the ETF concentrate. New storage tank(s) for ETF bottoms may be required to optimize processing of the projected low annually generated stream (approximately 180 kgal/yr) until Salt Processing begins operation. In addition to the potential installation of new tank(s), some transfer line modifications and Tank 50 shielding modifications must be completed.

The principal risk associated with the Recovery of Tank 50 for HLW storage is that the required modifications will not be completed in FY02. This would delay the use of Tank 50 for concentrated supernate storage until the modifications were completed.

5. Continue DWPF Recycle Stream reduction initiatives.

Several ideas have been identified that would reduce the volume of DWPF recycle waste sent to the Tank Farm. The DWPF recycle stream has a low salt concentration and can easily be evaporated. However, the inhibitors that must be added to this high volume stream to meet the Tank Farm WAC result in concentrate that eventually takes up space in the Tank Farm. Therefore, reductions in the total amount of DWPF recycle sent to the Tank Farm can result in space savings.

DWPF has been very proactive in implementing ideas to reduce the amount of recycle being sent to the Tank Farm. An Operations led facility task team took an initial list of DWPF recycle reduction ideas and expanded it to include several new innovative ideas. A major reduction effort was implemented in January 2000 to isolate the steam atomized scrubber steam from the melter offgas system. This idea alone has resulted in an annual 700,000 gallon reduction in recycle being sent to the Tank Farm. Ideas associated with the frit transfer system and reductions in sample line flushes resulted in additional water generation reductions. Through the efforts of this task team, it is now anticipated that the annual recycle being sent to the Tank Farm will be reduced from approximately 2,200 kgal for a 250 can/yr production rate to approximately 1,400,00 gallons or less. Additional DWPF recycle reduction ideas such as the installation of a DWPF acid evaporator are continuing to be evaluated. .

6. Reduce Contingency Transfer Space to 1,300 kgal

The long-standing practice of maintaining 1.3 million gallons of Contingency Transfer Space in the H-Area Tank Farm and the F-Area Tank Farm (2.6 million gallons total) has been analyzed. The Liquid Radioactive Waste Handling Facilities Safety Analysis Report (LRWHF SAR), WSRC-SA-33, specifies a "defense-in-depth" Contingency Transfer Space value for the Tank Farm equal to the largest tank inventory (1.3 million gallons). The use of the Inter-Area Line (IAL) would be required to reduce the Contingency Transfer Space to the minimum value of 1.3 million gallons. The IAL is an underground transfer line between F and H-Tank Farms of approximately 2.2 miles in length.

This idea states that the minimum Contingency Transfer Space would be reduced incrementally from its current value of 2.6 million gallons, as required, to a level that could eventually drop to the Authorization Basis (AB) "defense-in-depth" value of 1.3 million gallons.

Several conditions must be assessed before this idea is implemented. A prerequisite for reducing the Contingency Transfer Space would be to qualify the IAL for contingency transfer readiness. Procedures must be written and some upgrades made to the IAL to assure it is always available. The frequency of use of the IAL will increase significantly over the next few years as sludge slurry is sent to the Extended Sludge Processing (ESP) Facility and as backlog waste and wash water are sent to the 2F Evaporator. Experience gained from these transfers will provide a higher confidence in HLW's ability to use the IAL for contingency transfers.

For all cases in this Plan, maintenance of 1.3 million gallons of Contingency Transfer Space is assumed for each Tank Farm until major infrastructure projects are completed. The major infrastructure projects are Tank Farm Support Services (F-Tank Farm) and Piping Upgrades (H-Tank Farm East Hill). In FY06, when Piping Upgrades is completed, the Contingency Transfer Space requirements will be reduced to a total of 1.3 million gallons between the two Tank Farms. The majority of this Contingency Transfer Space will be maintained in H-Tank Farm since most processing activities will be in H-Tank Farm.

7. Retrofit additional tanks for use as salt receipt tanks for the Evaporator Systems.

The 3H Evaporator cooling issues have impacted the planned storage of saltcake formed in the evaporation process in Tank 30. That is, the lack of cooling capability in Tank 30 does not cool the 3H Evaporator concentrate adequately enough for salt to form in the tank (other than against the tank walls). Between now and the startup of Salt Processing, HLW will continue to receive influents, that when evaporated, will form salt. Therefore, to maintain evaporation operations, additional tanks must be made available to store saltcake. For this revision of the Plan, it is assumed that modifications will be required to allow Tanks 27 (FY05) and 42 (FY09) to be used for concentrate receipt service to store saltcake. These tanks are in the 2F and 2H Evaporator systems, respectively. A more detailed discussion of evaporator salt inventory management is discussed in Section 8.1.4.

8. Maintain Tank 26 in one of the earlier sludge batches and place the 2F Evaporator in standby.

Removal of Tank 26 sludge in an earlier sludge batch has been maintained in this Plan. Moving Tank 26 up earlier in the batch sequencing results in improvements in tank space management prior to the startup of salt processing. An additional 280 kgal of tank space becomes available in FY07-08 after sludge is removed from Tank 26 and the tank is returned to waste storage service.

This Plan also credits an additional 200 kgal of working space in F-Tank Farm from placing the 2F Evaporator System in standby. The FY09 time period is later than what was planned in Rev. 11 due to the need to operate the 2F Evaporator for a longer period to use available salt drop space in the 2F Evaporator system

9. Small Volume Gain Ideas

In 1999, the Space Management Task Team identified a list of ideas that have the potential to yield smaller increases in available space. The group of ideas can be broken down into two main categories. Some provide small volume gains ranging up to about 600 kgal. Others suggest better mechanisms (*e.g.* changing operating practices or developing better tracking indicators) that should be evaluated further. Even if the space gains from these ideas are small, they could result in better space forecasting to better manage the available space. If successfully implemented, the small volume gain ideas could also result in overall cost savings if they eliminate the need for other more costly space gain initiatives. The implementation of small volume ideas is important for all cases of the Plan. They will be evaluated and implemented over the next several years to maximize available tank space.

Some of the primary small volume gain ideas include:

- *Install Telescoping Transfer Jets (TTJ) in Selected Tanks*

  Transfer jets are used to move waste from tank to tank to support processing activities. Some of the fixed height transfer jets are set too high and will not allow complete removal of supernate to enable full evaporation of existing waste. Because of this condition, several tanks contain supernate that has not been fully concentrated. For example, the existing transfer jet in Tank 35 is at a level of 150 inches from the tank bottom. If a new TTJ were installed in Tank 35, up to an additional 250 kgal of space could be gained by evaporation of the additional supernate that could be removed from the tank.

  In FY01, the installation of a TTJ in Tank 30 (current 3H concentrate receipt tank) is planned to provide for more efficient operation of the 3H Evaporator. The existing fixed length jet in Tank 30 is 4" off the tank bottom. Therefore, every time a recycle transfer is made from Tank 30 to Tank 32 (3H Evaporator feed tank), the most concentrated supernate in Tank 30 is transferred. The installation of a TTJ will allow HLW to more provide less concentrated feed material for evaporation. This modification should result in more efficient operation of the 3H Evaporator system for the period that Tank 30 is used for evaporator concentrate receipt.

  The principal risk associated with this idea is difficulty (cost, RadCon concerns, etc.) in the removal and disposal of an existing jet and in the subsequent installation of a new TTJ in the required riser. Instead of replacing the transfer jets, an alternative method of reclaiming this space is also being evaluated. Under this alternative method, "heavier" concentrated waste would be transferred into the tank displacing the existing "lighter" waste. The existing jet would then be used to remove this displaced "lighter" feed for further evaporation. This process would be repeated until the waste in the tank was fully concentrated.

- *Revise Tank Farm Waste Acceptance Criteria (WAC)*

  This idea proposes to revise the Tank Farm WAC to eliminate or modify practices that can affect space negatively, especially excess caustic additions and dilutions imposed on receipts from the Canyons and recycle from DWPF. The Tank Farm WAC requires sufficient caustic to be added to waste before it is transferred to assure the tank chemistry is not altered when the waste is added to the tank. Uncertainty related to splashing of waste on walls above the liquid level and the inability to determine how well the new waste mixes with existing waste in the tank has led to these stringent specifications. Improved monitoring of tank chemistry may allow the concentration of inhibitors to be reduced in waste sent to the Tank Farm.

  Some limited progress was made on this strategy idea in FY00. For example, H-Canyon implemented some initiatives that allowed them to still meet HLW WAC while reducing overall waste volume for a limited low assay plutonium (LAP) campaign. For this campaign, a net savings in the Tank Farm of 20 kgal was realized. NMS&S is actively reviewing all waste campaigns for similar waste savings.

8.1.3 HLW System Material Balance

The Useable Tank Space charts shown in Appendices H.8, I.8, and J.8 (for the various cases) were created from data generated by SpaceMan. Inventory by tank type is shown in Appendices H.9, I.9 and J.9. The Tank Farm Material Balance, shown in Appendices H.3, I.3, and J.3, reflects the influent and effluent streams figures produced by the space management model. Note that the balance sheets only reflect the volume of waste coming into the tank farms and the volume leaving the tank farms. They do not include lost space from saltcake creation during the evaporation process, and therefore, actual space recovery cannot be ascertained from these tables. Refer to Useable Space Charts for a forecasted space outlook. Available tank space is dependent on a balance between influents to the Tank Farms, evaporation of excess water, process timing, and effluents to DWPF, Saltstone, and the Effluent Treatment Facility. Management of the available space is critical during the next ten years due to the current low Useable Tank Space in the Tank Farms. The lack of tank space adversely affects the ability to receive influents from the Canyons and DWPF, and to store salt concentrate from the evaporators. A detailed discussion on forecasted influents and effluents and their impact on the HLW System is provided below.

Influents – Canyons

The WSRC Nuclear Materials Stabilization and Storage Vision 2006 Roadmaps (both the Stretch Case and Base Case) have been used to identify materials to be stabilized in F and H Canyons and the time frame each campaign will occur. This is documented in the Waste Forecast for NMS&S. Waste volumes have been estimated for each campaign and are given below in chronological order of waste generation.

F-Canyon Low Heat Waste (LHW) and High Heat Waste (HHW):

- EBR II and Mark-42 will be dissolved and processed, creating approximately 84 kgal of LHW and 270 kgal of HHW.
- Rocky Flats Scrub Alloy (RFSA) will be processed and generate approximately 32 kgal of LHW.
- New SRS SS&C will be processed and generate approximately 32 kgal of LHW.
- The Am/Cm project is expected to generate approximately 30 kgal of HHW.
- Outside Facilities operations (General Purpose evaporator) will generate approximately 4 kgal of LHW per month. It is currently assumed that the Lab Waste evaporator will not operate.
- Generation of approximately 4 kgal of routine LHW and approximately 3 kgal of routine HHW is expected each month.
- The remainder of the carbonate solutions containing a plutonium di-butyl phosphate (Pu/DBP) complex will generate approximately 65 kgal of either LHW or HHW.
- Deinventory flushes are forecasted to generate approximately 240 kgal of LHW and 240 kgal of HHW.
- Shutdown flushes are forecasted to generate 240 kgal of LHW.

H-Canyon Low Heat Waste (LHW) and High Heat Waste (HHW):

- Processing of Mark 16 and Mark 22 charges is scheduled to continue through March 2004. This will generate approximately 16.7 kgal of low heat waste per month through March 31, 2004.

- A Warm Canyon Process Vessel Vent (PVV) filter flush is scheduled for October/November 2001. It will generate approximately 20 kgal of relatively dilute waste to be transferred to the Tank Farm in November 2001.
- Anion exchange recovery of neptunium in HB-Line is being planned, but is not currently scheduled.
- Transfer of Pu-238 flush was completed in January 2000. Dilution necessitated due to Pu-238 produced a total of approximately 17 kgal of low heat waste.
- Mixed scrap from HB-Line will generate about 4 kgal a month for 3 months starting May 2001.
- Beginning in April 2001, Sterling Forest Oxide will generate 3.1 kgal per month of low heat waste until June 30, 2003.
- Unirradiated Off Spec Type II HEU Alloy will generate about 17.6 kgal per month from April 2000 to December.

Influents – DWPF Recycle: DWPF recycle volume will vary over the life of the facility. The volume of recycle generated reflects sludge-only canisters versus combined sludge and precipitate canisters, planned canister production rates, and the age of the facility. (As the facility ages, maintenance needs for contaminated equipment will increase, thereby increasing the amount of spent decontamination water generated.) Significant efforts have been implemented to reduce the amount of recycle sent to the Tank Farm. Based on these reduction efforts, DWPF plans on sending approximately 1,000,000 - 1,300,000 gallons/yr of DWPF recycle to the Tank Farms over the next several years depending on the can production. The recycle algorithm has been updated to reflect recent facility operating experience, and is explained in Section 8.6.

Influents – Other: Miscellaneous influents are received into the Tank Farms from RBOF (approximately 120 kgal/year), the 299-H repair facility (approximately 12 kgal/year), rainwater from sumps (approximately 85 kgal/year), and internal additions such as flushes (approximately 50 kgal/year). The volumes are based on historical information. For the purposes of this plan, it is assumed that 99.5% of this volume is recovered via evaporation.

Influents – Inhibited Water: Inhibited water additions include ESP Wash Water, Salt Dissolution Water and Tank Wash Water.

> *ESP Wash Water:* The ESP wash water volumes are based on GlassMaker modeling for each of the remaining sludge batches. The wash water for each batch is generated during the 13 to 17 month period immediately before the batch is fed to the DWPF. The wash water duration will vary from batch to batch depending on waste composition. No distinction is made between sludge wash water and the water used to slurry and transport the sludge to the ESP tanks. It is currently assumed that all of the ESP washwater will be evaporated. However, some washwater may be used for sludge removal or to dissolve salt. For more details on ESP, refer to Section 8.5.1.
>
> *Salt Dissolution Water:* Inhibited water is added to dissolve the “saltcake” currently stored in evaporator receipt tanks. Though it varies from tank to tank, it takes approximately 2 - 3 gallons of water to dissolve a gallon of “saltcake”. In this Plan, salt dissolution is performed in Tank 37 to allow for its use as the 3H Evaporator concentrate receipt tank (See Section 7.11). Salt dissolution is also performed to feed Salt Processing.
>
> *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 kgal, which is a level of about 40 inches in most tanks. The annulus wash assumes two 25-kgal washes, which is a level of about 24 inches in the annulus for each wash. This Plan assumes that all tanks are water washed.

Influents – Jet Dilution: Transfer jets are used to transfer waste from tank to tank. Steam is used as the motive force for operation of the transfer jets. As the steam condenses, volume is added to the waste. This condensed steam, or jet dilution, is 4% of the transfer volume based on historical information. An additional 12% dilution is assumed for any inter-area line transfer to ensure that no pluggage occurs over this 2+ mile transfer route. The amount of jet dilution added is directly proportional to the volume of waste transferred.

Effluents – Space Recovered from Evaporation: The 2F, 2H, and 3H Evaporators reduce the volume of dilute, influent waste streams. In order to maintain available space in the Tank Farms during the extended Salt Processing evaluation outage, the evaporators have also begun to evaporate dilute supernate (backlog) from Type III tanks. In FY00, approximately 650 kgal of space was recovered in the 3H Evaporator system by the evaporation of waste that had been stored in Tanks 30 and 32. Additional tank space will be gained over the period FY01-FY06 as other backlog waste is processed through the evaporators. Reference to “evaporator space gain” for new Tank Farm influents is a misnomer, because evaporator operations can only minimize the effect of waste additions as saltcake, concentrated supernate (caustic liquor), and sludge accumulate. The only true source of Tank Farm space gain is to operate a Salt Processing facility, thereby processing the salt and supernate into an acceptable solid waste form (glass or grout). For more details on evaporator operations, refer to the “Evaporator Salt Inventory” section below, and Sections 8.2.2 and 8.3.2.

Effluents – Sludge to ESP: Removing sludge from Type III tanks provides the only space recovery from sludge removal operation.

Effluents – Supernate to Salt Processing: Space gain occurs when concentrated supernate, unconcentrated supernate, or dissolved saltcake is fed to a Salt Processing facility. This Plan credits recovered space immediately when it is fed to the Salt Processing facility. The recovered space could be made available to store concentrated supernate from an active evaporator drop tank or any liquid waste, in the unlikely event of a tank leak. Although the salt processing technology has not been selected, for planning purposes this Plan assumes that space gain is achieved using Small Tank Precipitation. For more details on Salt Processing, refer to Section 8.5.2.

8.1.4 Evaporator Salt Inventory Management

The evaporators reduce the volume of the various waste streams that have been received in 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. The Spaceman model takes the influent stream forecasted volumes and their associated compositional data and models the impact on Tank Farm space. The evaporation simulation for the generation of salt, salt concentrate, and overheads production to ETF is based on current supernate thermodynamic models.

As shown in the tank chart in Appendix G, salt receipt space in the Tank Farm is at a premium. The 2H and 2F Evaporator systems have limited remaining salt receipt space in Tanks 38 and 46, respectively. The 3H Evaporator system currently has salt receipt space in Tank 30. However, as discussed in Section 7.11, cooling issues in Tank 30 have limited its use for concentrate or salt receipt. Therefore, a salt dissolution campaign in Tank 37 is required in FY02 (for the Super Stretch and Stretch Cases) or in FY03 (for the Base Case) to allow its use for a concentrate (or salt) receipt tank for the 3H Evaporator. After dissolution, the salt solution will be transferred to the 2F Evaporator system where evaporation will re-deposit the salt in Tank 46. After processing the waste in the 2F Evaporator to remove the majority of the salt, the waste can then be transferred to the 3H Evaporator system for further concentration (See Section 8.2.2 and 8.3.2).

In running the Spaceman model for the various cases in this Plan, all efforts were made to maximize space gain by processing certain waste streams in selected evaporator systems to take advantage of the available salt receipt space. For example, all efforts were made to process all Canyon waste, which generates a high volume of salt when evaporated, in the 2F Evaporator system to take advantage of the salt receipt space in Tank 46.

Even with the optimization of processing certain influent streams in selected evaporators, the Spaceman modeling runs indicate that additional salt receipt space must be made available in all evaporator systems. For the Super Stretch Case it is predicted that the 2F and 2H Evaporator systems would run out of salt receipt space in FY05 and FY10, respectively. By that time, it was assumed that some modifications would have to be made to allow Tank 27 to be used as an evaporator receipt tank for the 2F system and Tank 42 to be used as an evaporator receipt tank for the 2H system. The modifications would include the installation of a new backflush valve and other associated equipment.. For the Super Stretch Case, an additional salt dissolution campaign must be performed in Tank 37 in FY04 to support continued 3H Evaporator operations.

The Stretch Case also required modifications to provide additional salt receipt tanks. Tank 27 must be available for use in FY06 and Tank 42 must be available in FY11. An additional Tank 37 dissolution campaign is required in FY05.

Similarly, the Base Case also required modifications to provide additional salt receipt tanks. Tank 27 must be available for use in FY06 and Tank 42 must be available in FY12. An additional Tank 37 dissolution campaign beyond the one performed in FY03 is not currently anticipated for the Base Case.

8.2 H-Tank Farm

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

8.2.1 H-Tank Farm Useable Space

The H-Tank Farm includes twelve non-compliant waste storage tanks, eleven new-style tanks, and three evaporator systems (two of which are operational). At the time of this Plan (March 1, 2001), H-Tank Farm has approximately 500 kgal of Useable space (or Working Inventory) available.

8.2.2 H-Tank Farm Evaporators

Described below are the current plans for waste processing in the evaporator systems. The evaporator processing plans are routinely evaluated to optimize available tank space to support HLW mission needs. At a minimum, this evaluation is performed with the development of each revision of the HLW System Plan. Resolution of major evaporator issues such as those described in Section 7.10 and 7.11, revised influent stream forecasts and alternative space management strategies are all factors reviewed in the evaluations.

The **2H Evaporator** system includes one feed tank (Tank 43) and two salt receipt tanks (Tanks 38 and 41). Tank 38 is the active receipt tank; Tank 41 is full of salt. In past years the primary role of the 2H Evaporator was to evaporate the 221-H Canyon LHW stream and the DWPF recycle stream, both of which have been received in Tank 43 and evaporated. With the resolution of the 2H Evaporator PISA still pending, as described in Section 7.10, the role of the 2H Evaporator is being reassessed. The primary H-Canyon waste streams have been successfully redirected into Tank 39. The only other waste streams that are transferred directly into Tank 43 are from the 211-H outside facility General Purpose Evaporator and the 299-H maintenance facility. As required, the H-Canyon waste will be transferred out of Tank 39 for eventual evaporation by either the 3H or the 2F Evaporators. For the purposes of this plan, it is assumed that the 2H will only be used for processing DWPF recycle (both newly generated and currently stored backlog) and other high silicon streams.

Based on the status of the 2H Evaporator PISA issue, this revision of the Plan does not count on the 2H Evaporator resuming operations until the summer of FY01. DWPF recycle will be received into Type IV tanks (Tanks 21-24) until 2H restarts. Transfers are planned to relocate some of the DWPF inventory in the Type IV tanks to Type I tanks (5, 6 and 8) in FTF. It should be noted that the receipt of DWPF recycle into Type IV and Type I tanks does not impact Tank Farm Usable Space since only Type III tanks are used in determining the Usable Space volume.

When restarted in FY01 the 2H Evaporator is forecast in this Plan to process the 1,000,000 - 1,300,000 (current rate) to 2,500,000 (after the start of Salt Processing) gallons/yr of DWPF recycle that is received into the Tank Farm. The ability of the 2H Evaporator to meet these higher early year production rates was demonstrated in FY98 and FY99 when over 2,000,000 million gallons of space gain was recorded in each year. Since this Plan assumes that the evaporation of DWPF recycle is limited to the 2H Evaporator only, its continued operation is key to the success of ensuring continued DWPF canister production.

It should be noted that the 2H Evaporator has experienced several unplanned extended outages over the last few years that have impacted its ability to operate as planned. Based on past experience it is expected that events (physical or technical) will continue to emerge that lead to unplanned future evaporator outages. A summary of recent unplanned evaporator outages is included in Section 11.3.2.

The **3H Evaporator system**, which was initially put into service in FY00, includes one feed tank (Tank 32) and two salt receipt tanks (Tank 30 and 29). Tank 30 is the active receipt tank; Tank 29 is mostly full of salt and is used as the evaporator vent tank. Over the past year, the 3H Evaporator gained ~650 kgal of space by evaporating backlog waste that had been stored in Tanks 30 and 32. The 3H ran better than forecast during FY00 until the early part of November when cooling coil failures were experienced in Tank 30. These failures have resulted in the inability of the 3H system to run for extended periods without challenging the temperature limits established for Tank 30 (See Section 7.11). A Multi-Discipline task team was assembled to study the failure and make recommendations on how the 3H could continue to operate on a limited basis while coming up with an alternate long-term strategy for running the 3H system. For the purpose of this plan, the 3H system is expected to be limited in its production capability, for the reasons mentioned previously, through the end of FY02. During FY03 and after, the 3H is currently planned to be used to evaporate ESP washwater and further volume reduce previously evaporated waste prior to final storage and processing by Salt Processing Facility.

In this capacity, the 3H Evaporator is a key element in ensuring adequate Tank Farm space is maintained until the start of salt processing. As discussed in Section 8.1.4, all efforts will be made to first evaporate high salt bearing waste streams in the 2F Evaporator due to its available salt receipt space. After evaporation in the 2F Evaporator to ~8 molar hydroxide [OH], the "de-salted" waste will be transferred for further concentration in the 3H Evaporator system. The 3H Evaporator has the ability to concentrate the waste to a higher molarity hydroxide (~11-13 molar), thereby obtaining additional tank space.

8.2.3 H-Tank Farm Waste Removal Operations

Salt Removal

With the delay in Salt Processing, maintaining sludge feed to DWPF will be the focus for the next several years. Note that as described in Section 8.1.4 there will be a salt dissolution campaign in Tank 37 during FY02 as part of the 3H Evaporator cooling resolution. It is anticipated that valuable information on salt dissolution will be obtained from this limited salt removal campaign.

Sludge Removal

The washed sludge in Tank 51 is currently being fed to DWPF as Sludge Batch #1A. This operation will continue until the end of FY00.

The Extended Sludge Processing facility is currently washing Sludge Batch #2 in Tank 40. This batch consists of the sludge in Tank 40 combined with the sludge from Tank 8. This batch must be ready to feed by 12/01 to support planned canister production.

8.2.4 H-Tank Farm Waste Removal Project

Tank 11 – design and construction activities will be stopped in FY01 after completion of the Tanks 9-16 gang valve and Tank 11 tanktop services. The tank will be layed up per the Tank 11 Lay-up Plan until work can be resumed in FY03.

Tank 37 – design and construction of salt removal and gravity drain line equipment will start in FY01 to enable Tank 37 to serve as a concentrate receiver for the 3H Evaporator in lieu of Tank 30. Construction and testing activities will be completed and the tank turned over to Operations in FY02.

Tank 50 – design and construction of modifications to return Tank 50 to HLW supernate storage service will be initiated in FY01. Construction and testing activities will be completed and the tank turned over to Operations in FY02.

8.3 F-Tank Farm

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

8.3.1 F-Tank Farm Useable Space

The F-Tank Farm includes twelve non-compliant waste storage tanks, two of which are now closed; ten new-style tanks; and two evaporator systems (one of which is operational). At the time of this Plan (March 1, 2001), F-Tank Farm has approximately 200 kgal of useable space available.

8.3.2 F-Tank Farm Evaporators

As can be seen in Appendix G the **2F Evaporator** system includes one feed tank (Tank 26) and seven salt receipt tanks (Tanks 25, 27, 28, and 44 – 47). Tank 46 is the active receipt tank while Tank 47 is the vent tank. Tanks 25, 28, 44 and 45 are full of salt. Tank 27 is currently full of high hydroxide concentrated supernate. In past years the primary role of the 2F Evaporator was to evaporate the 221-F Canyon LHW stream, existing stored "backlog" waste and some of the ESP washwater. With the resolution of the 2H Evaporator solids accumulation issue and the 3H cooling issue, as described in Sections 7.10 and 7.11, respectively, the role of the 2F Evaporator has been revised for this Plan. Due to the limited salt storage space in the 2H and 3H Evaporator systems, the current plan calls for the 2F Evaporator to evaporate all Canyon waste from both F- and H-Canyons. In addition, the 2F Evaporator will process a large share of the washwater generated from ESP and it will evaporate the salt dissolution streams from Tank 37 in FY02.

Under all cases in this Plan, the 2F Evaporator is expected to continue to operate until FY09. A 6 month outage is provided for in FY03 to account for an expected evaporator vessel tube bundle failure. HLW experience in operating HLW evaporators indicates that the average life expectancy of evaporator vessels is 10.5 years. The 2F Evaporator vessel will reach 11.5 years of service in April 2001. The plan is to operate the 2F Evaporator until failure, so a specific replacement outage is not specifically scheduled at this time. A new vessel has been received and placed in storage. The new vessel serves as a spare for either the 2F or the 2H Evaporator systems. In FY00 the **2F Evaporator** system achieved a space gain total of approximately 377 kgal. During the year, the 2F system experienced several planned and unplanned outages that varied from utility infrastructure problems to TSR implementation of key components. As described in Section 7.10 the 2F Evaporator operations were suspended while 2H PISA issues were resolved. The Evaporator System is back in normal operations at the time of this plan.

8.3.3 F/H Interarea Transfer Line

The capability to transfer between F-Tank Farm and H-Tank Farm is critical to the success of the Plan. Transfers are made through a 2.2 mile transfer line (Interarea Line). In the past two years, HLW has successfully made several inter-area lines including the recent Tank 8 to ESP sludge transfer recently completed in January 2001. To successfully support the current processing commitments for Sludge Batch 2 preparation and planned space management activities, a total of eleven (11) Interarea line transfers are currently planned over the next 12 months. This number of Interarea line transfers exceeds the total number made over the last 3 years and will be a major challenge for HLW. The Interarea Transfer Line will continue to be used over the life of the program to support waste removal and space management activities.

8.3.4 F-Tank Farm Waste Removal Operations

Salt Removal

With the delay in Salt Processing, all efforts for the next several years will be focused on maintaining sludge feed to DWPF.

Sludge Removal

Tank 8 – The first sludge removal campaign since the late 1980’s was recently completed in January 2001 when Tank 8 sludge was successfully slurried and transferred to Tank 40 in ESP. A detailed description of this successful sludge removal campaign is provided below. This process should be typical for future sludge removal activities, though lessons learned should allow some activities to be improved upon.

Project installed waste removal facilities were turned over to Operations in 4/00. A Graded Readiness Assessment was completed and waste removal operations were started in 5/00. The initial sludge elevation was 49”. The initial slurry pump suction elevation was 50” for all four pumps. A gas chromatograph (GC) was used to continuously measure the hydrogen concentration in the tank vapor space to ensure that an excessive release of hydrogen approaching a flammable or explosive concentration did not occur. The GC was also used to indicate when the slurry pumps achieved the full cleaning radius. This generally took about eleven days of continuous slurrying at each slurry pump elevation. The pumps were lowered in ten inch increments until the suction elevation of each pump was ten inches above the tank floor. The transfer pump was lowered to four inches above the tank floor. Inhibited water was added to adjust the insoluble solids concentration to about 12 wt %. The resultant slurry was transferred to Tank 40 down to a level of 4.8” in Tank 8. It is estimated that 15 kgal of sludge remain in Tank 8. This is significantly better than expected after one sludge removal batch. Bulk waste removal from Tank 8 was declared complete. There are no plans for heel removal in the near term due to the general lack of tank space.

Tank 19 – The waste removal line item project and the Tanks Focus Area provided the following facilities on Tank 19: three 50 hp Flygt mixers; a transfer pump mast supporting a Bibo pump (a 250 gpm industrial grade sump pump) and a Pitbull pump (a 50 gpm air powered pump capable of pumping down to a ½ inch heel); a piping system to transfer slurry to Tank 18, allow the solids to settle, and then transfer the clarified liquid back to Tank 19 for reuse as slurry media.

The project was turned over to Operations in 8/00. A Graded Readiness Assessment was completed and waste removal operations were started 9/00. The initial solids volume was estimated to be 33 kgal consisting of 13 kgal of zeolite, 7 kgal of sludge, and 13 kgal of insoluble salt. The Bibo transfer pump was initially installed on top of a 40" mound of hard sludge/zeolite. The Flygt mixers were unsuccessfully operated to slurry or erode the solids mound so that the Bibo transfer pump could be lowered to the tank floor. A 7,000 psi hydrolance was used to break up the solids mound and the transfer pump was then lowered to the tank floor. A total of 15 waste removal batches had been completed as of January 31, 2001. It is estimated that 18 kgal of solids remain. Waste removal will continue until less than 1,000 gallons of solids remain.

8.3.5 F-Tank Farm Waste Removal Project

Tank 7 - The sludge from Tank 7 will be combined with the heel of sludge in Tank 51 left over from Sludge Batch #1A thus forming Sludge Batch #3. Near term activities on Tank 7 are scheduled as follows:

- In FY01, the following activities will be completed: installation of shielding on riser 2, installation of pump platforms on risers 1 and 3, development and testing of an improved prototype Lawrence slurry pump, installation of all four improved slurry pumps, installation of the transfer pump and tie in of the transfer line.
- In FY02, the following activities will be completed: installation of the HVAC skid, installation of all instrument and electrical controls and services, and testing of all new instruments and equipment will be initiated.
- In FY03, testing will be completed, a Graded Readiness Assessment will be performed and bulk waste removal will be completed.

This schedule provides just-in-time support for planned DWPF production and easily supports the FFA closure date.

Tank 18 – the sludge removal technical baseline includes replacing the three failed slurry pumps with three new slurry pumps with different discharge configurations. A Systems Engineering Evaluation was completed 2/01 that recommended a high capacity Advanced Design Mixer Pump mounted in the center riser in lieu of the three standard slurry pumps in the outside risers and a Bibo sump pump in lieu of a standard Telescoping Transfer Pump in the northeast riser. Development of the safety strategy and equipment design started 3/01. Near term activities on Tank 18 are scheduled as follows:

- In FY01, the following activities will be performed: completion of design for the transfer system, initiation of procurement for all long lead items, initiation of design for slurry pump and other associated tank equipment, and a decision will be made regarding the feasibility of developing a modified ADMP that can fit in a 24" riser.

- In FY02, the following activities will be performed: all design will be performed: all construction and testing and turnover for the transfer system will be completed by 8/02, the ADMP refurbishment will be completed, and truss modifications will be completed.

- In FY03, the following activities will be performed: all construction and testing will be completed, a Graded Readiness Assessment will be completed, and the facility started up by 3/03.

Tank 19 – design for tank isolation and tank isolation field work will be completed in late FY02 in support of closure by 3/03.

8.4 Waste Removal

8.4.1 Sludge Removal Technical Baseline

The sludge removal technical baseline is based on four standard 150 hp slurry pumps per sludge tank. The slurry pumps are installed in available risers such that the affected cleaning radius of each individual pump overlaps with the adjacent pumps to enable the entire tank to be slurried. The initial elevation of the pump suction is positioned just above the sludge layer. Water is added to the tank if there is not enough supernate to use as the slurry media. Operation of the slurry pumps will typically suspend all of the sludge that can be suspended at that slurry pump elevation within a few days. The slurry pumps are then lowered in 10" increments, more water is added if needed, and the next layer of sludge is suspended. This sequence of operations is repeated until the slurry pumps are at the lowest elevation, typically 10" or less above the tank floor. The transfer pump is then lowered to its lowest elevation, typically 6" or less above the tank floor. The sludge is now ready to be transferred out of the tank. Sludge removal in this manner is referred to as “bulk waste removal.”

Several additional attempts may be made after bulk waste removal is complete to remove the residual sludge heel by adding more water, slurrying and transferring. This is typically repeated until a point of diminishing returns is reached. This technique was successfully used on Tanks 16 and 17. Sludge was also removed from Tanks 8, 15, 21, 22, and 42 with standard slurry pumps, however the sludge removal operation was stopped without making several attempts to remove the residual sludge heel due to the water additions required. There is currently no baseline for heel removal. A robotic crawler based water monitor will be demonstrated in Tank 19 in FY01-02 if needed. It is very likely that some form of chemical cleaning will be needed for many of the sludge tanks.

8.4.2 Sludge Removal Demonstrations

Two alternate sludge suspension technologies are being developed via the Tanks Focus Area: the Advanced Design Mixer Pump (ADMP) and submersible (Flygt) mixers. The latter is currently being demonstrated in Tank 19 to remove an estimated 33 kgal of sludge and spent zeolite resin. The ADMP, or a modified version thereof, will be demonstrated in Tank 18 in FY03.

8.4.3 Salt Removal Technical Baseline

The salt removal technical baseline is based on 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 operated, the boundary layer of salt solution in contact with the saltcake is displaced thus exposing the underlying saltcake to unsaturated water. When the bulk solution nears saturation, it is transferred to the salt processing facility. Then the slurry pumps are lowered, water is added and the process is repeated. This technique was successfully used on Tanks 17, 19, 20, and 24. Three slurry pumps for salt removal were selected as the project baseline in the early 1980s for four reasons:

- The salt removal rate was fast enough to support a production rate of 405 canisters/year
- The agitation provided by three slurry pumps was vigorous enough to also remove insoluble solids known to be in all salt tanks
- Economy of scale could be achieved by using the same pumps for salt and sludge removal
- Slurry pumps were considered to be cost effective.

Since that time, the cost has increased due to the use of enhanced mechanical seals and slurry pump containment.

8.4.4 Salt Removal Demonstrations

Salt removal demonstrations in actual waste tanks have been postponed due to the delay in salt processing. See Section 9.2 under Technology Development for current work being done on alternative waste removal methods. Three less expensive alternative salt removal techniques were previously proposed, including Modified Density Gradient, a Single Slurry Pump, and a Water Jet.

Note that as described in Section 8.1.4 there will be a salt dissolution campaign in Tank 37 during FY02 as part of the 3H Evaporator cooling resolution. It is anticipated that valuable information on salt dissolution will be obtained from this limited salt removal campaign.

8.4.5 Waste Removal Cost Baseline

Waste Removal project rebaselining for the cost of retrofitting salt and sludge tanks with waste removal equipment is complete. The Baseline Change Proposal was approved by the Energy Systems Acquisition Advisory Board in April 2000. This significant effort provides up-to-date project cost information to use in the HLW Financial Model to determine annual funding requirements and Life Cycle Costs.

8.4.6 Waste Removal Sequencing Considerations

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

1. Maintain Contingency Transfer Space per the Tank Farm Authorization Basis (AB)
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 salt processing, DWPF, and Saltstone feed criteria
5. Remove waste from tanks with a leakage history
6. Remove waste from tanks that do not meet FFA requirements
7. Provide continuous radioactive waste feed to DWPF
8. Maintain an acceptable PHA balance within the salt processing facility
9. Remove waste from the remaining tanks

The principal goal of the regulatory drivers is to remove waste from the non-compliant tanks. In every case, waste will be removed from all of the non-compliant tanks before the FFA commitment date of 2022. However, once Salt Processing is operational salt waste must concurrently be removed from some of the Type III Tanks to support the cleanup of the older tanks. Concentrated supernate and/or salt removal from new tanks are required to maintain the evaporator systems on-line and to provide receipt space for large transfers of ESP washwater and DWPF recycle**.** Removal of concentrated supernate or salt from some Type III Tanks must receive priority over some of the non-compliant salt tanks to enable continued operation of the 2H and 3H Evaporator systems.

Summary of Waste Removal Sequencing Changes

Several changes in sludge batch sequencing have been made in this Plan from what was assumed in Revision 11. The changes, as shown in the Table below, are primarily driven by the current projected funding over the FY01 – FY06 period and the associated impact on preparing tanks for waste removal. Efforts were also made to address higher source term issues in the later sludge batches. The re-sequenced batches were modeled using Glassmaker and are all projected to make acceptable glass:

	Rev. 11 Target	**Rev. 12**
Sludge Batch 2	Tk 8 & 40	Tk 8 & 40
Sludge Batch 3	Tk 7 (100%)	Tk 7, 18 & 19 (70% of all)
Sludge Batch 4	Tk 26, 11 (w/ Al diss.), 18 & 19	Tk 7, 18 & 19 (30% of all), 11 (w/o Al diss.)
Sludge Batch 5	Tk 5, 12 & 15 (w/ Al diss.)	Tk 15 (w/o Al diss.), 26
Sludge Batch 6	Tk 13 (100%)	Tk 5, 6, 12 & 13 (30%)
Sludge Batch 7	Tk 4, 6, 32, 33 & 39 (40%)	Tk 13 (70%), 4 &33
Sludge Batch 8	Tk 21, 22, 23, 34, 39 (60%), 43 & 47	Tk 21, 22, 23, 34, 39 &47
Sludge Batch 9	Tk 35 & Misc. heels	Tk 32 & 43
Sludge Batch 10		Tk 35 & Misc. heels

A summary of the major changes follows:

- Tank 7 has been split into 2 batches. The second part of Tank 7 sludge is combined with Tank 11 sludge to create a new sludge batch. Tank 26 sludge is no longer included in Sludge Batch 4.

  Reason: Projected FY01-06 funding is not sufficient to provide waste removal facilities on Tanks 11 and 26 in time to prevent a DWPF feed break in the FY07-09 time period. If adequate savings could be achieved elsewhere in the overall MSIP program to allow funding to be allocated to either Tank 11 or 26, then an operational strategy could be formulated that could result in no DWPF feed break (i.e. Super Stretch Case). GlassMaker modeling has shown that good glass can be made by combining a portion of the Tank 7 sludge with Tank 11. Tank 11 was chosen over Tank 26 and any other tanks since a large amount of the waste removal project scope has already been completed on this tank. Enough sludge is provided by the new Tank 7 (30%) and Tank 11 sludge batch to provide feed to DWPF over the FY07-09 period at a rate of 200 canisters/yr.

- Tanks 32, 33, 35 and 39 sludge was included in separate batches.

  Reason: These tanks contain the highest source term sludge stored in the Tank Farms. Maintaining them in separate batches helps to alleviate potential future processing problems at DWPF. In particular, Sludge Batches 8, 9 and 10 exceed currently analyzed inhalation dose and/or design basis shielding limits for DWPF. Further analysis will be required to address this issue, though it is likely no or limited changes will be needed to the facilities.

- Aluminum dissolution is not assumed to be performed on Tanks 11 and 15.

  Reason: It is assumed that aluminum dissolution is not performed on any sludge batch due to technical and safety bases uncertainties associated with the process. In particular, impacts on the evaporator operations from the processing of a high aluminum ESP decant are not known at this time. In addition, it is hypothesized that the aluminum removed during the process converts back to sludge over time and is not removed out to Saltstone as originally predicted. While this slightly increases the number of canisters produced during the life of the program, it does not have a negative affect on glass durability and it reduces the technical risk to the program. Additional evaluations and analyses must be completed before aluminum dissolution should be assumed.

8.4.7 Closure Program

The Savannah River Site has begun to close HLW tank systems.

Tank 19 bulk waste removal occurred in 1986 using two slurry pumps mounted in diametrically opposing risers. This equipment configuration created a “beachline” of sludge and zeolite (spent ion exchange media), 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 sample tool (mud snapper) in 1996, revealed that most of the heel is soft and probably easily mobilized. However, very little zeolite was present in this sample. There is a concern that several thousand gallons of zeolite under the northeast riser may exist in a consolidated mass that could be difficult to slurry. Tank 19 heel removal began in October 2000 using three 50 horsepower submersible (Flygt) mixers. Because of the presence of zeolite in Tank 19, SRTC developed and tested a remote crawler. The residual waste and wash water from Tank 19 will be consolidated in Tank 18. The Tank 19 transfer pump riser (TPR) was built to support Tank 18 to 19 transfers. The TPR, along with the two Tank 19 transfer pumps and the Tank 18 recycle pump, allows the liquids, used to suspend the Tank 19 sludge/zeolite for transfer to Tank 18, to be reused. This greatly reduces the new liquid added to the tank farm inventory to empty Tank 19. The two pumps in Tank 19 allow the rapid removal of the majority of the slurry, while also allowing the liquid heel to be reduced to less than one inch. Tanks Focus Area funding supported a significant portion of FY00 activities. Tank 19 closure is currently funded in FY02 and FY03. Closure in FY03 meets DOE’s FFA commitment to close Tank 19 by 2003.

Tank 18 will be the last tank closed in this cluster because Tanks 17, 19 and 20 can only transfer into Tank 18, and Tank 18 is the only one of the four that can transfer out to other tanks. The tank currently contains about 42 kgal of sludge and 308 kgal of supernate. After the Tank 19 waste is transferred into Tank 18, the combined contents of Tanks 18 and 19 will be slurried and transferred to Tank 7. Tank 18 will be closed in FY04. This meets DOE’s FFA commitment to close Tank 18 by 2004.

Tank 16 was the subject of a rigorous waste removal, water washing, and acid washing demonstration during 1978-80. Waste removal from the primary tank is considered complete. However, large quantities of insoluble salts remain in the annulus. Some of the crystallized saltcake may have evolved into natro-devyne, a hard, insoluble compound. A sample tool was developed in the spring of 1998 and deployed in May 1998. Samples retrieved from the annulus were analyzed and preliminary fate and transport modeling revealed that further cleaning is required due to the presence of long half-life radionuclides. Further work on Tank 16 is not currently funded for several years due to other priorities. The FFA closure commitment date is FY15.

8.5 HLW Pretreatment

8.5.1 Extended Sludge Processing (ESP)

General

The main function of the ESP facility is to wash sludge with water to remove excess alkali in order to make the sludge compatible with the vitrification process. As described below, the ESP facility consists of two high level waste tanks (Tanks 40 and 51) that have each been outfitted with four slurry pumps to perform the sludge washing operation. As one of these ESP tanks is being used to feed sludge to DWPF, the other is being used to prepare the next sludge batch. As an example, Sludge Batch 1B is currently being fed from Tank 51 to DWPF, while Sludge Batch 2 feed preparation is underway in Tank 40.

<u>Production Capacity</u>

For planning purposes, sludge batch preparation is expected to require from 13 to 17 months. The feed preparation duration at ESP is typically broken down into the following major activities:

- Receive portion of designated sludge and associated transfer water from designated tank (amount limited by several variables in both the sending and receiving tank)
- Slurry contents using transfer water to remove as much soluble Na as possible
- Decant transfer water to evaporator system
- Repeat process as required until all sludge is received in the ESP processing tank
- When all sludge is in ESP processing tank, perform additional wash and decant cycles. Repeat as necessary to reach proper waste composition. (typically an estimated 4 to 5 additional wash cycles required)
- Sample washed sludge for sludge qualification once all sludge is in the ESP processing tank
- Qualify sludge by characterization of the sludge and produce glass in SRTC High Level Cells (performed in parallel with wash and decant cycles
- Batch Ready for feed to DWPF

The total duration for sludge preparation is dependent primarily on the number of washes, though many other factors will also apply. The size of each batch is limited to approximately 600 to 800 kgal of equivalent 16 – 19 wt% solids. The remaining volume in the ESP processing tank is reserved for handling washwater additions while maintaining established vapor space flammability limits. Provided waste removal projects are completed to support ESP batches, ESP can produce approximately 600 – 800 kgal of sludge feed every two to three years for feed to DWPF.

<u>Production Plan</u>

Tank 51 is being used to store and transfer ESP Batch 1B sludge, which has been qualified to meet DWPF feed requirements. As of February 28, 2001, 589 canisters have been prepared using sludge feed from this batch. About 658 - 738 total canisters are projected from ESP Batch 1B depending upon the amount of Tank 51 sludge heel used. The sludge concentration in the tank has slowly decreased over the time transfers from ESP Batch 1B have been made to DWPF. The decrease in concentration is attributed to dilution from slurry and transfer pump bearing water and transfer line flushes back into the tank required after each transfer. The dilution of sludge negatively affects DWPF ability to produce canisters since the sludge solids are lower in each ESP to DWPF transfer. These dilution impacts have larger implications as Tank 51 level decreases. The transfer pump has been lowered to one inch off the tank bottom and slurry pump operations have been adjusted to help address the dilution issue.

Tank 40 preparations were completed so the tank could be used for processing ESP Batch 2. Sludge from Tank 8 was successfully transferred into Tank 40 in January 2001 and combined with the existing Tank 40 sludge. Sludge washing is being performed at the time of this Plan.

Tank 42 is now used for storage of supernate that has been partially concentrated. Plans are to eventually transfer the Tank 42 supernate waste to an evaporator system for further concentration. The tank will then be used for long-term concentrated waste or salt storage until the start of salt processing. Tank 42 is no longer available for ESP washing.

8.5.2 Salt Processing

Of the 37 million gallons of high level waste in storage, approximately 3 million gallons are sludge waste and 34 million gallons are salt waste. The sludge waste, which is insoluble and settles to the bottom of a waste tank, generally contains insoluble radioactive elements including strontium, plutonium, americium, and curium in the form of metal hydroxides. The salt waste, which is soluble and is dissolved in the liquid rather than settling to the bottom of the waste tanks, contains most of the soluble radioactive element cesium. The salt supernate and dissolved salt cake removed from the waste storage tanks will be processed to remove the radioactive cesium. The cesium contains approximately 99.99% of the radioactivity in the salt waste but is only a small fraction of the total previous volume. Since cesium is the only part of salt waste that is high-level waste, must be transferred to DWPF for vitrification and ultimate storage in a Federal Repository. Alpha-emitting radionuclides must be removed from the waste so that Saltstone produced from decontaminated salt solution will not exceed Z-Area's Authorization Basis and to insure that Saltstone remains Class "A" Radioactive Waste, or better. The remaining salt solution, now without radioactive cesium, is classified as low-level waste. This decontaminated salt solution, although it contains less than 0.01% of the previous radioactivity, is the bulk of the previous volume. It is sent to the Saltstone Facility for safe, on-site disposal.

Processing at the In-Tank Precipitation (ITP) Facility was suspended because the facility could not cost effectively meet both the safety and production requirements for the High Level Waste System. A HLW salt solution processing alternative evaluation is currently underway. An extensive list generated through a Systems Engineering Evaluation of potential treatment options has been pared down to three primary alternatives. These alternatives include Small Tank Tetraphenylborate (TPB) Precipitation, Crystalline Silicotitanate (CST) Non-Elutable Ion Exchange and Caustic Side Solvent Extraction.

Science and Technology activities are continuing on these three alternatives with a final DOE technology selection expected in FY01. For the purpose of this Plan, the documented values (salt solution feed volumes, precipitate feed rates, etc.) from the Small Tank Tetraphenylborate Precipitate process were used for modeling of the HLW System. Once a final decision is made on the preferred salt disposition process, a new revision of the Plan will be generated.

It is critical to resolve the salt processing flow sheet as quickly as possible. The DWPF vitrification specifications allow for sludge-only canisters and for combined salt-sludge canisters. This is because certain sludge constituents are required chemically to make high quality glass. Additionally, when a combination salt-sludge batch is being processed, the treated salt waste dissolves into the molten glass, creating minimum additional volume. Therefore, the total number of canisters made is minimized if salt is combined with sludge. However, to produce salt-only canisters, special chemicals, or "sludge simulant," must be added to replace the sludge. This would increase costs and create more canisters though studies to develop a cesium only (*i.e.* salt-only) glass formulation could reduce the number of salt-only canisters that would be produced.

Production Capacity

The salt solution removal rate (at an average of 6.44 M Na^+) is projected to be a long-term average of 6,000 kgal annually, based on logistical constraints imposed by the infrastructure of the Tank Farms.

A projected maximum of 6,000 kgal of salt solution are made available every year from the Tank Farm. However, the DWPF forecasts that the melter must be replaced every 2-3 years, which requires a six-month outage. The salt processing alternative processes have included 60 days of product storage capacity in design basis flowsheets. This storage allows all of the options to operate 2.17 years out of every 2.5 years, making the required capacity to 6,900 kgal of 6.44M salt solution on an annualized basis to match the waste removal capability.

Therefore, the instantaneous salt solution processing rate for all three salt processing alternatives is 13.1 gpm at 100% attainment, corresponding to 17.5 gpm at 75% attainment. The Small Tank Tetraphenylborate Precipitation facility has the capability to hydrolyze all the precipitate it produces. This product (precipitate hydrolysis aqueous or PHA) is transferred to DWPF, combined with high level radioactive waste sludge and vitrified.

For this revision of the System Plan, salt dissolution, blending and batching to the Salt Waste Processing Facility (SWPF) was planned in detail. Salt waste was put into 67 batches (See Appendix 1.4, J.4, and K.4) and compositions and volumes of these batches were estimated. This input was used to estimate the quantities of PHA produced. The PHA was matched in sequence with the sludge batches proposed in this plan. Maximum loadings of PHA were determined and combined with the maximum quantities of sludge[i]. No treatment to remove aluminum from sludge is proposed as described in Section 8.5.1. This allows higher PHA loadings than were estimated in the last revision to this plan.

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[i] The maximum PHA that could be vitrified was found and then the sludge was increased to the maximum compatible with that loading. Of course, the procedure could be reversed and the maximum sludge loading determined and then the PHA could be increased to the maximum loading compatible with maximum sludge.

No PHA only (called salt only in the last Plan) canisters were required. However, early in the program, the DWPF cannot accommodate all the PHA produced at the planned 6 million gallon per year salt processing rate. Also, later in the program, the rate of salt production required to provide the high PHA loading exceeds the 6 million gallon per year salt production rate. Both of these inconsistencies can be eliminated by more carefully matching the timing of salt batching to PHA consumption in DWPF. This requires further analysis and will be done after the Salt Processing flowsheet is selected. Further, the PHA loading can be reduced and fewer (ideally zero) sludge only canisters could be produced at the end of the program. This has the potential to reduce the total canisters produced.

8.6 Defense Waste Processing Facility (DWPF)

DWPF is currently in "sludge-only" Radioactive Operations. At the time of this, DWPF has poured 1,073 canisters (64 in FY96, 169 in FY97, 250 in FY98, 236 in FY99, 231 in FY00, and 123 in FY01 through March 1, 2001). This represents completion of approximately ~18% of the total number of canisters to be produced over the life of the facility.

Total Projected Canister Production

This table depicts the estimated total canister production per the Plan:

Canister Type	Rev. 11 Target Case	Rev. 12 Super Stretch Case	Rev. 12 Stretch Case	Rev. 12 Base Case
Sludge-only	2,986	3,074	3,117	3,117
Coupled Salt and Sludge	2,663	2,797	2,797	2,797
Salt-only	0	0	0	0
Total	**5,649**	**5,871**	**5,914**	**5,914**

For every case in this Plan, there is an increase from the estimated 5,649 canisters in the last revision of the Plan (Rev. 11 Target Case).

This 222 can increase is primarily driven by three factors. First, the estimated canisters projected for the last sludge batch (Sludge Batch 10) has been increased from 528 in Revision 11 to 679 in this Plan. This increase results from a more detailed modeling analysis of the sludge making up this last batch (Tank 35 and Miscellaneous sludge heels). Note that the source and mass of the sludge (516,333 kg total) for the last batch was assumed to be the same for Revision 12 as was used in Revision 11. Second, the elimination of aluminum dissolution for Tanks 11 and 15 results in an estimated additional ~180 cans. Last, work done on integrating the salt and sludge batches over the life of the program resulted in an ~100 can reduction in total cans.

Similar changes in the outyear estimates will occur as we continue to gain additional operating experience and improved understanding of the relationships among waste composition, waste characteristics, and waste processing.

Production Capacity

During the overall mission of the HLW Program, the chemical composition of the feed batches will change each time a new sludge batch is processed. The average pour rate in Batch 1A and 1B ranged from 146 to 161 lbs. of glass per hour (obtained by evaluating stable operating periods during each of the batches). The feed composition of these two batches is relatively consistent with the future batches remaining to be processed. Therefore, we predict the average pour rate for the future batches to be approximately 155 lbs. of glass per hr. The attainment percentage in Batch 1A and 1B ranged from 68.0% to 77.1% attainment. As you will note, as we have become more knowledgeable of plant operations and implemented improvements (*e.g.*, improved cold cap management, SRAT Lab aliquotting, etc.), this percentage has increased. Based on this learning curve, we predict that in the future an attainment percentage of as high as 83% can be maintained (not including melter outages). Therefore, based on our current knowledge of DWPF operations, we currently predict the following production capacity for the facility during full production years after successful implementation of production improvement initiatives.

$$\frac{155\,\text{lbs. glass}}{\text{hr}} \times \frac{\text{canister}}{3{,}800\,\text{lbs. glass}} \times \frac{24\,\text{hr}}{\text{day}} \times \frac{365.25\,\text{day}}{\text{yr.}} \times 83\%\,\text{attainment} = \frac{297\,\text{canisters}}{\text{yr.}}$$

The production rate above, however, does not include any deduction from the attainment percentage to incorporate a melter change out that will be necessary at certain times in the processing at DWPF. To date, DWPF has not experienced a melter failure and therefore, there is no plant experience to improve the assumed timeframes for predicting melter failures or a melter outage.

DWPF is pursuing initiatives to improve production capacity. The programs associated with a more reducing feed and its impact on Technical Safety Requirement flammability limits and melter vapor space kinetics should provide an increase in the melt rate. Sample analytical time requirements are not expected to present a near term restriction for Sludge Only operation, but could impact production at higher melt rates.

The current melter has operated well past its expected life, chiefly due to lower quantities of noble metals in the initial sludge batches. Based on the higher noble metal content of subsequent sludge batches, however, the forecast melter life will remain at an estimated 2-3 years. Since melter failures can not be predicted precisely, the timing of outages accounted for in the Case specific canister production numbers is considered typical of what will be experienced over the next 6 years.

Melter Pour Spout Inserts

Melter pour spout inserts continue to perform well and support DWPF canister production rates by virtually eliminating problems with glass “wicking.”

Production Plan

DWPF is currently processing Sludge Batch #1B from Tank 51. Depending on the processing rate and the amount of Tank 51 heel used, Sludge Batch 1B is expected to last through the end of FY01. For additional information on preparation of future sludge batches, refer to Appendix H.5, I.5, or J.5, Sludge Processing.

The higher curie content of Sludge Batch 2 will require the safety class nitrogen missile-shielding project to be completed before this sludge batch can be processed in DWPF. This modification is being implemented.

DWPF will continue sludge-only processing until precipitate feed is available from the salt processing facility. At the time of this Plan, the salt processing flowsheet remains under evaluation. This Plan assumes that salt processing will resume in FY10.

The DWPF production rate is impacted in future years by two major factors. First, it is desirable to feed sludge and salt streams at a rate that allows the two inventories to be depleted around the same time. This is achieved in all Cases in this Plan. Second, sufficient Waste Removal funding must be provided to maintain or exceed the planned DWPF production rates. Waste Removal must be funded so that modifications can be made to support the removal of sludge or salt from waste storage tanks.

Replacement Control Systems

The current distributed control system (DCS) at DWPF is over 14 years old. The system is approaching the end of its useful life. Therefore, plans have been initiated to procure and install a new system by FY04 consistent with funding availability. See Section 7.15 for more details on this issue.

Replacement Melters

Ongoing vitrification operations will require periodic melter replacement. SRTC predicts that noble metals deposition (causing the electrodes to short-circuit) may be the most likely cause of melter failure. Other possible causes of melter failure include the failure of non-replaceable heaters in the riser, pour spout, and vapor space. SRTC also predicts that melter life expectancy will average about two years. The melter presently in service (melter #1) has been in operation for 6.5 years (5 years radioactive — 1.5 years simulated). Noble metal content of the feed during this period has been very low (<10% of design basis). Replacement melter projects are planned accordingly. Melter replacement outages are expected to last approximately 6 months.

Melter #1 is in service. 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 325% of its nominal two-year life expectancy. The long service life of Melter #1 may be attributed, at least in part, to the low noble metals content of Sludge Batch #1A. The noble metals content of Sludge Batch #1B is higher. Melter #1 will remain in service as long as it operates normally.

Melter #2 is on site. Construction modifications are complete, and the melter itself is ready to install, pending modification to the Dome Heater Bussbars based on the failure of cooling water tubes on Melter #1. Some modifications to the Melter #1 Storage Box and the Failed Equipment Storage Vault crane are being evaluated, but are currently unfunded. Plans and procedures to conduct the melter outage are task ready, should Melter #1 fail. However, because Melter #1 will be allowed to operate until failure, the Melter #2 replacement outage is not specifically scheduled at this time.

The **Melter #3** vessel, 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. Thermocouples will be ordered, pending availability of funding. Once all components are on site, final assembly of Melter #3 is expected to take 6-12 months. Assuming funding is available when needed, overall lead time for a replacement melter project, from project inception through actual installation in the DWPF, is about 5 years.

Failed Equipment Storage Vaults

Failed Equipment Storage Vaults (FESVs) are repetitive projects required to sustain ongoing DWPF operations. Failed melters and other large failed DWPF equipment, which are too contaminated to dispose in the site's Burial Ground, will be contained in engineered boxes and temporarily stored in the DWPF FESVs. Each FESV can store one failed melter. Over the life of the HLW program, approximately 10 FESVs will be needed. FESVs #1-2 are already operational in DWPF. Additional FESVs line items are scheduled on a just-in-time basis. The need dates for FESV #3-6 and successive pairs of vaults are evaluated on an ongoing basis.

Recycle Handling

As part of normal operations, DWPF generates an aqueous recycle waste stream originating from four sources in the DWPF process:

- the primary (or back-up) Melter Off-Gas Condensate Tank (OGCT)
- the Sludge Receipt and Adjustment Tank (SRAT)
- the Slurry Mix Evaporator Condensate Tank (SMECT)
- the Decon Waste Treatment Tank (DWTT)

These streams are collected in the Recycle Collection Tank (RCT) for transfer to the Tank Farm. The contents of the RCT are adjusted with corrosion inhibitors prior to transfer.

Melter Off-Gas Condensate Tank (OGCT): The melter is not designed to accommodate thermal cycling. Once it has been brought up to temperature, it remains heated — containing a molten glass pool — 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 that is collected in the primary (or back-up) OGCT. Currently both steam-atomized scrubbers are not required to be operational due to the lower than design basis source term of Sludge Batch 1B.

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), the Sludge Receipt and Adjustment Tank (SRAT), and the Formic Acid Vent Condenser. The amount of aqueous waste produced by the SME and the SRAT 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 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) OGCT, the SMECT, the DWTT, and the DWPF Analytical Laboratory sample waste streams are collected in 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, recycle transfers to HTF must occur routinely. The normal HLW transfer configuration for these transfers uses the S to H inter-area line. This line runs from DWPF through the Low Point Pump Pit (LPPP) to the HDB8 complex. The HDB8 complex redirects the DWPF recycle into one of several waste storage tanks. The normal route, prior to the 2H PISA issue, was to direct the recycle stream through HDB7 to Tank 43 (the feed tank for the 2H evaporator). Since the 2H evaporator has been out of service to resolve the PISA issue, the recycle has been directed to Tank 38 (the 2H evaporator drop tank) and to three type IV tanks, 21, 22 and 24.

Currently the majority of the recycle stream is directed to Tank 22, with Tanks 21 and 24 available as needed. Because of the time required to resolve the 2H PISA, several Type I tanks in F-area are being made available for DWPF recycle storage (See Section 8.1.2). A large volume (~300 kgal) was transferred from Tank 22 to Tank 6 in January 2001. If several facility conditions are met, Tanks 5 and 8 will also be used to receive large volume transfers from Tank 22. The use of the Type I and IV tanks has allowed DWPF to remain in operation during the time period that the 2H Evaporator has not been operating. Current plans have the 2H Evaporator operational before the Type I and IV tank space has been fully utilized.

Recycle Forecast

DWPF Engineering has developed an algorithm for predicting recycle generation rate. The algorithm is derived from recent operating experience, including demonstrated or anticipated results of ongoing efforts to reduce recycle volume; planned program activities, and increasing waste generation from decontamination operations as DWPF equipment ages.

Beginning October 1, 2000, the recycle transfer volume projection algorithm is forecast to be:

DWPF Recycle = 5,151 gallons * (# of cans/year) + 143,000 gallons

This algorithm incorporates the recycle reduction initiatives associated with the shut off of the Melter steam atomized scrubbers and reductions in frit slurry make up and canister decontamination systems.

Note that even at zero attainment, some recycle waste continues to be generated.

Mercury Disposal

The sludge contains mercury, which must be removed prior to vitrification. The recovered mercury is returned to the Separations facilities for re-use in their processes per a Memorandum of Understanding that became effective February 1, 1999.

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 that 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 steel-frame 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 **Shielded Canister Transporter (SCT)** moves one canister at a 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. Actions will be taken to make 450 of these positions usable. Upon completion of these activities GWSB #1 will have a working capacity of 2,159 usable storage locations. At the time of this Plan, GWSB #1 was storing 1,073 radioactive canisters.

In this Plan, a change has been incorporated to move away from a single large (2,286 position) GWSB # 2 to privatize individual glass waste storage modules (585 positions). This was incorporated to accommodate DOE cash flow issues in the FY02 – FY06 period. It is assumed that a private contractor would provide the upfront capital for the construction of these facilities and the government would lease the facilities. By breaking the facility into individual modules in two of the planning cases, it is possible that only one module will be needed if the repository shipping schedule can be maintained. Even in the Super Stretch Case only two modules will be required.

In the Super Stretch Case the first module of a privatized glass waste facility would be needed by FY07 and a second module by FY10. In both the Base and Stretch Cases only one module with be required. The Base Case would need the module in FY10 with the Stretch Case needing the module by FY13. The detailed canisters storage requirements are defined in Appendixes H.6, I.6, and J.6 for the different cases.

In parallel with the development of the standard Glass Waste Storage Buildings and privatized module storage facilities, an above-ground, modular storage concept for HLW canisters is being evaluated. The concept involves concrete storage casks which utilize the existing inventory of SRS depleted uranium oxide to enhance the shielding capability of standard concrete. The casks and cask transporter would be provided under a subcontract. The facility would be responsible to provide a cask interface facility, the cask storage pad, and access roadways for the SCT and the cask transporter. The cask interface facility would accept canisters delivered by the SCT, load the canisters into the storage cask, close the cask, and make it accessible to the cask transporter for transport to the storage pad. A decision is expected on whether to proceed any further with the aboveground modular storage concept within the next month.

8.8 HLW Disposal

HLW — consisting of glass filled canisters, failed melters, and non-routine HLW — is destined for permanent disposal in a deep geological repository. To support disposal of these items, the following must continue to be pursued:

- Site approval for the permanent geological repository
- DOE/DOT approved transport routes for HLW
- DOE approval to ship HLW from SRS
- Transportation/storage containers for the HLW
- Canister handling facility
- Continued funding to support safe storage of canisters, failed DWPF melters, and non-routine HLW

8.9 Effluent Treatment Facility (ETF)

The ETF treats the low-level aqueous wastes from the F and H-Canyons and the F and H-Tank Farms. The ETF provides enhanced environmental control over the previous practice of discharging liquid directly to seepage basins. Additional waste streams from Environmental Restoration are treated. After treatment at ETF, the wastewater 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 throughput is approximately 80 gpm, with a peak rate of 120 gpm for short periods.

Production Plan: ETF plans to treat 20,000 kgal of wastewater in FY01. At the time of this Plan, the facility has treated about 5.0 million gallons (FYTD). ETF Concentrate is currently transferred to Tank 50 for storage prior to disposal in the Saltstone Facility or by alternative means.

8.10 Saltstone Facility

The Saltstone Facility treats and disposes the Salt Waste Processing filtrate stream and the ETF concentrate stream. The two low-level radioactive waste streams are treated 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 cure. The solidified waste form is known as saltstone.

Production Capacity: The Saltstone facility is normally staffed with one ten-hour shift per day, four days per week. About seven hours each day are available for salt solution processing at an instantaneous 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 approximately 23,100 gallons of salt solution processed per day or approximately 4,805 kgal of salt solution processed per year. This may be increased by modifying the shift schedule to allow more hours per day or days per week.

Production Plan: Since Salt Waste Processing began its re-evaluation of technology alternatives, only ETF concentrate has been available to Saltstone for processing. The waste inventory in Tank 50, approximately 300 kgal, was processed in FY98. In FY99, the Saltstone Facility was placed in a partial lay-up mode. Partial lay-up reduces facility costs while minimizing potential deterioration of the plant, thereby minimizing the cost to resume operations in the future.

Tank 50 is presently used as a receipt tank for Effluent Treatment Facility (ETF) bottoms, an aqueous waste that is ready for final treatment and disposal at Saltstone. This Plan assume that Tank 50 can be returned to HLW waste storage service by the end of FY02. This is 2 years earlier than was forecast by the Space Team. Returning Tank 50 to HLW service requires that the ETF bottoms stored in Tank 50 (an estimated 700 - 900 kgal by FY02) be processed at Saltstone beginning in FY02. This is a change from Revision 11 of the Plan, where an off-site vendor was going to be used to process the Tank 50 waste and future ETF bottoms until FY10.

Since Tank 50 will be required for concentrated waste storage service, operation of Saltstone for processing newly generated ETF concentrate must be continued on a periodic basis until the startup of Salt Processing in FY10. At that time, the Saltstone Facility must be operated continuously to support the large volume filtrate stream from Salt Processing and the ETF concentrate can continue to be sent to Saltstone.

The future salt processing flowsheet is not known; therefore, the production requirements for Saltstone are not known. This Plan assumes salt processing will resume in FY10, and that the process will generate decontaminated salt solution similar to that planned for ITP. This Plan assumes Saltstone will alter its staffing plan to support production level through a two-shift operation, if necessary.

Vaults: Saltstone operations require periodic construction of additional vaults, capping of filled vault cells and construction of permanent vault roofs. The required schedule for these repetitive projects is dependent upon the salt processing production plan. Each vault cell can hold 242,500 cubic feet of saltstone grout, or approximately one million gallons of salt solution. The construction and startup of new vaults supports planned Salt Processing production rates on a just-in-time basis.

Currently, construction of **Vault #1 and #4** is complete. Vault #1 has six cells, three of which are now filled and capped. Vault #4 grout filling will resume in FY02 (one cell out of twelve is filled), in lieu of filling Vault #1.

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. However, to maximize budget efficiencies, this Plan assumes that 6-cell vaults will be used until a better planning basis is available.

Saltstone Vault Alternatives: The high cost of building replacement vaults has been identified as a potential area for cost reduction. 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. However, feasibility studies of this option are on hold pending outcome of the Salt Waste Processing technology alternative study and scheduled resumption of salt processing.

9. Technology Development

Since 1996, DOE's Office of Science and Technology (S&T), EM-50, has provided technical support and co-funding to sites in the complex to develop and integrate technologies to accelerate cleanup of legacy waste. Several national focus areas are chartered to provide this support and the Tanks Focus Area (TFA) is specifically chartered to support the weapons complex high level waste programs. The SRS Site Technology Coordination Group (STCG) provides assistance to the site operating divisions in developing technology planning to support the DOE "Path To Closure" mission.

As part of this mission, the HLW division has successfully executed several key activities supported by the TFA. These activities include:

- Closure of Tanks 17 and 20
- Development and demonstration of several types of new waste retrieval tools that are presently being used to retrieve the waste heel in Tank 19
- Development and testing of a new generation of slurry pumps
- Deployment of a fluidic sampler in Tank 48.
- Deployment of a fluidic mixer pump in F Pump Tank 1
- Development of additional glass chemistry data that will be used to increase the glass waste loading in DWPF

The HLW division has ongoing activities and future planning in the following areas:

- Waste Pretreatment
- Waste Retrieval
- Tank Closure
- Vitrification
- Safety

A Technology Program Plan and development proposal has been prepared and submitted to the TFA for technology needs in each of these areas for FY02 and out years. A brief description of these plans and proposals are provided below.

9.1 Waste Pretreatment Technology

As was described earlier in the System Plan, the original baseline Salt Processing Facility could not simultaneously meet both production and safety requirements. Over the next several years, a solid science and technology underpinning will be developed to make the final process selection and provide the data required for process scale up and design.

Science and technology (S&T) roadmaps and an R&D program plan has been developed to support the ongoing R&D activities to define the technical risks and benefits for three candidate salt processing technologies (small tank tetraphenylborate precipitation, crystalline silicotitanate ion exchange, and caustic-side solvent extraction). The DOE will use the results of this R&D program to downselect a preferred process technology in June of 2001. Work is also proceeding to define the requirements of a salt processing pilot facility.

An extensive R&D program has been underway to address the issues associated with the deposition and of sodium aluminosilicate and sodium diuranate in the HLW evaporators. The R&D program is directed at defining the technology to be used for cleanout of these deposits and to understand the deposition mechanism so as to avoid formation of deposits in the future.

Several changes have made this year in the DWPF flowsheet to reduce the DWPF recycle stream that enters the tank farm. A task team has proposed a number of alternative longer-term changes to the flowsheet to further reduce or eliminate the recycle stream.

9.2 Waste Retrieval

Planning and execution of waste retrieval is an ongoing activity within HLW.

In FY01, several waste retrieval tools have been deployed (or may be deployed) in Tank 19 to retrieve the residual heel in the tank in preparation for closure. These tools include:

- Submersible (Flygt) mixers as low cost alternatives to slurry pumps
- Weight % solids instruments to monitor sludge suspension efficiency
- Pitbull waste removal pumps capable of removing waste within approximately one inch of the tank bottom
- A remotable tank bottom crawler and water spray system for tank cleaning.

Transfer of tank cleaning technology from the Russian nuclear program is currently underway. The Russians have been very successful using chemical cleaning technology. Application of this technology for caustic sludge looks encouraging based on preliminary results. This technology has the potential for addressing cleanout of tanks having interior obstructions that would interfere with mechanical cleaning.

A long life fluidic mixer was deployed for hot operations in F-Area Pump Tank 1 (FPT-1). This mixer was developed by AEA Technologies and tested in their facilities as part of an EM-50 program to transfer British technology. Fabrication and installation of the mixer was partially funded by the EM-50 Accelerated Site Technology Deployment (ASTD). This mixer was placed in service in FY01 and was successfully used to transfer sludge from Tank 8 to Tank 40. Additional mixers of similar design are being considered for the four canyon waste receipt pump tanks based on evaluation of the FPT-1 mixer.

Deployment of a fluidic sampler in Tank 40 similar to the design of the Tank 48 sampler was suspended pending completion of additional safety evaluations and testing by AEA. A third sampler originally planned for TPB slurry in Tank 49 is available for modification to support extended sludge processing in Tank 51.

Pipeline blockage detection and removal systems are planned and under development in cooperation with TFA, Florida International University (FIU), and the National Energy Technology Laboratory (NETL). A test facility has been developed at FIU to test several industrial prototype systems. Successful detection and blockage removal systems will be pre-staged for deployment in the complex in case of a pipeline blockage.

The development of remotable systems to decontaminate and disassemble contaminated process equipment in the Tank Farm and DWPF is currently underway. At present disposal of large pumps, jumpers, etc., is expensive and requires large burial boxes.

9.3 Tank Closure

The lessons learned during closure of Tank 17 and 20 and Tank 19 heel removal are being used in the planning for future tank closures. The reducing grout formulation is being modified to improve performance and reduce cost. Performance Assessments for the composition of future candidate tanks indicate that technetium will be the radionuclide that will dominate the extent and cost of tank cleaning to meet closure criteria. This problem extends across the DOE complex and a comprehensive program began in FY00 to develop technology to better remove, bind up, or immobilize technetium.

9.4 Vitrification

- With Sludge Batches 1A and 1B, waste loading in DWPF glass is limited to about 26% waste oxides. A 2% increase in waste loading offers the potential for life cycle cost reduction equivalent to a year’s DWPF production. R&D is underway to reduce the uncertainty bands on processing constraints that will provide an expanded operating window allowing both flexibility and increased waste loading. Data is now available to reduce uncertainty in the liquidus constraint. This data has been incorporated into preliminary statistical models and work is in progress to validate model predictions with experimental glass melter tests.
- DWPF has been operating for a number of years and opportunities have been identified for improvements in the process and glass melter design. The glass melter is one of the most expensive and complicated components in DWPF. Although the melter has exceeded its two-year design life, improvements in pour spout design and enhancements to accommodate future feeds are desirable. Earlier problems with pour stream control have been solved with replaceable pour spout inserts. However, an improved overall design is needed to better accommodate erosion and corrosion. In addition, the present melter has operated at lower melt rates than were initially planned. The DWPF melter was designed before the potential for electrode shorting by an accumulation of noble metals was

recognized. Although the melter is currently operating with low noble metal concentrations, a more noble-metal tolerant melter with higher melt rate capacity may be needed for future operation. A cooperative R&D program is planned and underway at FIU and at Clemson University to address some of the design issues for the next generation of melters.

- Once filled, DWPF glass canisters are stored in Glass Waste Storage Building #1 (GWSB). Depending on DWPF canister production rates in the various cases, this first GWSB may be filled as early as FY07. A second GWSB would be required once GWSB #1 is filled. An alternative to the glass canister storage technology has been proposed. This technology uses concrete casks with depleted uranium to provide additional shielding. These storage modules would provide the required shielding and structural integrity for outdoor surface storage of glass canisters. This technology is currently under evaluation as a potential cost saving initiative and a decision will be made before the end of this fiscal year.

9.5 Safety

The Tank Farm presently employs paper HEPA filters in the ventilation systems of the high level waste tanks. These paper filters become blinded by water vapor and have service life of about two years. Replacement of these filters involves occupational exposure and significantly contributes to the solid wastes generated by the Tank Farm. Moreover, a loaded paper filter represents a significant source term in the event a fire was to occur. The extent of loading is not known inasmuch as the trapped particulates are alpha emitters and cannot be easily monitored in their self-shielded filter geometry. A cooperative program is underway between SRS, TFA, and NETL to develop permanent washable HEPA filters using sintered metal or ceramic filter media. A prototype filter will be fabricated and tested this year and a downselect of the preferred media will be made by the end of this fiscal year. Deployment of a filter system is planned for FY02.

Several remote sensing and monitoring probes have been under development in cooperation with TFA and the Characterization Monitoring and Sensing Technology (CMST) Cross Cut Area:

- A weight percent solids probe to monitor high weight percent solids has been deployed in the Tank 19 waste retrieval program to define the end point of sludge suspension during sludge removal.
- A combined corrosion probe and corrosion species probe is being developed using Hanford technology. Initial deployment is expected in FY02. The probe offers the potential to reduce operator exposure during normal sampling. It will also help in the management of our tank space by enabling a reduction in caustic added to tanks to maintain corrosion control.

10. Support for Future Missions

A number of new programs are currently being evaluated or developed. Many of these programs have the potential to impact HLWD operations in the future. At the time of this Plan, there has been no decision to incorporate any of these programs into the baseline; therefore, none are included in the current Plan. They are addressed in this Plan for information only.

10.1 Plutonium Immobilization

With the end of the Cold War, the U.S. has declared about 50 metric tons of U.S. weapons-grade plutonium as excess for disposition. A minimum of 8 metric tons of U.S. weapons-grade plutonium has been identified in a joint agreement with Russia signed in September, 2000 for disposition via a "can-in-canister" process. Plans are to construct a facility at SRS, probably in F-Area, to convert the plutonium to ceramic forms. The plutonium ceramic forms would be placed in small stainless steel cans, measuring approximately 21" high and approximately 3" in diameter. These small cans would be positioned in racks inside a full-size DWPF canister. HLW glass would then be poured into the DWPF canister as usual. The presence of the HLW glass would act as a deterrent to the unauthorized retrieval of the weapons-grade plutonium. The filled canisters would then be stored in the Glass Waste Storage Building, pending transfer to the Federal Repository for long-term storage. The preliminary concept was successfully tested at DWPF in 1996 (prior to the start of Radioactive Operations) using a simulated plutonium glass inside the small cans. The final concept was successfully tested again in 2000 at Clemson University with simulated Pu ceramic cans, prototypic magazines and racks, and a stirred melter that has glass pour characteristics similar to the melter at DWPF. Results for both tests, and an interim test in 1999, indicated that the HLW glass flowed around the cans without creating any significant void spaces, and cooled without forming any significant crystallization. This option would require cesium from salt to provide the appropriate radiation levels to deter unauthorized retrieval of the plutonium. The salt processing will not be available until mid FY10. Although no additional HLW glass would be produced, the plutonium ceramic forms, cans, magazines, and racks would occupy space that would have been filled with glass. Disposal of 8 metric tons of plutonium would result in approximately 34 additional DWPF canisters; disposal of all 50 metric tons of plutonium would add approximately 210. However, because this mission is still under development, the additional canisters are not included in the Plan at this time.

10.2 U-233 Processing

Oak Ridge and Idaho have significant quantities of U-233. There are a number of options for beneficially using or disposing of this material. Options involving SRS include:

- Dissolving the U-233 in the Canyons, diluting the U-233 with depleted uranium and sending the waste to the HLW tanks
- Dissolving the U-233 in the Canyons, adding neutron poisons, and sending the waste to HLW tanks already containing depleted uranium to reduce the additional glass logs generated by DWPF
- Separating Th-229 for future medical use
- Packaging breeder reactor fuel pellets in DWPF canisters similar to the plutonium can-in-canister proposal

Currently, the only option being studied is medical uses of the U-233 materials. The development of all other options is on hold pending the results of the studies of medical uses.

All of these options will result in the production of additional DWPF canisters. Because this mission is still under development, these additional canisters are not included in the Plan at this time.

10.3 Pit Manufacturing

Savannah River Site is currently being considered for the large-scale pit manufacturing mission, which will augment the small lots facility currently under construction at LANL. This proposed facility will process return pits to make feedstock, cast the pit halves, and machine and assemble the components into war reserve certified pits. Project start-up would occur in the 2018 time frame. The facility would generate a maximum of approx. 33,600 gal./yr. of high level waste. It has not been determined if the high level waste would be treated as a part of the system described in this Plan or be converted to a Waste Isolation Pilot Plant (WIPP) compatible disposal form. No additional canisters are included in this revision of the Plan pending a definitive proposal to include this waste into the HLW waste stream.

10.4 Am-Cm Vitrification

Approximately 3,600 gallons of solution containing isotopes of americium (Am) and curium (Cm) are stored in F-Canyon Tank 17.1. These isotopes were recovered during plutonium-242 production campaigns in the mid- and late-1970s. The continued storage of these isotopes was identified as an item of primary concern in the Defense Nuclear Facility Safety Board's (DNFSB) Recommendation 94-1. No operating SRS facilities can presently be used to stabilize this material for safe interim storage and transportation to the heavy isotopes program at the Oak Ridge National Laboratory (ORNL).

A previous analysis of several alternatives resulted in the recommendation to stabilize the Am-Cm solution in a high-lanthanide glass. The Multi-Purpose Processing Facility (MPPF) in the F-Canyon would be used for the vitrification process. Pretreatment operations would be performed in existing canyon vessels to separate actinides and lanthanides from other impurities (primarily iron, aluminum, and sodium) prior to the vitrification operation. The pretreatment and vitrification processes would produce limited quantities of liquid waste when operations begin.

Per recent guidance, Am/Cm is now considered to be excess material and a stabilization project should incorporate requirements for final disposition to the Federal Repository. HLW is investigating the feasibility of a cost beneficial alternative for receiving and processing the Am/Cm material within the HLW system. At the time of this Plan, the identified HLW alternative to the MPPF project is to receive the Am/Cm material within the acceptable waste limits into F-Tank Farm. The Am/Cm stream would be directed through the inter-area line into an ESP feed tank for processing in Sludge Batch 3. Hardware modifications would be required to perform this mission. Technical risk is under evaluation and is focusing on ensuring the Am/Cm stream can be successfully processed through all affected facilities, including the waste tanks, evaporators, ETF, DWPF, Salt Processing and Saltstone. Estimates, schedules, and risks for the envisioned cost project are in development and are planned to be complete in the May 2001 timeframe.

10.5 Other Potential Nuclear Materials Stabilization & Storage Missions

In addition to processing nuclear materials required to satisfy the DNFSB 94-1 and 2000-1 Recommendations, there is potential that the SRS Canyon facilities may be used for processing of other selected DOE Complex surplus materials. These streams include various Pu and HEU oxides, scrap and residue materials as identified in the SRS Canyons Nuclear Materials Identification Study. Many of these potential new missions are in the NEPA documentation development stage. Preliminary waste estimates have been developed for each of these potential missions. An additional 1.5 to 2.0 million gallons of waste could be sent to the Tank Farms between FY03 and FY11 if all potential streams are processed at SRS. HLW and NMS&S are working closely to ensure Tank Farm space impacts are taken into account as a major factor in determining if these materials will be processed at SRS.

These new potential mission streams are not currently included in this Plan. Status of new NMS&S missions will continue to be tracked and incorporated into future Plan revisions, as appropriate.

10.6 Mixed Oxide Fuel Fabrication Facility (MFFF)

The U.S. has declared a surplus of weapons-grade plutonium since the end of the cold war. Approximately 30 metric tons of this excess plutonium will be disposed of in the Mixed Oxide Fuel Fabrication Facility (MFFF). The plutonium will be converted into fuel that will be burned in commercial reactors to produce electricity. The fuel will be sintered pellets containing a mixture of weapons-grade plutonium and depleted uranium. DOE has contracted Duke, Cogema, Stone and Webster to design, build, and operate the MFFF. The facility will operate from 2007 to 2017. The MFFF has an aqueous polishing feed preparation step which produces an acidic waste stream. Although the volume of this stream is low (<100,000 gal/yr), capacity issues continue to be of concern to the HLW system and will require continual monitoring. The waste stream will be neutralized before being sent to the HLW system. More significantly, the stream will contain three constituents which are a cause of concern to the HLW system: americium, silver, and HEU. The waste stream will contain approximately 20

Kg/year of amercium-241. The alpha dose associated with the americium-241 is within the current limits of the Waste Acceptance Criteria (WAC). The waste stream will also contain approximately 4 Kg/year of silver. While the current WAC does not allow silver, studies have been completed and concluded that this small amount of silver will not create a safety issue in the HLW waste system. The WAC must be changed to allow this small amount of silver. The waste stream will also contain approximately 17Kg/year of HEU. Before transfer to the HLW system, depleted uranium will be added to the HEU as a neutron poison to ensure ever-safe conditions with respect to criticality.

In the development of this Plan, the impact of receiving the MOX waste to HLW was analyzed. From a tank space perspective, the yearly influent of the MOX stream is considered to be of minimal impact. GlassMaker modeling of the MOX waste stream was performed to identify potential impacts to the existing HLW Authorization Bases. As expected, GlassMaker modeling did indicate that the MOX stream had an impact on the source term of several of the proposed sludge batches that will be fed to DWPF. However, several of these same batches (in particular, Sludge Batches 8, 9 and 10) exceed currently analyzed inhalation dose and/or design basis shielding limits for DWPF even without the influence of the MOX stream. The addition of the MOX stream is considered to be in the bounds of the analyses that must already be performed to address the source term issue for these late sludge batches.

11. History

11.1 Introduction

The Savannah River Site (SRS) in South Carolina is a 300-square-mile Department of Energy (DOE) complex that has produced nuclear materials for national defense, research, and medical programs since it became operational in 1951. As a waste by-product of this production, there are approximately 37 million gallons of liquid, high-level radioactive waste currently stored on an interim basis in 49 underground waste storage tanks. Continued, long-term storage of these liquid, high-level wastes in underground tanks poses an environmental risk (ten of the SRS tanks have a waste leakage history). Therefore, the High Level Waste (HLW) Division at SRS has, since FY96, been removing waste from tanks; pre-treating it; vitrifying it; and pouring the vitrified waste into canisters for long-term disposal. From FY96 to the end of FY01, over 1,100 canisters of waste will have been vitrified. The canisters vitrified to date have all contained sludge waste. Salt waste processing was suspended in FY98 because the facility could not cost effectively meet both the safety and production requirements of the HLW System. DOE selection of an alternative salt processing technology is expected in FY01, with construction of a salt processing facility scheduled to be completed by FY10, depending on available funding.

11.2 High Level Waste Characterization

Most of the high-level waste inventory stored at SRS is a complex mixture of chemical and radionuclide waste generated during the acid-side separation of special nuclear materials and enriched uranium from irradiated targets and spent fuel using the Purex process in F Canyon and the modified Purex process in H Canyon (HM process). Waste generated from the recovery of ^{238}Pu in H Canyon for the production of heat sources is also included. The variability in both nuclide and chemical content is due to the fact that waste streams from the 1st cycle (high heat) and 2nd cycle (low heat) extractions from each canyon were stored in separate tanks to better manage waste heat generation. When these streams were neutralized with caustic, the resulting precipitate settled into four characteristic sludges presently found in the tanks where they were originally deposited. The soluble portions of the 1st and 2nd cycle waste were similarly partitioned but have and continue to undergo blending in the course of waste transfer and staging of salt waste for evaporative concentration to supernate and saltcake.

Historically, fresh HLW receipts have been segregated into four general categories in the SRS Tank Farm: Purex High Activity Waste (HAW), Purex Low Activity Waste (LAW), H-Area Modified (HM) HAW and HM LAW. Because of this segregation, settled sludge solids contained in tanks that received fresh waste are readily identified as one of these four categories. Fission product concentrations are about three orders of magnitude higher in both Purex and HM HAW sludges than the corresponding LAW sludges. Because of differences in the Purex and HM processes, the chemical compositions of principal sludge components (Fe, Al, U, Mn, Ni, Hg) also vary over a broad range between these sludges.

Combining and blending salt solutions has tended to reduce soluble waste into blended Purex salt and concentrate and HM salt and concentrate, rather than maintaining four distinct salt compositions. Continued blending and evaporation of the salt solution deposits crystallized salts with overlying and interstitial concentrated salt solution in salt tanks located in both tank farms. More recently, with transfers of sludge slurries to ESP, removal of salt cakes for tank closure, receipts of DWPF recycle and space limitations restricting full evaporator operations, salt solutions have been transferred between the two tank farms. Intermingling of Purex and HM salt waste will continue until processing in the Salt Waste Processing Facility can begin.

11.2.1 Waste Characterization System (WCS) Database

The basic separation, waste treatment and storage procedures and the principal components in the waste at SRS have not changed significantly since processing began in the mid 1950’s. Very accurate material irradiation and process records together with ongoing sampling results have been maintained and incorporated into a Waste Characterization System (WCS) database. The available data in the WCS is more than sufficient to support the ongoing HLW systems integration planning and to allow selection of a salt process.

The Waste Characterization System (WCS) database is used to track the composition of the waste in each of the HLW tanks. Sludge, crystallized salts, and aqueous salt solution (supernate) are described separately. The data encompass 41 radionuclides, 48 chemical species, and 23 other waste characteristics. The WCS database is compiled from information obtained from a multitude of reports.

Irradiation records for reactor charges are used to estimate the fission products sent to the HLW Tank Farms. Canyon process and flowsheet records, the chemicals used to process targets and fuel elements (i.e., consumption of essential materials) and the losses of uranium and transuranics provide a basis for the total chemical components sent to waste tanks. The inventory of stored radioactive contaminants is adjusted annually to reflect radioactive decay. For example, half of the total curies of ^{90}Sr transferred to the Tank Farms in 1971 (based on the irradiation records of the materials processed) have now decayed to ^{90}Zr.

Waste transfers into and out of waste tanks, waste tank histories, waste evaporator operations, solubility studies, known chemical properties, field measurements of waste levels in individual tanks and analyses on waste samples obtained during storage and processing serve as bases to estimate the waste composition within each tank. Samples taken over the years include: salt solution samples for corrosion control, evaporator feeds and concentrated salt solution samples, settled sludge samples, salt cake samples, sludge slurry samples during transfers and processing to prepare DWPF sludge feed, and salt cake dissolution samples generated during waste removal for tank closure.

The tank farms are a dynamic system because fresh waste continues to be received, transferred and processed to reduce the stored waste volume and provide sludge slurry feed for the DWPF. Accordingly, the WCS database is also dynamic and is updated as new information on individual tanks becomes available. Thus the WCS data base is time dependent and is subject to change as waste receipt, storage and processing continue at the SRS.

11.2.2 Effect on Waste Solidification

Because of the variability in the waste composition in individual tanks and the continuing operations that lead to changes in composition, SRS has developed waste solidification processes that are capable of handling a broad range of chemical compositions to produce solid waste forms suitable for disposal. Acceptable ranges for key components that control waste form properties and long-term performance have been developed, based on simulant and real waste tests using a broad range of concentrations for key contaminants that could adversely impact product performance, permit limits, waste processing equipment or waste treatment processes. Based on these tests and treatment equipment and process limitations, Waste Acceptance Criteria have been developed for feeds transferred to waste processing facilities used to convert the liquid waste to stable solid waste forms suitable for disposal.

Based on the known range of compositions of waste stored in the HLW Tank Farms, a waste pretreatment and blending strategy has been developed to yield qualified blended waste feeds that are within defined composition ranges for processing into acceptable waste forms. This approach eliminates the need for extensive sampling and detailed analyses of existing waste inventory beyond identifying waste tanks that contain unusually high concentrations of key components that must be blended with other wastes to assure all feeds are within acceptable ranges for processing. Instead, blended feeds to these processes are fully characterized and qualified to be acceptable for processing, thus assuring solid waste forms produced will meet long-term performance requirements for final disposal.

11.2.3 Sludge Waste Characterization

Characteristics and principal components projected for the four sludge categories from canyon process flowsheets are summarized below. Historical records yield the total mass of iron, nickel, manganese, uranium, mercury and aluminum sent to the waste tanks from the canyon processes. Historical tank records for waste receipts and transfers, when combined with canyon process records and known chemistry, enable the location of these principal sludge components to be readily identified. The principal uncertainty for sludge is the location of aluminum, since its amphoteric characteristic leads to partitioning of aluminum between sludge and salt solution in the waste.

Purex HAW Sludge

Based on process flowsheets, Purex HAW sludge contains principally iron, nickel and uranium (natural or depleted U from targets), with lesser amounts of manganese from occasional use in head-end treatment, Primary Recovery Column (PRC) resin digestion and decontamination operations. Some insoluble aluminum from the use of aluminum nitrate as a salting agent during the first cycle of Purex solvent extraction is also present, although aluminum partitions between sludge solids and soluble waste in the presence of excess caustic, due to the amphoteric nature of aluminum. Purex HAW has also been described as “high-iron sludge”. Fission product concentration in fresh Purex HAW sludge is about three orders of magnitude higher than Purex LAW.

Sodium salts of hydroxide, nitrate, sulfate and aluminate are the principal soluble components in the interstitial salt solution initially associated with settled Purex HAW sludge. Some of the sodium nitrate in the salt solution radiolyzes to sodium nitrite as the waste ages. Any trace organics present in the sludge also radiolyze to produce sodium carbonate, although this source of carbonate is very small compared to the carbonate formed from absorption of carbon dioxide from the air used to ventilate the waste tanks. The HLW tanks are ventilated to provide slight negative pressure relative to ambient pressure. Air flow through the tanks is filtered to prevent uncontrolled emissions of radioactive particulates.

Purex LAW Sludge

Purex LAW / Coating waste sludge contains comparable concentrations of iron and aluminum, with minor amounts of Mn from decontamination operations. A very high caustic to aluminum ratio is used in the decladding operation (Free OH^{-}**:**$Al(OH)_4^{-}$ = 5.2**:**1 at the end of decladding). The excess caustic stabilizes aluminum as soluble sodium aluminate) in the Coating waste, thus preventing most of the Al in the combined waste streams from precipitating as a sludge component.

Sodium salts of hydroxide, nitrate, sulfate, aluminate and fluoride are the principal soluble components in the interstitial salt solution associated with settled Purex LAW sludge, based on chemicals used in the various F canyon processes.

HM HAW Sludge

Based on process flowsheets, HM HAW sludge contains principally aluminum, iron, mercury and manganese, since the HM process always uses a permanganate-manganese(II) head-end treatment. Aluminum is co-dissolved with uranium in the HM process using a mercury catalyst and nitric acid, and thus ends up in the HAW waste from the HM process, rather than as a separate stream containing principally aluminum. Aluminum also partitions between sludge solids and soluble waste in the HM waste, due to the amphoteric nature of aluminum. Unlike the Coating waste generated in the Purex process, a large excess of caustic is not present in the HM HAW sent to the H Area Tanks (free OH^{-}**:**$[Al(OH)_4]^{-}$ = 1.5**:**1). Consequently, more of the Al precipitates as a component of the HM HAW sludge, leading to a “high-aluminum” sludge. Fission product concentration in fresh HM HAW sludge is about three orders of magnitude higher than HM LAW sludge.

Sodium salts of hydroxide, nitrate, sulfate, and aluminate are the principal soluble components in the interstitial salt solution associated with settled HM HAW sludge, based on chemicals used in the various H canyon processes.

HM LAW Sludge

HM LAW sludge contains comparable concentrations of iron and aluminum. Aluminum nitrate is sometimes used as a salting agent in the second cycle of the HM solvent extraction process, although nitric acid is preferred to minimize waste volume. Waste containing aluminum and fluoride that is generated from the recovery of ^{238}Pu from neptunium targets is also sent to the same waste receipt tank as the HM LAW, and provides an additional source of aluminum.

Sodium salts of hydroxide, nitrate, sulfate, aluminate and fluoride are the principal soluble components in this stream, based on chemicals used in the various H canyon processes. Soluble sodium salts of hydroxide, nitrate, sulfate and aluminate are generated when caustic is added to the acidic waste to enable transfer to a waste tank.

11.2.4 Soluble Waste Characterization

Current inventories of salt cake, supernate and soluble radionuclide inventories are available in the Waste Characterization System (WCS) database. Note that these current inventories do not include future waste receipts from continuing operations at the SRS, and thus estimates of total required years of operations would be increased for a new facility to account for future receipts containing soluble salts.

Because of corrosion concerns from the alkaline supernate, anion concentrations are analyzed regularly. The potassium ion concentration is also determined during these analyses, since potassium concentration is currently used as a basis for preparing salt solution blends for the HLW System Plan. Solubility models are used to estimate other soluble metal ion inventories, since analytical data for soluble trace metal ion concentrations are meager. Even though the metal ion inventories (other than potassium) are estimates, the total metal ion inventories in the entire waste inventory are largely unaffected, since these metals are primarily present as insoluble sludge components in alkaline waste. One of the primary reasons for being so concerned with tank chemistry is to be able to accurately predict and understand the mechanisms involved in the salt processing alternatives.

11.3 HLW Facilities

11.3.1 Tanks

The HLW system includes 51 waste tanks which are or have been used for safely storing and processing liquid radioactive waste. Of the 51 tanks, 29 are located in the H-Area Tank Farm, with the remainder in the F-Area Tank Farm. All of the tanks were built of carbon steel and reinforced concrete, but they were built with four different designs. The newest design (Type III) has a full-height secondary tank and forced water cooling; two of the designs (Types I and II) have five-foot-high secondary pans and forced cooling; the fourth design (Type IV) has a single steel wall and does not have forced cooling.

The first SRS HLW tanks were put into service in the early 1950s. Twenty-four of the 51 tanks, the Types I, II, and IV, are considered "old-style" (non-compliant) tanks and do not meet current requirements for secondary containment and leak detection. Ten of these "old style" tanks have a leakage history. Two of these 51 tanks have been closed. DOE has enforceable commitments to SCDHEC and the EPA to close these "old-style" tanks by FY22.

Tank	Tank Type (Type I, II, & IV non-compliant)	Date of Const.	Date Placed in HLW Service	Position Relative to Water Table	Known Leaks	Closed
1	I	1951-53	1954	above	X	
2	I	1951-53	1955	above		
3	I	1951-53	1956	above		
4	I	1951-53	1961	above		
5	I	1951-53	1959	above		
6	I	1951-53	1964	above	X	
7	I	1951-53	1954	above		
8	I	1951-53	1956	above		
9	I	1951-53	1955	submerged	X	
10	I	1951-53	1955	submerged	X	
11	I	1951-53	1955	submerged	X	
12	I	1951-53	1956	submerged	X	
13	II	1955-56	1956	slightly in	X	
14	II	1955-56	1957	slightly in	X	
15	II	1955-56	1960	slightly in	X	
16	II	1955-56	1959	slightly in	X	
17	IV	1958-62	1961	near		1997
18	IV	1958-62	1959	near		
19	IV	1958-62	1961	near	in leakage	
20	IV	1958-62	1960	near	in leakage	1997
21	IV	1958-62	1961	near		
22	IV	1958-62	1965	near		
23	IV	1958-62	1964	near		
24	IV	1958-62	1963	near		

Tank	Tank Type (Type III Compliant)	Date of Const.	Date Placed in HLW Service	
25	IIIA	1976-81	1980	Above Water Table No Leaks None Closed
26	IIIA	1976-81	1980	
27	IIIA	1976-81	1980	
28	IIIA	1976-81	1980	
29	III	1967-72	1971	
30	III	1967-72	1974	
31	III	1967-72	1972	
32	III	1967-72	1971	
33	III	1967-72	1969	
34	III	1967-72	1972	
35	IIIA	1976-81	1977	
36	IIIA	1976-81	1977	
37	IIIA	1976-81	1978	
38	IIIA	1976-81	1981	
39	IIIA	1976-81	1982	
40	IIIA	1976-81	1986	
41	IIIA	1976-81	1982	
42	IIIA	1976-81	1982	
43	IIIA	1976-81	1982	
44	IIIA	1976-81	1982	
45	IIIA	1976-81	1982	
46	IIIA	1976-81	1986	
47	IIIA	1976-81	1980	
48	IIIA	1976-81	1983	
49	IIIA	1976-81	1983	
50	IIIA	1976-81	1983	
51	IIIA	1976-81	*	

*Placed in LLW service in 1986.

11.3.2 Evaporators

The **1H Evaporator** was placed in service in 1963 and was used to evaporate high-heat waste. High-heat waste produces a decay heat of 5 to 16 But/hr-gal and is aged for at least one year prior to evaporation. This aging allows separation of the sludge and supernate and allows the shorter-lived radionuclides to decay to acceptable levels.

The 1H Evaporator was shut down in 1988 for hardware repairs and other upgrades as well as improvements to operator training and operating procedures. It restarted in 1993 and operated until 1994 when a leak was discovered in the 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 January 1, 1998 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. This is similar to the method used for the 2H Evaporator vessel replacement. The 1H system is currently in lay-up mode.

The **2H Evaporator** was placed in service in 1982 and has been used to evaporate low-heat waste. Low-heat waste contains a fission product content of $^{1}/_{1,000}$ to $^{1}/_{100,000}$ of the high-heat waste and does not require aging before evaporation. This evaporator system includes one feed tank (Tank 43) and two salt receipt tanks (Tanks 38 and 41). Tank 38 is the active tank; Tank 41 is full of salt. In recent years the primary role of the 2H Evaporator had been to evaporate the 221-H Canyon LHW stream and the DWPF recycle stream, both of which have been received in Tank 43.

The **3H Evaporator system** received DOE approval for operation in December 1999. Final preparations for radioactive operations continued throughout January and February 2000. The 3H initiated radioactive operations in May 2000, after some equipment issues identified during startup testing were resolved. However, in November 2000, it was discovered that all the cooling coils in Tank 30 (the 3H Evaporator drop tank) had failed. This severely limited the operation of this evaporator. A project is currently underway to install a drop line to Tank 37 so it can be used as the primary drop tank for this evaporator. This is expected to be complete by late 2002.

The **1F Evaporator** was placed in service in 1960 and was used to evaporate high-heat waste until it was shut down in 1988 because of high maintenance and lack of feed. There are no plans to restart this evaporator system. Some contaminated rainwater was pumped out of the 1F Evaporator cell in February 1998 and steam to the 1F system was permanently isolated in May 1998. However, no chemical cleaning has been done and no decontamination and decommissioning activities have occurred.

The **2F Evaporator** was placed in service in 1980 and has been used to evaporate low-heat waste. Experience in operating HLW evaporators indicates that the average life expectancy of evaporator vessels is 10.5 years. The 2F Evaporator vessel will reach 11.5 years of service in April 2001. The plan is to operate the 2F Evaporator until failure, so a replacement outage is not specifically scheduled at this time. A new vessel is currently on hand. The new vessel will serve as a spare for either the 2F or the 2H Evaporator systems.

Overall **Evaporator Utility** has been difficult to predict. Although a reasonable availability factor is used when projecting evaporator operation for future years, a number of unforeseen events have continued to significantly impact evaporator operation. For example, the 2H Evaporator experienced several unplanned extended outages that have significantly impacted its ability to operate as planned:

- In May 7, 1997, the 2H Evaporator was shut down in response to a Potential Inadequacy in Safety Analysis (PISA) regarding the source term in the evaporator vessel. Sample analyses of Tank 38 indicated a higher-than-expected quantity of sludge solids. The projected source term in the evaporator was calculated to exceed the SAR limit for offsite dose in the unlikely event of an evaporator explosion. This required two major modifications - the Tank 43 feed pump eductor was raised and a safety class steam cut-off valve was installed. The 2H Evaporator resumed operations on July 4, 1997 **(two month outage).**
- On July 19, 1997, the 2H Evaporator was shut down because the gravity drain line (GDL) was plugged. Standard flushing techniques failed to clear the line. A vendor with a 10,000-psi pressure wash system had to be brought in to clear the line. The 2H Evaporator resumed operations on September 2, 1997 **(two month outage).**
- The 2H Evaporator experienced Erratic lift rates and was shut down in January 2000 when attempts to correct the lift rate were unsuccessful. Sample results from solids previously found in the evaporator pot revealed the material consisted of sodium aluminosilicate and sodium diuranate (averaging 6.9 wt% total uranium content of and 2.3% enrichment). Based on the analysis results, a PISA was issued and all evaporators were shutdown. Initial analysis indicated that these solids form in the presence of high silica content feed. Appropriate controls were put in place to limit the amount of silica content in the feed to the 3H and 2F evaporators, and they were restarted in mid-January. However, the issue involving evaporation of high silica content feed (DWPF recycle & some sludge washing decants) has required considerable additional evaluation. Modifications are now underway to the 2H Evaporator to

allow cleaning to remove the solids. Also, modification of the Authorization Basis is underway to allow restart of the 2H Evaporator and the processing of these high silica feeds. This has resulted in at least an **18 month outage** for the 2H Evaporator.

11.3.3 F/H Interarea Transfer Line

The H and F Tank Farms are connected by a two mile long transfer line with a high point in the middle and a low point at each end. The line segments terminate at the high point in a small diversion box type structure that is used to flush and/or vent the transfer line. Use of this line was discontinued in 1989 and it was not used again until an upgrade to the controls was completed. Radioactive use of the line was fully restored in 1997. A number of successful transfers have been made since then, including the transfer of sludge from Tank 8 to Tank 40 in January 2001.

11.3.4 Waste Removal

Sludge was removed from seven tanks in 1966 through 1969 by a hydraulic mining and slurrying technique using once-through water at several thousand psi pressure. The practice was discontinued because so much added water was needed for thorough sludge removal that sufficient tank space to accommodate it was not available. The technique was modified to use waste supernate as the vehicle for breaking up and suspending the sludge. Several centrifugal slurry pumps were submerged in the tank being cleaned in lieu of the external pumps formerly used, which could be used only with clean water. This allowed the slurrying operation to be repeated as often as necessary to suspend all the sludge without adding significantly to the waste volume. This technique was used successfully to clean Tanks 16 and 17 and to remove a portion of the sludge from Tanks 15 and 18. HLW was also removed from Tanks 19-22 and 24.

Sludge Removal History

Tank	Sludge Removal Date	Amount of "Settled" Sludge Removed, kgal	Slurry Technology Used	Number of Transfer Pumps	Number of Slurry Pumps	Receipt Tank
1	1969	34	water sluicer	4	0	7
2	1966	44	water sluicer	4	0	7
3	1968	67	water sluicer	3	0	7
9	1966	38	water sluicer	4	0	13
10	1967	58	water sluicer	3	0	13
11	1969	176	water sluicer	4	0	13
14	1968	80	water sluicer	2	0	13
15	1982	125	slurry pump	1	2	42
16	1978-1979	67	slurry pump	1	4	15, 21
17	1983-1985	373	slurry pump	1	3	18
18	1986-1987	518	slurry pump	1	3	40, 42, 51
21	1986	205	slurry pump	1	3	22, 42, 51
22	1986	78	slurry pump	1	3	40, 51
8	2001	126	slurry pump	1	3	40

Salt Removal History

Tank	Salt Removal Date	Volume of Salt Removed, kgal	Notes
10	1979-1980	284	Density Gradient Demo.
19	1980-1981	916	Agitation Demo.
19	1986	7	Zeolite remains
20	1980-1981	570	Density Gradient Demo.
20	1986	366	Agitation
24	1983	403	Agitation, Zeolite remains

11.3.5 Tank Closure

The Savannah River Site has begun to close HLW tank systems. SRS closes HLW tank systems under the F/H Tank Farm Industrial Wastewater Operating Permit and South Carolina Regulation R.61-82, "Proper Closeout of Wastewater Treatment Facilities." In addition, SRS recognizes that future RCRA/CERCLA remediation actions may be required to clean up contaminated soils and groundwater 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. See additional discussion on Tank Closure under Section 5.3 Regulatory Constraints – NEPA.

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.

In July of 1999 DOE issued Order 435.1 "Radioactive Waste Management." Order 435.1 sets forth the requirements for handling all DOE radiological waste, including the residual waste heel that cannot be removed from HLW tanks after bulk waste removal.

Waste resulting from reprocessing spent nuclear fuel that is determined to be incidental to reprocessing is not high-level waste, and is managed under DOE's regulatory authority in accordance with the requirements for transuranic waste or low-level waste, as appropriate. When determining whether spent nuclear fuel reprocessing plant wastes are managed as another waste type or as high-level waste, either the citation or the evaluation process is used:

1. **Citation**. Waste incidental to reprocessing by citation includes spent nuclear fuel reprocessing plant wastes such as, contaminated job wastes including laboratory items such as clothing, tools, and equipment.
2. **Evaluation**. Waste incidental to reprocessing will be managed as low-level waste and meet the following criteria:
   - Have been processed, or will be processed, to remove key radionuclides to the maximum extent that is technically and economically practical; and
   - Will be managed to meet safety requirements comparable to the performance objectives set out in 10 CFR Part 61, Subpart C, *Performance Objectives*; and
   - Are to be incorporated in a solid physical form at a concentration that does not exceed concentration limits for Class C low-level waste as set out in 10 CFR 61.55, *Waste Classification*; or will meet alternative requirements for waste classification and characterization as DOE may authorize.

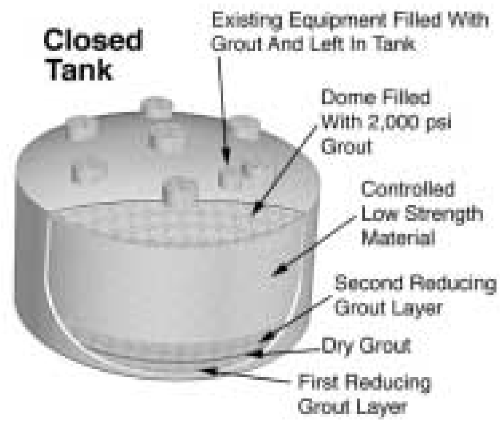
DOE is developing a Waste Incidental to Reprocessing Determination to satisfy the requirements in Order 435.1 for the waste heel remaining in Tank 19.

The general protocol for SRS tank system closure is as follows:

1. Bulk waste is removed and the tank is water washed.
2. Any waste remaining in the tank after water washing is considered residual waste and subject to a Waste Incidental to Reprocessing (WIR) Determination. The residual waste is characterized, and a method for stabilizing the residual contaminants is proposed. Based on work done to date, it is evident that some type of mechanical or chemical cleaning, using oxalic acid or some other more DWPF compatible chemical, will be required. This is necessary to reduce the waste heel to levels required to meet closure requirements. (See Sections 9.2 and 9.3 for technical development work on this subject).
3. 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.
4. Specially designed containers to store, transport, and dispose of equipment are necessary to support equipment failures and equipment removal for tank closure. Each of these containers are required to pass an On-site Safety Assessment for the on-site transport of radioactive materials as required by RADTRANS2000 which incorporates the requirements of DOE Order 460.1A Packaging and Transportation Safety.
5. The portion of the performance objectives remaining after subtracting non-tank sources is apportioned among the tanks to determine individual, tank-specific performance objectives.
6. Detailed tank-specific closure modules are prepared for each tank system and submitted to SCDHEC for approval. SCDHEC approval is a prerequisite to starting emplacement of backfill material.

Equipment removed from tanks due to failure, obsolescence, or to support Waste Removal for tank closure must also be proven to be "incidental waste" prior to disposal. To support this, decontamination of equipment must be routinely performed prior to, upon, or after equipment removal. Enhanced decontamination efforts are expected to be necessary for equipment in idled tanks to ensure it can meet the disposal requirements for "incidental waste."

Grout backfill is used to perform three functions:



- A "reducing" grout is poured in the tank first to stabilize the residue. This grout has chemically reducing properties, which encourage some of the radioactive isotopes to remain insoluble and therefore less mobile. This reduces the migration of contaminated materials to the surrounding water systems. A dry grout layer and a second layer of reducing grout may be used if necessary.
- Controlled Low Strength Material (CLSM) is a specially formulated grout that fills the empty voids in the tank system thereby eliminating the chance for subsidence. Its mechanical properties are similar to compacted soil.
- In case institutional control is lost, an intruder barrier is provided by pouring a layer of relatively strong grout at the top of the tank or by crediting the reinforced concrete tank top. For the Type IV tanks a strong grout layer was poured to provide this added intruder protection. Different grout formulations continue to be tested to reduce cost and/or improve performance.

The Tank 17-20 cluster in F-Area was selected as the first set of tanks to be closed, for several reasons. Tanks 17-20 are non-compliant 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. In addition, these are Type IV tanks, which lack internal structures, thereby simplifying removal of sludge heels and emplacement of backfill material. Tanks 20 and 17 were closed in 1997.

Tank 20 was the first HLW Tank operationally closed at SRS. Bulk waste removal and water washing were completed in 1986. Ballast water was removed in July 1996. Photographic inspections of the tank interior revealed approximately 1,000 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 determined through their ongoing interactions with the NRC that the NRC had "no objection" to the closing of Tanks 20 and 17. WSRC began placing the reducing grout in Tank 20 on April 24, 1997, using an on-site continuous feed plant located near Tank 20. The reducing grout was placed in several stages. The first layer was placed in liquid form using multiple pour locations. Grout was alternately poured through six perimeter risers and one center riser. The dense grout lifted the waste sludge, which is less dense, off the tank bottom and spread it across the tank. The loose waste sludge was then immobilized by blowing in dry powdered grout. The dry particles hydrated, incorporating the water into the grout powder, and formed a hard mass. More liquid grout was poured from the center riser, forming a domed cap fully encapsulating the waste within the grout layers. Bleed water generation was kept to a minimum due to the special formulations of the backfill materials. Approximately 518 cubic yards (2 feet deep in tank) of reducing grout were used. This was followed by approximately 7,000 cubic yards of CLSM (approximately 32 feet deep). The entire filling operation was observed using a remotely operated video camera. The grouts and CLSM were shown to be very flowable while in the liquid state and were able to self-level and fully surround and enclose tank equipment. SCDHEC approved the Tank 20 closure on July 31, 1997.

Tank 17 was the second waste tank operationally closed at SRS. Bulk waste removal of 376 kgal of sludge and salt was completed in 1985. Approximately 280 kgal of tritiated water was transferred from Tank 17 to Tank 6 in March 1997, leaving a sludge heel of approximately 10 kgal. Submersible (Flygt) mixers (4 horsepower and 15 horsepower sizes) were used to suspend the sludge heel, and water brushes were used to sluice the suspended sludge toward diaphragm pumps for removal to Tank 18. Approximately 2,200 gallons of solids and 200 gallons of water remained in Tank 17 after sluicing. These waste solids were sampled; sample results confirmed that process knowledge estimates were reasonable. The reducing grout was placed in several layers. The first one-foot layer was placed in liquid form using multiple pour locations. When the grout was first introduced, some of the sludge was lifted off the tank bottom by the dense grout. Some intermixing occurred between the grout and the sludge. After the first one-foot layer, no visible sludge remained on the top of the grout. At this point, the remaining reducing grout was poured from the center riser to achieve a total of approximately 6 feet (1,330 cubic yards) of reducing grout. This was followed by approximately 28 feet (5,416 cubic yards) of CLSM, and approximately 11 feet (1,307 cubic yards) of 2,000 psi high strength grout. The Tank risers were filled with 28 cubic yards of 5,000-psi high strength grout. SCDHEC approved the Tank 17 closure on December 15, 1997.

11.3.6 Sludge Preparation

A full-scale demonstration of the sludge washing and aluminum dissolution process was successfully completed in Tank 42 during FY82-83. About 77% of the aluminum and over 98% of the soluble salts were removed from a 125,000 gallon batch of sludge that originated in Tank 15.

Sludge Batch 1A consisted of the sludge in Tank 51 that originated in Tanks 17, 18, 21, and 22. Sludge Batch 1B consisted of the sludge in Tank 42 combined with the heel of Sludge Batch 1A in Tank 51. The sludge in Tank 42 had originally been moved there from Tanks 15, 17, 18, and 21. The data below shows the sending tank, the receiving tank, date transfer started, and gallons of slurried sludge transferred out of the sending tank. Note that this is the volume transferred and does not represent the "settled sludge" volume.

Sludge Batch Makeup

Sludge Batch	Sending Tank	Receiving Tank	Date of Transfer	Volume of Transfer, kgal
1A	17	18	6/26/85	150
1A	17	18	10/15/85	117
1A	18	51	7/10/86	270
1A	18	51	8/27/86	282
1A	18	51	9/7/86	196
1A	21	51	9/27/86	174
1A	22	51	7/17/86	344
1B	15	42	2/26/82	403
1B	15	42	3/9/82	301
1B	18	42	9/17/86	222
1B	18	42	9/23/86	277
1B	18	42	10/18/86	129
1B	18	42	11/3/86	100
1B	21	42	9/20/86	345
1B	21	42	9/25/86	93
1B	21	42	9/27/86	174
2	18	40	1986-1987	1243*
2	22	40	1986	158*
2	8	40	1/11/01	460*

* Volume as received in Tank 40

11.3.7 Salt Processing

Of the 37 million gallons of high level waste in storage, approximately 3 million gallons are sludge waste and 34 million gallons are salt waste. The sludge waste, which is insoluble and settles to the bottom of a waste tank, generally contains insoluble radioactive elements including strontium, plutonium, americium, and curium in the form of metal hydroxides. The salt waste, which is soluble and is dissolved in the liquid rather than settling to the bottom of the waste tanks, contains most of the soluble radioactive element cesium. The salt supernate and dissolved salt cake removed from the waste storage tanks will be processed to remove the radioactive cesium. The cesium contains approximately 99.99% of the radioactivity in the salt waste but is only a small fraction of the total previous volume. Since cesium is the only part of salt waste that is high-level waste, it is the only part that must be transferred to DWPF for vitrification and ultimate storage in a Federal Repository. The remaining salt solution, now without radioactive cesium, is classified as low-level waste. This decontaminated salt solution, although it contains less than 0.01% of the previous radioactivity, is the bulk of the previous volume. It is sent to the Saltstone Facility for safe, on-site disposal.

Systems Engineering Evaluation

Processing at the In-Tank Precipitation (ITP) Facility was suspended because the facility could not cost effectively meet both the safety and production requirements for the High Level Waste System. A HLW salt solution processing alternative evaluation is currently underway. An extensive list of potential treatment options has been pared down to three primary alternatives. These alternatives include Small Tank Tetraphenylborate (TPB) Precipitation, Crystalline Silicotitanate (CST) Non-Elutable Ion Exchange and Caustic Side Solvent Extraction:

- **Small Tank Tetraphenylborate Precipitation**
  The Small Tank TPB facility uses chemical precipitation/adsorption and filtration to separate Cs-137, Sr-90 and Pu from salt solution into a low-volume, high radioactivity waste stream known as "precipitate," and a high-volume, low radioactivity waste stream known as "filtrate." The precipitate is washed to reduce the nitrite concentration from 0.4 M NO_2 to 0.01 M NO_2. The lower NO_2 concentration reduces the formation of attainment limiting, high boiling organic compounds in the ventilation system to manageable levels. The filtrate is combined with ETF evaporator concentrate and then solidified and disposed as Saltstone grout.
- **CST Non-Elutable Ion Exchange**
  The CST Non-Elutable Ion Exchange process uses adsorption filtration to remove the Sr-90, U, and Pu from the waste using monosodium titanate (MST). It then removes the Cs-137 by adsorption on crystalline silicotitanate (CST). The decontaminated salt solution is then combined with ETF evaporator concentrate, solidified and disposed as Saltstone grout. The adsorption media (both CST and MST) are transferred to DWPF for incorporation into the glass.
- **Caustic Side Solvent Extraction**
  In solvent extraction (liquid-liquid), a sparingly soluble diluent material carries an extractant that will complex with cesium ions in the caustic solution. The separated cesium can then be stripped back into an aqueous phase for transfer back to DWPF.

11.3.8 Defense Waste Processing Facility (DWPF)

DWPF operation was initiated in FY96. In FY96, FY97, and the majority of FY98, substantial shakedown runs and learning experience was gained. However, since DWPF has now operated for approximately four years in a full sludge only production mode, it is appropriate to update the production capacity based on the knowledge of the plant behavior versus the initial design capacity calculations.

For reference, Research and Development (R&D) work conducted in the late 1970s and early 1980s indicated that the average instantaneous pour rate for the DWPF melter should be 228 lbs./hr. This was based on scale up calculations from data derived from the small R&D melters with a specific chemistry. The melt rate is controlled by several key chemical and physical properties of the liquid high level waste and the molten vitrified waste:

- Glass oxidation state
- Molten vitrified waste viscosity
- Melter feed solids content
- Melter vapor space temperature as defined in the Safety Authorization Basis
- Quantities of combustibles in the melter feed

A limited study was also performed in 1989 that estimated the DWPF plant attainment to be approximately 75%, including melter outages.

Therefore, the initial design capacity for the facility was based on the following:

$$\frac{228\,\text{lbs. glass}}{\text{hr}} \times \frac{\text{canister}}{3{,}705\,\text{lbs. glass}} \times \frac{24\,\text{hr}}{\text{day}} \times \frac{365.25\,\text{day}}{\text{yr.}} \times 75\%\ \text{attainment} = \frac{405\,\text{canisters}}{\text{yr.}}$$

However, based on the production capability that has been accomplished for Batch 1A and for Batch 1B, it does not appear that this type of production capability will be accomplished without modifications being implemented. The limitations being experienced in production are primarily related to:

- the higher oxidation state of the sludge feed relative to the original test data and its impact on production
- foaming of the melter cold cap

- pressure surging of the off gas system
- lowering of the melter vapor space temperature

These limitations result in a lower production rate.

Based on the first two macro-batches of feed processed in the DWPF, the following production capacity has been accomplished to date:

Batch 1A Results (5/25/98 to 9/15/98)

$$\frac{161\,\text{lbs. glass}}{\text{hr}} \times \frac{\text{canister}}{3{,}800\,\text{lbs. glass}} \times \frac{24\,\text{hr}}{\text{day}} \times \frac{365.25\,\text{day}}{\text{yr.}} \times 68.0\%\ \text{attainment} = \frac{253\,\text{canisters}}{\text{yr.}}$$

Batch 1B Results (12/3/98 to 3/30/99)

$$\frac{146\,\text{lbs. glass}}{\text{hr}} \times \frac{\text{canister}}{3{,}800\,\text{lbs. glass}} \times \frac{24\,\text{hr}}{\text{day}} \times \frac{365.25\,\text{day}}{\text{yr.}} \times 77.1\%\ \text{attainment} = \frac{260\,\text{canisters}}{\text{yr.}}$$

The melt pour rates of 161 and 146 lbs. of glass per hour for Batch 1A and 1B, respectively, were obtained by evaluating a stable period of operating time (dates shown above) and is considered representative of the macro-batch.

As you will note above, the pounds of glass per hour that was poured during Batch 1A was greater than is currently being poured in Batch 1B. This is caused by the differing chemical composition of the two batches. For example, Batch 1B feed is more viscous than Batch 1A feed and is therefore predicted to have a lower melt rate based on development data.

During the overall mission of the HLW Program, the chemical composition of the feed batches will change each time a new sludge batch is processed. The average pour rate in Batch 1A and 1B ranged from 146 to 161 lbs. of glass per hour. The feed composition of these two batches is relatively consistent with the future batches remaining to be processed. Therefore, we predict the average pour rate for the future batches to be approximately 155 lbs. of glass per hr. The attainment percentage in Batch 1A and 1B ranged from 68.0% to 77.1% attainment. As you will note, as we have become more knowledgeable of plant operations and implemented improvements (*e.g.*, improved cold cap management, SRAT Lab aliquotting, etc.), this percentage has increased. Based on this learning curve, we predict that in the future an attainment percentage of as high as 83% can be maintained (not including melter outages). Therefore, based on our current knowledge of DWPF operations, we currently predict the following production capacity for the facility during full production years after successful implementation of production improvement initiatives.

$$\frac{155\,\text{lbs. glass}}{\text{hr}} \times \frac{\text{canister}}{3{,}800\,\text{lbs. glass}} \times \frac{24\,\text{hr}}{\text{day}} \times \frac{365.25\,\text{day}}{\text{yr.}} \times 83\%\ \text{attainment} = \frac{297\,\text{canisters}}{\text{yr.}}$$

The production rate above, however, does not include any deduction from the attainment percentage to incorporate a melter change out that will be necessary at certain times in the processing at DWPF. To date, DWPF has not experienced a melter failure and therefore, there is no plant experience to improve the assumed timeframes for predicting melter failures or a melter outage.

Melter pour spout inserts continue to perform well and support DWPF canister production rates by virtually eliminating problems with glass “wicking.” A replaceable insert is installed remotely in the melter pour spout. Its function is to provide a clean, sharp “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. Glass pouring eroded the original melter pour spout knife-edge, leaving a rounded surface that caused the glass pour stream to waver. This caused the glass to contact, cool, and solidify on the inside surfaces of the lower pour spout and bellows liner. This greatly reduced DWPF attainment, because melter feeding and pouring had to be interrupted while the glass was removed from the affected surfaces. However, the fresh, sharp edge provided by each new insert allows the glass to flow smoothly and drop cleanly through the bellows and into the canister. The first melter pour spout insert was installed in May 1997. Operating experience shows that each insert lasts for approximately 60 canisters, before it must be removed and replaced.

Several facility modifications have been implemented to support production improvements:

- The DWPF sludge-only flowsheet was revised to eliminate the addition of simulated precipitate hydrolysis aqueous (PHA) in FY98. This improved the Sludge Receipt and Adjustment Tank (SRAT) batch preparation time by 40%, eliminated the need to prepare and sample the batches of simulated PHA, and reduced the volume of recycle generated by 11 kgal per SRAT batch cycle. This reduced the volume of recycle transferred to the Tank Farm. This improvement continues to support high production rates at minimum water generation.
- The Slurry Mix Evaporator (SME) operating sequence was modified to increase productivity. The spent decon frit and wash water resulting from canister decontamination is recycled to the SME for incorporation in subsequent glass batches. Previously, canister decontamination was a time-limiting item in melter feed preparation, because the SME could only accommodate spent decon frit and wash water at a rate of two canisters per day. However, under the new operating sequence, the SME can now accept up to 6 canisters' worth of spent decon frit and wash water per day. This improvement required no facility modifications. It continues to operate successfully.
- The dilute nitric acid decon system, presently in use in the Remote Equipment Decon Cell (REDC) and the Contact Decon Maintenance Cell (CDMC), has been augmented by a carbon dioxide (dry ice) pellet system. This system assists equipment decontamination in these two cells by generating streams of high-pressure air bearing the CO_2 pellets. Initial testing has been successful. Implementation of this system would reduce one source of aqueous waste in DWPF, because the spent CO_2 pellets will sublime (phase change directly from solid to gas). This helps reduce the volume of decontamination related recycle waste being returned to the Tank Farms, thereby reducing the burden on Tank Farm Evaporators and storage space.
- Mock-up testing of laboratory aliquotting has been completed and the method implemented for the SRAT related analysis. Side by side testing is underway for SME aliquotting samples. Initial results are very encouraging. Successful implementation will increase DWPF analytical Lab capacity.
- Several additional facility modifications were completed to prepare DWPF for processing of Batch 1B sludge. The Melter Feed Tank interlocks were upgraded and seismically qualified to ensure that, in the event of an earthquake, feeding to the melter will stop. Motor Control Centers for Zone 1, 2, and 3 Ventilation were seismically qualified to ensure that, following an earthquake, forced air ventilation into the Vitrification building can be shut down while exhaust fans continue to operate. This will maintain negative pressure inside the Vitrification Building, thereby reducing the risk of an unfiltered release of radioactive material. A safety class air purge supply to the Slurry Mix Evaporator Condensate Tank (SMECT) was added to maintain a dilute vapor space. This will prevent the SMECT vapor space from reaching the lower flammability limit in the event of a solids carryover from the Sludge Receipt and Adjustment Tank (SRAT) or the Slurry Mix Evaporator (SME), which could result in hydrogen generation.

DWPF is currently in "sludge-only" Radioactive Operations. Since startup, yearly production rates are:

FY96	64 canisters (actual)
FY97	169 canisters (actual)
FY98	250 canisters (actual)
FY99	236 canisters (actual)
FY00	231 canisters (actual)

Organic Waste Storage Tank (OWST)

The OWST is a double-shell aboveground tank located southwest of the Vitrification Building in S-Area. The primary tank is constructed of 304L stainless steel, and has a capacity of 150 kgal. 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, is to be maintained to limit benzene emissions. The secondary tank is constructed of carbon steel, and includes a leak detection system.

Essentially all benzene generated during cold chemical runs has been removed from the OWST. Although it is considered empty for RCRA purposes, the OWST still contains a very small quantity (about 15 gallons) of benzene and continues to be operated under RCRA requirements.

11.3.9 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 that 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 steel-frame 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 **Shielded Canister Transporter (SCT)** moves one canister at a 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. In addition, five positions are occupied by test canisters strategically located to monitor for possible corrosion.

11.3.10 Saltstone Facility

The Saltstone Facility treats and disposes the Salt Waste Processing filtrate stream and the ETF concentrate stream. The two low-level radioactive waste streams are treated 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 cure. The solidified waste form is known as saltstone.

Since Salt Waste Processing began its re-evaluation of technology alternatives, only ETF concentrate has been available to Saltstone for processing. The waste inventory in Tank 50, approximately 300 kgal, was processed in FY98. In FY99, the Saltstone Facility was placed in a partial lay-up mode. Partial lay-up reduces facility costs while minimizing potential deterioration of the plant, thereby minimizing the cost to resume operations in the future.

Vaults: Saltstone operations require periodic construction of additional vaults, capping of filled vault cells and construction of permanent vault roofs. The required schedule for these repetitive projects is dependent upon the salt processing production plan. Each vault cell can hold 242,500 cubic feet of saltstone grout, or approximately one million gallons of salt solution. The construction and startup of new vaults supports planned Salt Processing production rates on a just-in-time basis.

Currently, construction of **Vault #1** is complete. Vault #1 has six cells, three of which are now filled and capped. A Rolling Weather Protection Cover (RWPC) protects the cell that is being filled.

Vault #4 has one cell filled, leaving eleven of Vault #4’s twelve cells available for grout disposal (Cell A was filled in 1989 when 10,032 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 approximately 25 feet
- more than one cell can be filled at a time
- disposal of the RWPC as radioactive waste is eliminated.

11.4 HLW System Performance

Production

Actual storage and processing data for the last few years is provided in the table below:

End of Year	Influents (kgal)							
	F Canyon	H Canyon	DWPF Recycle	299-H	RBOF	ESP Wash Water	Other	**Total In**
FY95								
FY96	405	92	1,087	16	132	700	325	**2,757**
FY97	409	65	1,848	12	158	210	814	**3,516**
FY98	224	111	2,249	8	155	262	214	**3,224**
FY99	292	314	2,106	8	91	0	599	**3,410**
FY00	260	164	1,481	14	53	493	628	**3,093**

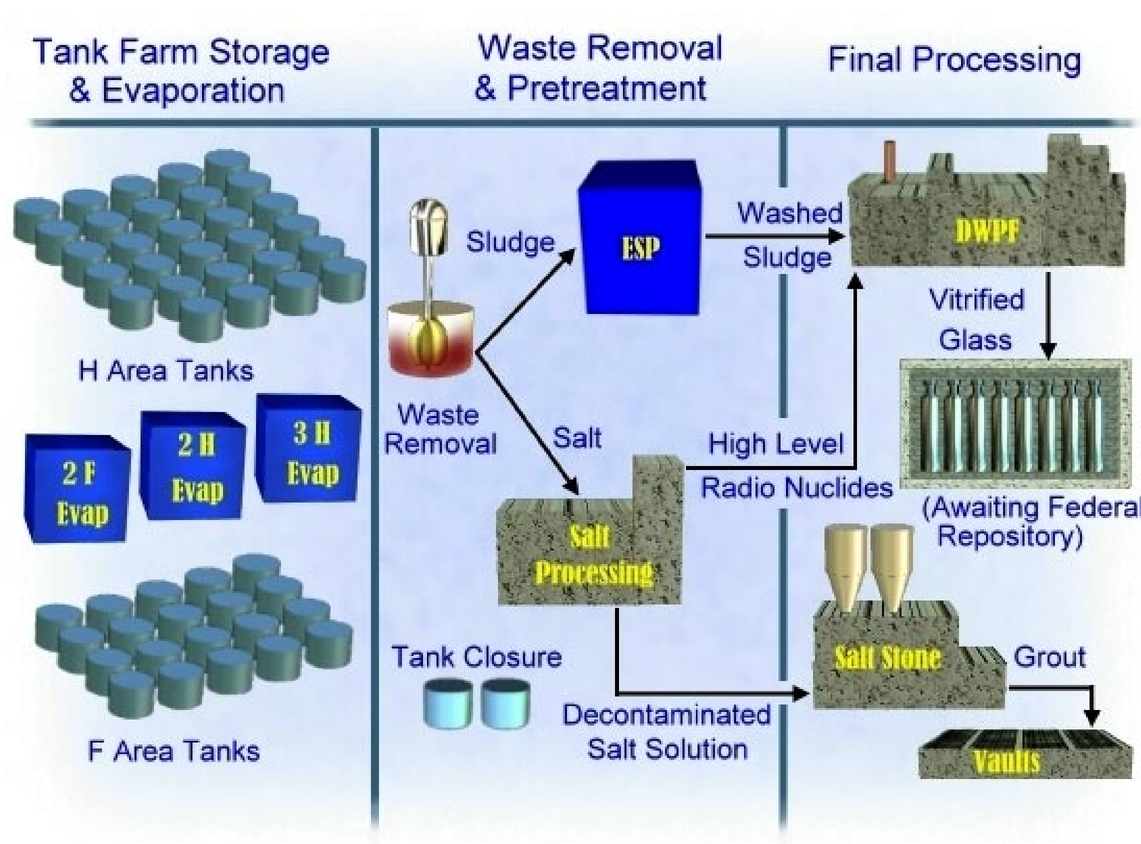
End of Year	Effluents (kgal)					**Total Waste Volume Stored** (kgal)	Canister Production
	Evaporator Overheads			Sludge to DWPF	**Total Out**		
	2F Evap	2H Evap	3H Evap				
FY95						**32,367**	
FY96	457	1,648	N/A	59	**2,165**	**32,960**	64
FY97	908	1,598	N/A	155	**2,662**	**33,814**	169
FY98	706	2,232	N/A	230	**3,169**	**33,869**	250
FY99	675	2,064	N/A	181	**2,919**	**34,359**	236
FY00	377	(4)	652	177	**1,203**	**36,250**	231

12. System Description

12.1 Background

The Savannah River Site (SRS) in South Carolina is a 300-square-mile Department of Energy (DOE) complex that has produced nuclear materials for national defense, research, and medical programs since it became operational in 1951. As a waste by-product of this production, there are approximately 37 million gallons of liquid, high-level radioactive waste currently stored in 49 underground waste storage tanks. Continued, long-term storage of these liquid, high-level wastes in underground tanks poses an environmental risk. Therefore, the High Level Waste Division at SRS has, since FY96, been removing waste from tanks; pre-treating it; vitrifying it; and pouring the vitrified waste into canisters for long-term disposal. By the end of FY01, over 1200 canisters of waste will have been vitrified. The canisters vitrified to date have all contained sludge waste. Salt waste processing is still being developed.

The High Level Waste System is the integrated series of facilities at SRS that convert waste stored in the tanks into glass. This system includes facilities for storage, evaporation, waste removal, pre-treatment, vitrification, and disposal. These facilities are shown in the sketch below and are briefly described in the text that follows.



12.2 Tank Storage

The 37 million gallons of liquid, high-level radioactive waste at SRS are stored in 49 underground waste storage and processing tanks. In addition, there are two waste storage tanks that have been emptied and closed, making a total of 51 original tanks. The waste storage tanks are located in two separate "tank farms," one in H-Area and the other in F-Area. The stored waste contains 426 million curies of radioactivity.

There are four types of underground waste storage tanks at SRS. The Type I and Type II tanks are described as being "high risk" because they do not meet current secondary containment and leak detection standards, sit near or at the water table, and together store 6.4 million gallons of waste and 146 million curies of radioactivity. Removing waste from these tanks as soon as possible is important, given the environmental risks posed by continuing to store HLW in these aging tanks.

The age and condition of the 16 Type I and II waste storage tanks at SRS is of increasing concern. They were placed in service between 1954 and 1964. Over the years, ten of these tanks have leaked waste from the primary tank into the secondary pan. In one case, some waste leaked from the secondary pan into the environment.

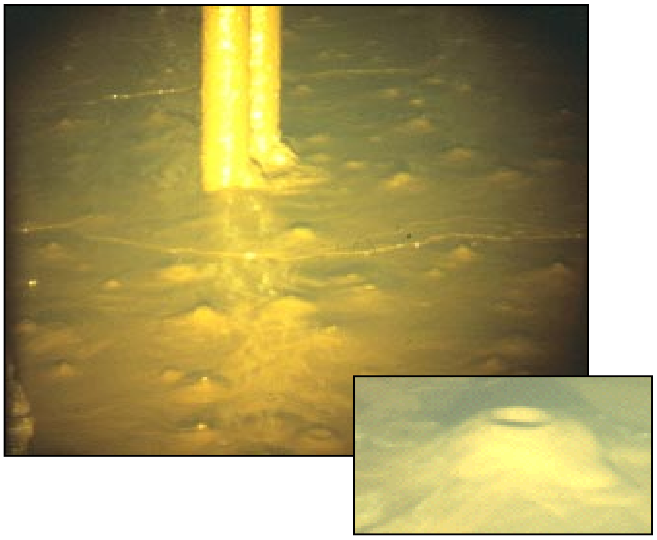
In 1997, a new kind of leak site, a horizontal crack approximately 18 inches in length, was found on one Type II tank, Tank 15. This leak site was discovered by SRS's extensive tank-integrity monitoring program. SRS has not determined the cause of this crack, although it may indicate that a different mechanism is affecting tank wall integrity. In addition, increased corrosion is being seen in several tank secondary containment pans. In January 2001, after a transfer of low source term waste, approximately 90 gallons of waste was detected in the annulus of Tank 6. An extensive exterior wall inspection has since identified six (6) leak sites. At the time of this plan, compensatory measures are in progress to address the continued use of Tank 6 for storage. These findings underscore the urgency to remove waste from these tanks as soon as possible.

Tanks under construction. Note tank size relative to construction workers. Later, dirt is backfilled around the tanks to provide shielding.

Overhead View of H Tank Farm showing the tops of three tanks. Each tank is approximately 90 feet across and can contain over one million gallons of waste.

The waste stored in SRS tanks is broadly characterized as either "sludge waste" or "salt waste." Sludge waste is insoluble and settles to the bottom of a waste tank, typically beneath a layer of liquid supernate. Sludge generally contains the radioactive elements strontium, plutonium, and uranium in the form of metal hydroxides. Sludge is only 8% of the SRS waste volume (3 million gallons) but is 53% of the waste radioactivity (226 million curies).

Salt waste is soluble and is dissolved in the liquid. Salt generally contains the radioactive element cesium and trace amounts of other soluble radioactive elements in the form of dissolved salts. Salt waste is 92% of the SRS waste volume (34 million gallons) and 47% of waste radioactivity (200 million curies). Salt waste can be further described as being "supernate" (in normal solution), "concentrated supernate" (after evaporation has removed some of the liquid) or "saltcake" (previously dissolved salts that have now crystallized out of solution). A single waste tank can contain sludge, supernate, and salt cake; although an effort is made to segregate sludge and salt in different tanks.



Recently slurried sludge waste in a tank. Sludge consists of insoluble solids that settle to the bottom of a tank. Note the offgas bubbles, including hydrogen, generated from radiolysis.

Salt waste is dissolved in the liquid portion of the waste. It can be in normal solution as Supernate (top picture) or, after evaporation, as salt cake (bottom picture) or concentrated supernate. The pipes in all the pictures are cooling coils

<u>Volume Reduction — Evaporation</u>

To make better use of available tank storage capacity, incoming liquid waste is evaporated to reduce its volume. This is critical because most of the SRS Type III waste storage tanks are already at or near full capacity. Since 1951, the tank farms have received over 100 million gallons of high-level liquid waste, of which over 60 million gallons have been evaporated, leaving the 37 million gallons being stored in the 49 storage tanks. The System Plan carefully tracks the projected available tank space to ensure that the tank farms do not become "water logged," a term meaning that all of usable tank space has been filled. A portion of tank space must be reserved for Contingency Transfer Space and for working space within the tanks. Waste receipts and transfers are normal tank farm activities as the tank farms receive new waste from the F and H Separations Canyons, stabilization and de-inventory programs, recycle water from DWPF processing, and wash water from sludge washing. The tank farms also make routine transfers to and from tanks and evaporators. Currently, there is a backlog of waste that has not been evaporated. Once this backlogged waste has been evaporated, the working capacity of the tank farms will be steadily reduced each year until salt processing becomes operational.

Two evaporator systems are currently operating at SRS - the 3H and 2F systems. A third system, the 2H Evaporator is down for cleaning and modifications. It is scheduled to be operational again before the end of FY01.

12.3 Waste Removal & Tank Closure

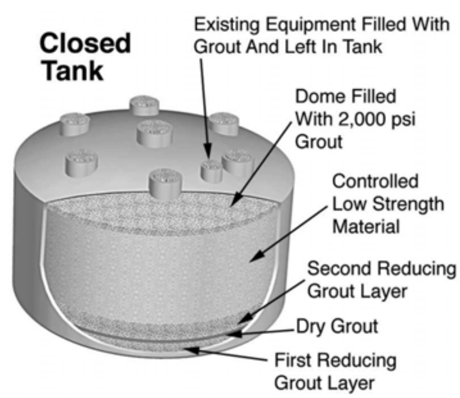
Waste Removal from Tanks

During waste removal, water is added to waste tanks and agitated by slurry pumps. If the tank contains salt, this water and agitation dilutes the concentrated salt or re-dissolves the salt cake. If the tank contains sludge, this water and agitation suspends the insoluble sludge particles. In either case, the resulting liquid slurry, which now contains the dissolved salt or suspended sludge, can be pumped out of the tanks and transferred to waste pre-treatment tanks.

Typical Waste Removal equipment includes three to four 45-foot long slurry pumps and one transfer pump or jet. Note the substantial structural steel required to support the loads in the picture above. At right is the typical installation of a transfer pump (Tank 8) requiring difficult, high-risk entries into High Level Waste Tanks.

Waste removal is a multi-year process. First, each waste tank must be retrofitted with 45-foot long slurry and transfer pumps, steel infrastructure to support the pumps, and various service upgrades (power, water, air, or steam). These retrofits can take between two and four years to complete. Then the pumps are operated to slurry the waste. Initially, the pumps operate near the top of the liquid and are lowered sequentially to the proper depths as waste is slurried and transferred out of the tanks. Bulk waste removal normally takes between six to twelve months, with the pumps being left in place for later heel removal.

Tank Closure



Once bulk waste has been removed from a tank, a series of activities are needed to prepare it for closure. Tank closure involves heel removal and water washing, isolation, and filling with grout. Heel removal and water washing are used to remove the residual waste "heel" in the tank (the last several inches at the bottom). Spray nozzles wash down the tank sides and bottom, and specialized equipment removes this residual waste. The tank is then isolated by cutting and capping all service lines (power, steam, water, and air) and sealing all tank risers and openings. Finally, the tank is filled with layers of grout, which bind up any remaining waste, leaving the tank safe for long-term surveillance and maintenance. The schedule for waste removal and tank closure is part of the Federal Facility Agreement (FFA) between DOE, the Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC).

Pre-Treatment

Salt Processing: To separate Salt Waste into its High-level and Low-level Radioactive Components

During salt processing, radioactive cesium and trace amounts of strontium and plutonium are separated from the salt supernate and dissolved salt cake that has been removed from waste storage tanks. This separated waste is highly radioactive because it contains almost all the radioactivity of the original salt waste but only a small fraction of the original volume. It is high-level waste that must be vitrified at DWPF. The remaining waste, now without its highly radioactive components, contains only a small fraction of the original radioactivity but the bulk of the volume. It is low-level waste called "salt solution" that can be safely disposed, on site, at the Saltstone Facility. Separating salt waste into its high-level and low-level components greatly reduces the amount of waste that must be vitrified into glass canisters, in turn greatly reducing the capacity and costs of the Federal Repository being built to dispose of the HLW glass canisters.

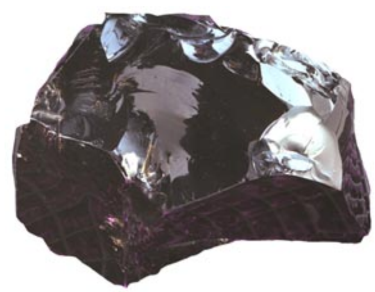
Salt waste processing was suspended in FY98 because the facility could not cost effectively meet both the safety and production requirements of the HLW System. DOE selection of an alternative salt processing technology is expected in FY01, with construction of a salt processing facility scheduled to be completed by FY10.

Sludge Processing: To produce "Washed Sludge"

Sludge is "washed" to reduce the amount of non-radioactive soluble salts remaining in the sludge. This ensures that the waste meets DWPF Waste Acceptance Criteria and Federal Repository requirements as well as reducing the overall volume of high-level waste to be vitrified. The processed sludge is called "washed sludge" and is sent to DWPF. During sludge processing, large volumes of wash water are generated and must be returned to the tank farms where it is volume-reduced by evaporation. Over the life of the waste removal program, the sludge currently stored in a number of tanks at SRS will be blended into a total of ten separate sludge "batches" to be processed and fed to DWPF for vitrification.

12.4 Final Processing

DWPF Vitrification



Sample of Vitrified Radioactive Glass

Final processing for the highly radioactive washed sludge and salt waste occurs at the DWPF facility. In a complex sequence of carefully controlled chemical reactions, this waste is blended with glass frit and melted at 2100 degrees Fahrenheit to vitrify it into a borosilicate glass form. The resulting molten glass is poured into 10-foot-tall, 2-foot-diameter, stainless steel canisters. As the filled canisters cool, the molten glass solidifies, immobilizing the radioactive waste within the glass structure. The vitrified waste will remain radioactive for thousands of years. After the canisters have cooled, they are permanently sealed and the external surfaces are decontaminated to meet US Department of Transportation requirements. The canisters are then ready to be stored on an interim basis on-site in the Glass Waste Storage Building, pending shipment to a Federal Repository for permanent disposal.

DWPF Canisters being received
(prior to being filled with Radioactive Glass)

View through protective shielding of DWPF Melter Cell showing a canister being filled.

DWPF has been fully operational since FY96. By the end of FY01, it will have filled over 1200 canisters. The 37 million gallons of liquid waste in the SRS tank farms are projected to produce approximately 6,000 canisters of vitrified glass. SRS is expected to complete vitrifying the existing waste by FY23.

Glass Waste Storage Building (GWSB)

Once the DWPF vitrification facility has filled, sealed and decontaminated the canisters, a Shielded Canister Transporter (SCT) moves the highly radioactive canisters from DWPF to GWSB #1 for interim storage. GWSB #1 is a standard, steel-frame building with a below-ground seismically-qualified concrete vault with vertical storage positions for 2,159 canisters. A five-foot thick concrete floor separates the storage vault from the operating area above ground. When the Federal Repository is opened (currently scheduled for FY10), all canisters will begin shipping with the last canisters' shipment scheduled for FY39.

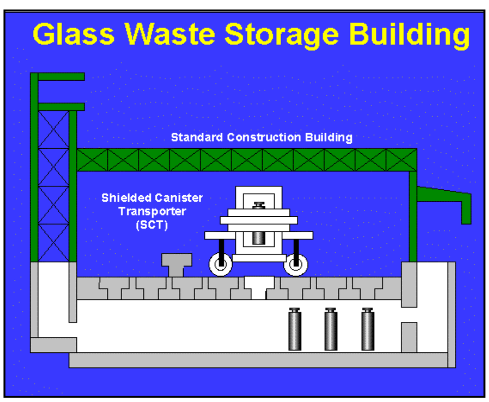


Diagram of Glass Waste Storage Building

The Shielded Canister Transporter (SCT) moves highly radioactive canisters from DWPF to the GWSB. The SCT removes a round shield plug from the floor, lowers the canister into a vertical storage position, and replaces the shield plug.

Saltstone: On-site Disposal of Low-Level Waste

Final processing for the low-level "salt solution" that results from salt processing occurs at the Saltstone Facility. In the Saltstone process, this low-level waste is mixed with cement, flyash, and slag to form a grout that can be safely and permanently disposed in on-site vaults. The grout mixture is transferred to disposal vaults where it hardens into "saltstone," a non-hazardous solid. The vaults are constructed on a "just-in-time" basis, in coordination with salt processing production rates.

View of Saltstone Facility: Processing Facility in foreground, two vaults in rear.

Appendix A - Acronyms

2000-1	DNFSB Recommendation 2000-1, *Stabilization and Storage of Nuclear Materials* (covers many of the materials under Recommendation. 94-1)
2001-1	DNFSB Recommendation 2001-1, *High-Level Waste Management at the Savannah River Site*
94-1	DNFSB Recommendation 94-1, *Improved Schedule for Remediation in DNF Complex*
ACP	Accelerating Cleanup Plan
ADS	Activity Data Sheet
ALARA	As Low As Reasonably Achievable
AOP	Annual Operating Plan
ASTD	Accelerated Site Technology Deployment
BA	Budget Authority
BCP	Baseline Change Proposal
BDAT	Best Demonstrated Available Technology
BIO	Basis for Interim Operations
BO	Budget Outlay
CAB	Citizen's Advisory Board
CDMC	Contact Decontamination Maintenance Cell (DWPF)
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
Ci	Curies
CIF	Consolidated Incinerator Facility
Ci/gal	Curies per gallon
CFR	Code of Federal Regulation
CLFL	Composite Lower Flammability Limit
CLSM	Controlled Low Strength Material
CMST	Characterization Monitoring & Sensing Technology
CPES	Chemical Process Evaluation System
CRC	Cesium Removal Column
CST	Crystalline Silicotitanate
CTS	Concentrate Transfer System
CY	Calendar Year (January through December)
DB	Diversion Box (e.g. HDB-8 – H Area Diversion Box #8)
DBP	di-butyl phosphate
DCS	Distributed Control System
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DOE-MD	DOE – Material Disposition
D&R	Dismantle & Removal
DWPF	Defense Waste Processing Facility
DWTT	Decon Waste Treatment Tank
EA	Environmental Assessment
EIR	External Independent Reviews
EIS	Environmental Impact Statement
EM	Environmental Restoration and Waste Management, usually as a suffix to DOE
EPA	Environmental Protection Agency
ESH&QA	Environmental Safety, Health, and Quality Assurance Division
ESP	Extended Sludge Processing
ETF	Effluent Treatment Facility
FESV	Failed Equipment Storage Vault (DWPF)
FFA	Federal Facility Agreement
FIU	Florida International University
FY	Fiscal Year (October through September)
FYTD	Fiscal Year To Date
GDL	Gravity Drain Line
GS/PS	General Service / Production Service
GWSB	Glass Waste Storage Building
HEU	Highly Enriched Uranium
HHW	High Heat Waste
HLW	High Level Waste
HLWIFM	High Level Waste Integrated Flowsheet Model
HLWD	High Level Waste Division
HQ	Headquarters, usually as a suffix to DOE
HVAC	Heating, Ventilation, & Air Conditioning
INMM	Integrated Nuclear Material Management
ITP	In-Tank Precipitation
kgal	Kilo-gallons = 1,000 gallons
LCO	Limiting Condition of Operation
LHW	Low Heat Waste
LI	Line Item
LIMS	Laboratory Information Management System
LLW	Low Level Waste
MD	Material Disposition
MOX	Mixed Oxide (Fuel)
MFFF	Mixed Oxide Fuel Fabrication Facility
MPPF	Multi-Purpose Processing Facility
MST	Monosodium Titanate
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
NMS&S	Nuclear Materials Stabilization and Storage Division
NRC	Nuclear Regulatory Commission
OE	Organic Evaporator (DWPF)
OECT	Organic Evaporator Concentrate Tank (DWPF)
OGCT	Off-Gas Condensate Tank (DWPF)
ORNL	Oak Ridge National Laboratory
ORR	Operational Readiness Review
OWST	Organic Waste Storage Tank (DWPF)
OYB	Out Year Budget
PCCS	Product Composition Control System
PCO	Process Controls of Operation
PHA	Precipitate Hydrolysis Aqueous
PIMS	Process Information Management System
PISA	Potential Inadequacy in Safety Analysis

Appendix A - Acronyms

PLC	Programmable Logic Controller
PNNL	Pacific Northwest National Laboratory
PR	Precipitate Reactor (DWPF)
ProdMod	Production Model computer program
PTC	Path To Closure
PUREX	Plutonium Recovery and Extraction
Pu/DBP	plutonium di-butyl phosphate
PVV	Process Vessel Vent
QA	Quality Assurance
R&D	Research and Development
RBOF	Receiving Basin for Off-site Fuels
RCRA	Resource Conservation and Recovery Act
RCT	Recycle Collection Tank (DWPF)
REDC	Remote Equipment Decontamination Cell (DWPF)
RFSA	Rocky Flats Scrub Alloy
RHLWE	Replacement High Level Waste Evaporator (3H Evaporator)
RK	Rotary Kiln (CIF)
ROD	Record Of Decision
RWPC	Rolling Weather Protection Cover (Saltstone)
SAP	Statistical Analysis Program
SAR	Safety Analysis Report
SCC	Secondary Combustion Chamber (CIF)
SCDHEC	South Carolina Department of Health and Environmental Control
SCT	Shielded Canister Transporter
SEIS	Supplemental Environmental Impact Statement
SFD	Spent Fuel Division
SGF	Space Gain Factor
SME	Slurry Mix Evaporator (DWPF)
SMECT	Slurry Mix Evaporator Condensate Tank (DWPF)
SpaceMan	Space Management Computer Model
SR	Savannah River - usually a suffix to DOE
SRAT	Sludge Receipt and Adjustment Tank (DWPF)
SRS	Savannah River Site
SRTC	Savannah River Technology Center
SS/SC	Safety Significant / Safety Class
SSC	Systems, Structures, and Components
S&T	DOE's Office of Science & Technology
STP	Site Treatment Plan
STPB	Sodium Tetraphenylborate
TEC	Total Estimated Cost
TFA	Tank Focus Area
Tk	Tank
TOPR	Task Order Proposal Request
TOST	Technical Oversight Steering Team
TPB	Tetraphenylborate
TPP	Technology Program Plan
TPR	Transfer Pump Riser
TSR	Technical Safety Requirement
WAC	Waste Acceptance Criteria
WCS	Waste Characterization System
WIPP	Waste Isolation Pilot Plan
WIR	Waste Incidental to Reprocessing
WMS	Works Management System
WRP&S	Waste Removal Plan and Schedule
WSRC	Westinghouse Savannah River Company
WVDP	West Valley Demonstration Plant
WW	Wash Water

Appendix B – Glossary

General

HLW:

"**H**igh **L**evel **W**aste" is the term used for "the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation." [From DOE Order 435.1]. The waste storage tanks at SRS include strontium-90, cesium-137, plutonium-238, plutonium-239, plutonium-241, and various uranium isotopes. Due to the intense radiation fields, all waste storage tanks are built underground and all process work is done under radiological conditions, which can mean being done remotely or with proper shielding. The radiation field for direct exposure to this waste could be as high as 50 rem/hr (which in 6 minutes would exceed Federal yearly limits for a nuclear industry worker).

HLW System

The HLW System refers to the integrated series of facilities at SRS that convert HLW waste into glass. The system includes the facilities for storage, waste removal, pre-treatment, processing, and disposal.

HLW System Plan

This is the detailed planning document that describes the HLW System operations through the end of the program. The plan uses sophisticated computer models to schedule production, track chemical and radioactive materials, and model process flows.

Salt and Sludge

HLW stored in tanks can generally be characterized as being either "salt" or "sludge."

Salt Waste containing radioactive elements that are **dissolved in the waste liquid**. This generally contains cesium and trace amounts of other soluble radioactive elements.

Sludge Waste containing **insoluble** radioactive elements that have settled to the bottom of waste tanks. This generally contains strontium, plutonium, and uranium as metal hydroxides. The salt waste can be further characterized as being –

supernate	liquid containing dissolved radioactive salts in normal solution
concentrated supernate	supernate that has had liquid removed by evaporation
salt cake	waste that has crystallized out of solution.

A single tank can contain sludge, supernate and salt cake, although an effort is made to segregate the sludge and salt by tank. During waste removal, water is added to waste tanks and agitated by 45-foot-long slurry pumps to dilute or re-dissolve salts if it is a salt tank or to suspend the sludge if it is a sludge tank. The resulting liquid slurry is pumped out of the tanks and transferred to pre-treatment.

Salt Processing:

During salt processing, the highly radioactive constituents (especially cesium) of the salt waste are separated out of solution and sent to DWPF for vitrification. The remaining liquid is "salt solution" (now without its highly radioactive constituents) which is low-level waste and can be safely sent to the Saltstone Facility for on-site treatment and disposal. Salt processing greatly reduces the volume of waste to be vitrified and sent for permanent disposal in a Federal repository.

Vitrified Glass

In a process called "vitrification" the HLW is blended with glass frit and melted at 2,100 degrees Fahrenheit to form a borosilicate glass. Once HLW is immobilized within the structure of the glass, it cannot dissolve out of the glass and migrate into the environment. Vitrification greatly reduces the environmental risk of HLW and converts it into a safe form for permanent disposal.

Appendix B – Glossary

Tank Space Terms

Freeboard

The empty space in a HLW storage tank. Freeboard is the total tank volume (at its operating limit) minus the volume of waste currently in the tank. Freeboard space is not necessarily available to be filled with new waste. A portion of freeboard may be reserved for tank farm Contingency Transfer Space, evaporator working space, or tank farm transfer space. Any empty space in a tank retired from service or otherwise not available to receive new waste is not considered freeboard.

Total HLW Freeboard

The sum of the freeboard in all of the HLW tanks.

Contingency Transfer Space

The freeboard that must be maintained in reserve in Type III/IIIA Tanks at all times in the unlikely event that a leak in a tank requires immediate transfer of waste from that leaking tank to this reserve space. The amount of Contingency Transfer Space that is reserved is set by regulatory commitments, is documented in TSRs, and is currently set at 370" (1.3 million gallons) in each Tank Farm (a total of 2.6 million gallons).

Working Space

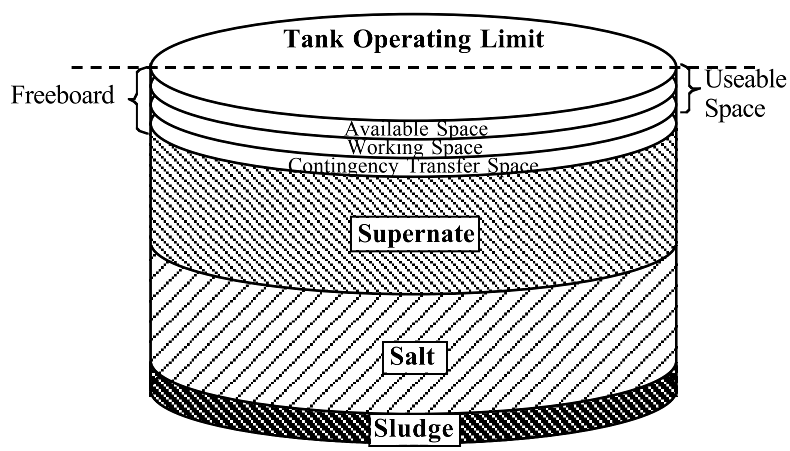
The minimum amount of freeboard required for normal tank farm operations, including waste receipts and evaporator operations. The amount of working space is determined by engineering estimates and operating experience. Working space is currently set at 200 kgals per evaporator system and 100 kgals per area for waste receipts (this translates to 500 kgals for H-Area and 300 kgals for F-Area). When the total amount of usable space in the Tank Farms approaches this Working Space minimum, then operating flexibility is significantly limited.

Available Space

The freeboard that can be used for receipt of incoming waste. Available space is calculated as total Freeboard less Contingency Transfer Space and Working Space.

Useable Space (Working Inventory)

The combination of working space and available space. This is the space the tank farms use on a routine basis. With adequate Useable Space, the tank farms have the flexibility to respond to unplanned outages, receive unplanned influent streams and fully support waste processing activities including DWPF recycle water and ESP wash water (where large receipts of wash water are received into the Tank Farm over a short duration).



Backlog Waste

Unconcentrated supernate. This supernate from past operations waiting to be concentrated and volume-reduced by evaporation. The tank farm evaporator systems are working off this backlog of unconcentrated waste as quickly as possible.

Concentrated Liquor

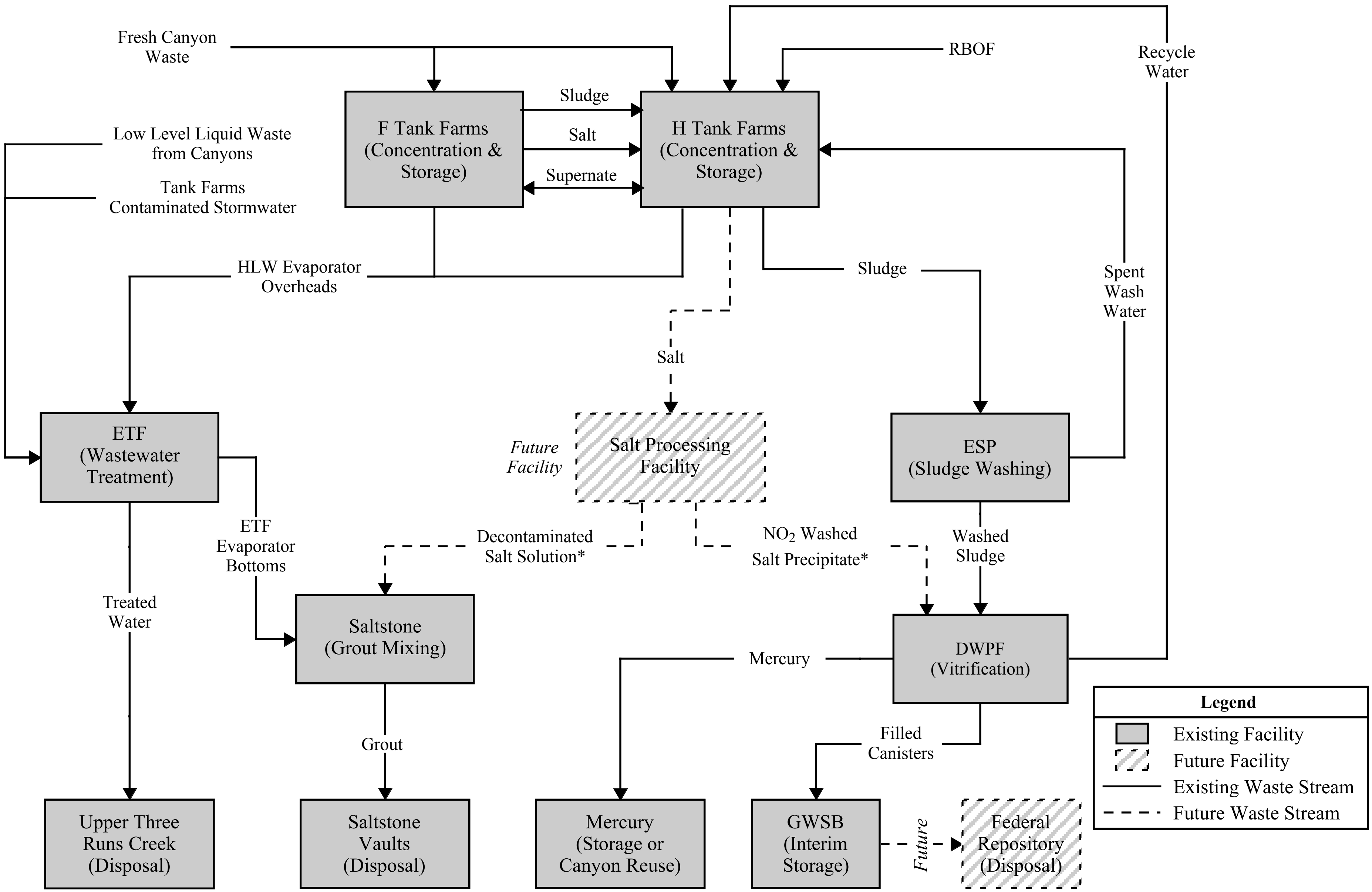
Supernate that has been evaporated to a specific gravity of 1.45 or greater, thus reducing its volume and minimizing the tank farm space it uses.

Appendix C - HLW System Priorities

1. Maintain operating facilities in a safe and production-ready condition:
   - 1a. Safeguard health and safety of workers and public
   - 1b. Continue stewardship of current waste inventories
   - 1c. Implement improvement programs/projects critical to 1a and 1b
2. Support critical Site missions (i.e., DNFSB 2000-1):
   - 2a. Operate Evaporators and Tank Farms as required to provide receipt space for Canyon waste
   - 2b. Operate ETF to support Canyons, Tank Farms and Evaporators
3. Reduce the risk of High Level Waste Storage by removing curies from "high risk" non-compliant tanks.
4. Near-term compliance with the Site Treatment Plan
   - 4a. Provide DWPF materials and analytical support to produce forecast number of canisters
   - 4b. Resolve Evaporator performance issues including:
     - Restart of the 2H Evaporator
     - Retrofit Tank 37 as the 3H Evaporator Salt Receipt Tank

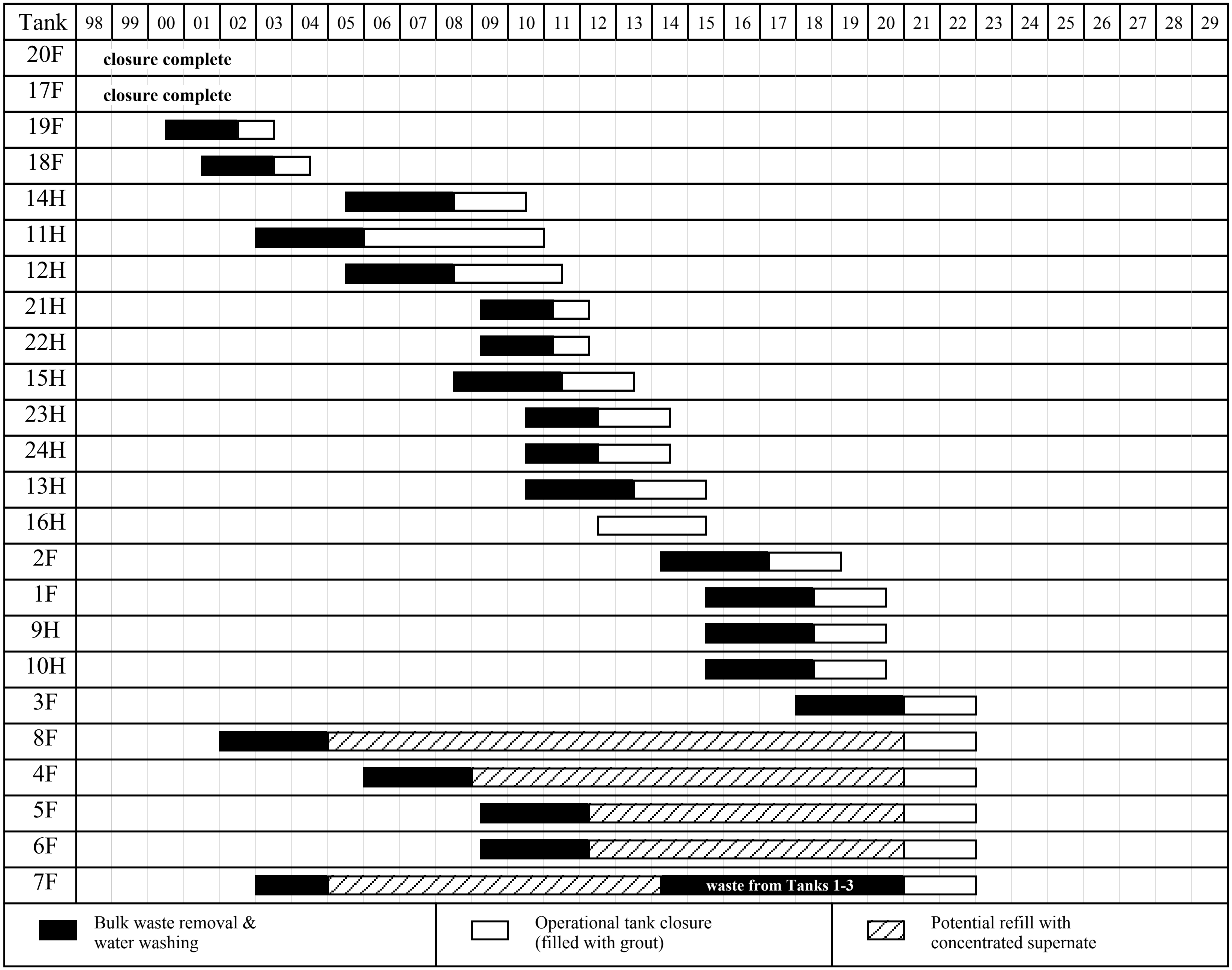
     to provide adequate tank space
   - 4c. Provide Tank 51 (Batch 1B) sludge feed to DWPF
   - 4d. Prepare Sludge Batch 2 feed to DWPF
5. Mid-term strategy to support Canyon missions and DWPF production:
   - 5a. Implement Tank Farm Space Management initiatives
   - 5b. Prepare Tank 49 as a concentrated waste storage tank
   - 5c. Evaporate backlog supernate to create space in the Tank Farms
   - 5d. Prepare Tank 50 as a concentrated waste storage tank
   - 5e. Prepare future sludge batches (Batches 3-4) to maintain continuity of DWPF operations
6. Comply with the approved FFA Waste Removal Plan and Schedule (*i.e.*, empty and close all old-style tanks by 2022)
   - 6a. Support Tank 19 closure to meet commitment date of FY03
   - 6b. Support Tank 18 closure to meet commitment date of FY04
7. Support Salt Processing
   - 7a. Support the Salt Processing alternative selection process including R&D initiatives
   - 7b. Support Salt Processing pilot activities.
   - 7b. Support Salt Processing design activities on selected alternative
   - 7c. Support Salt Processing construction activities on selected alternative
   - 7d. Support Salt Processing startup activities on selected alternative
8. Long-term strategy to ensure continuity of DWPF operations, with both sludge and salt:
   - 8a. Continue sludge processing to maintain continuity of DWPF operations (Batch 5-9)
   - 8c. Retrofit Tank 27 & 42 as 2F and 2H Evaporator Salt Receipt Tanks
   - 8d. Complete design, construction and startup of Salt Processing facility
9. Develop new technologies that have a strong potential to reduce cost
10. Accelerate operation of the HLW System and thereby reduce program duration and life cycle cost
11. Develop and implement tank and facility closure methods
12. Perform engineering, technical and planning activities that reduce programmatic risk

Appendix D - Simplified HLW System Flowsheet (Small Tank TPB Precipitation)

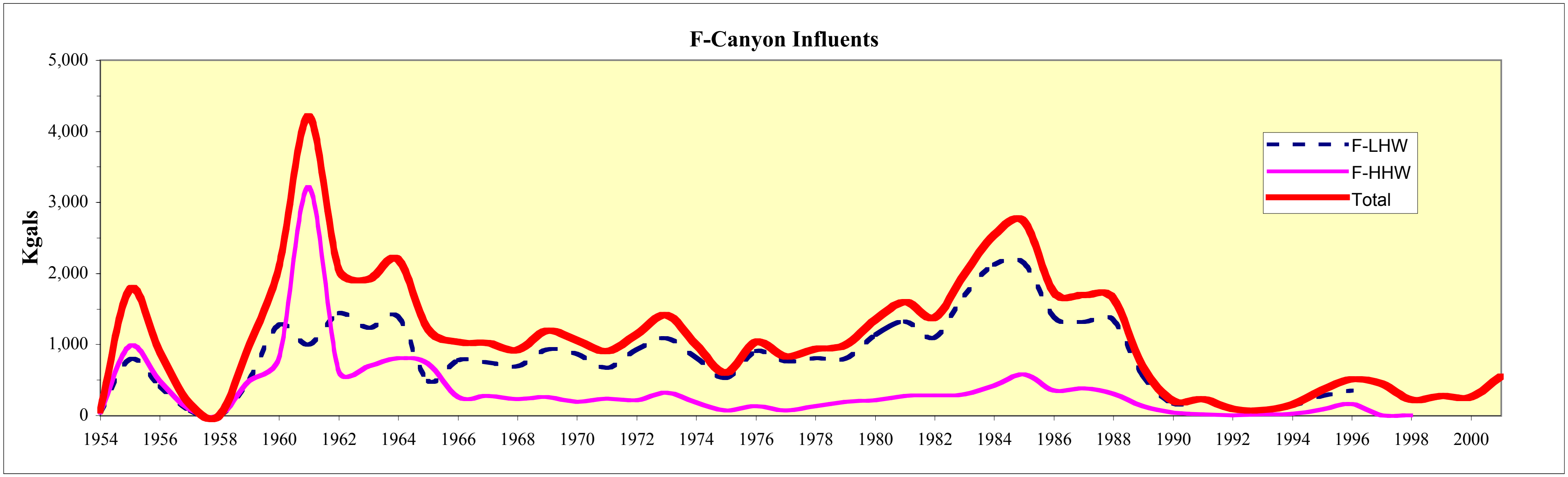


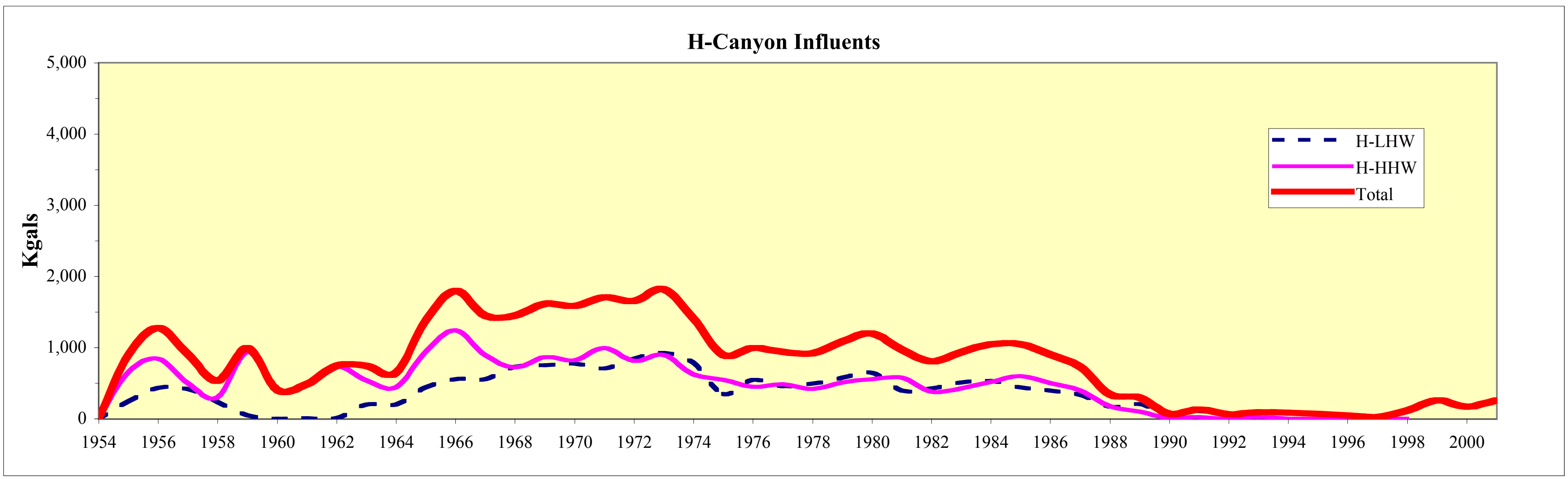
* These streams are based on the Small Tank Tetraphenylborate Precipitation process. Actual streams may vary based on the Salt Processing alternative chosen.

Appendix E - Approved FFA Waste Removal Plan & Schedule

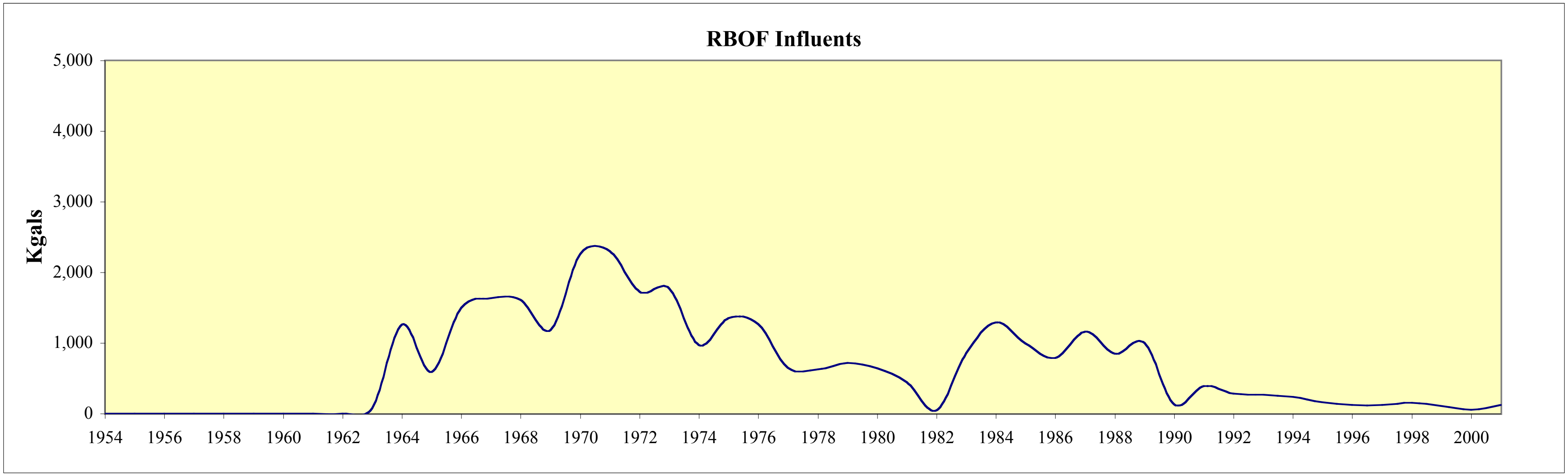


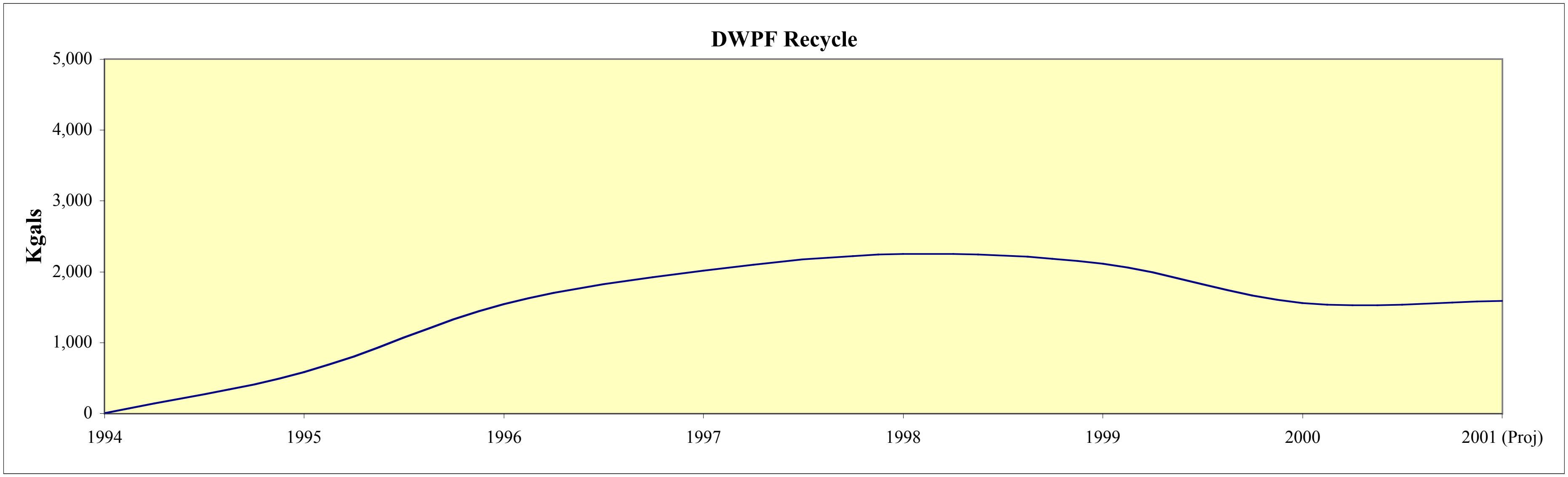
Appendix F - Historical Tank Farm Influents and Effluents



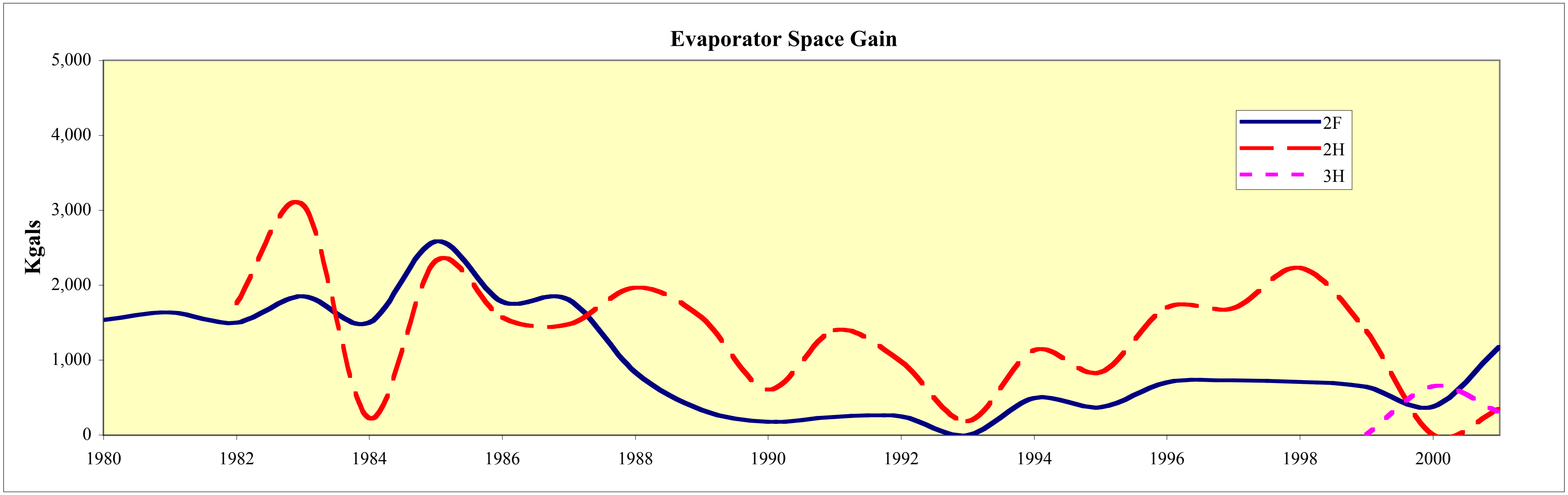


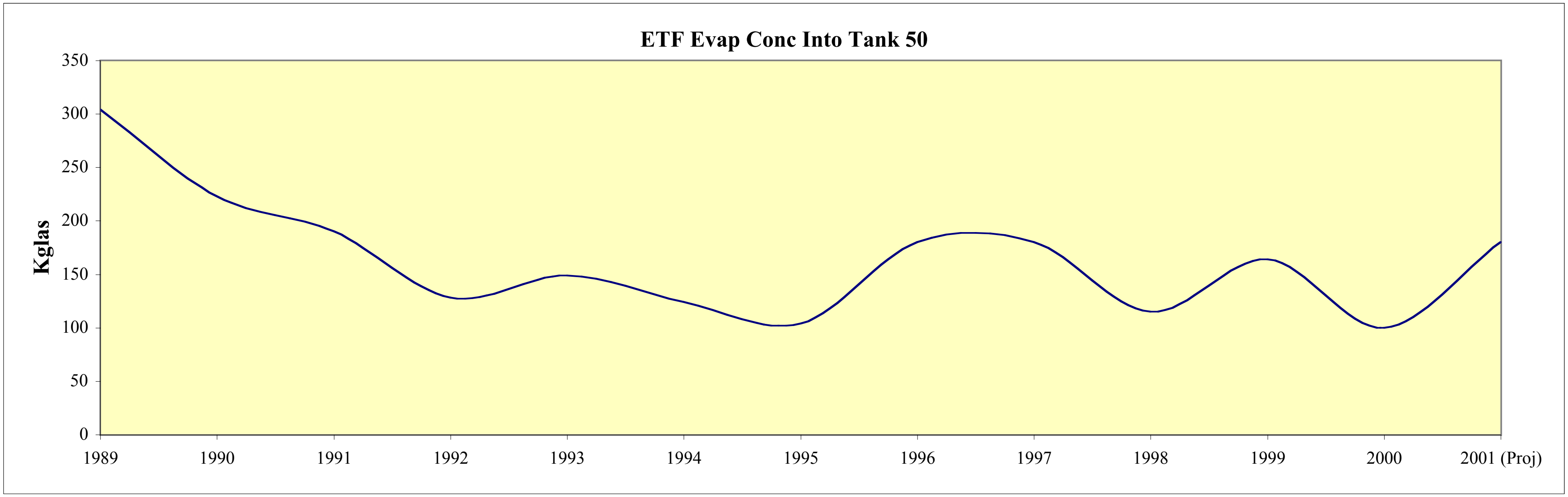
Appendix F - Historical Tank Farm Influents and Effluents





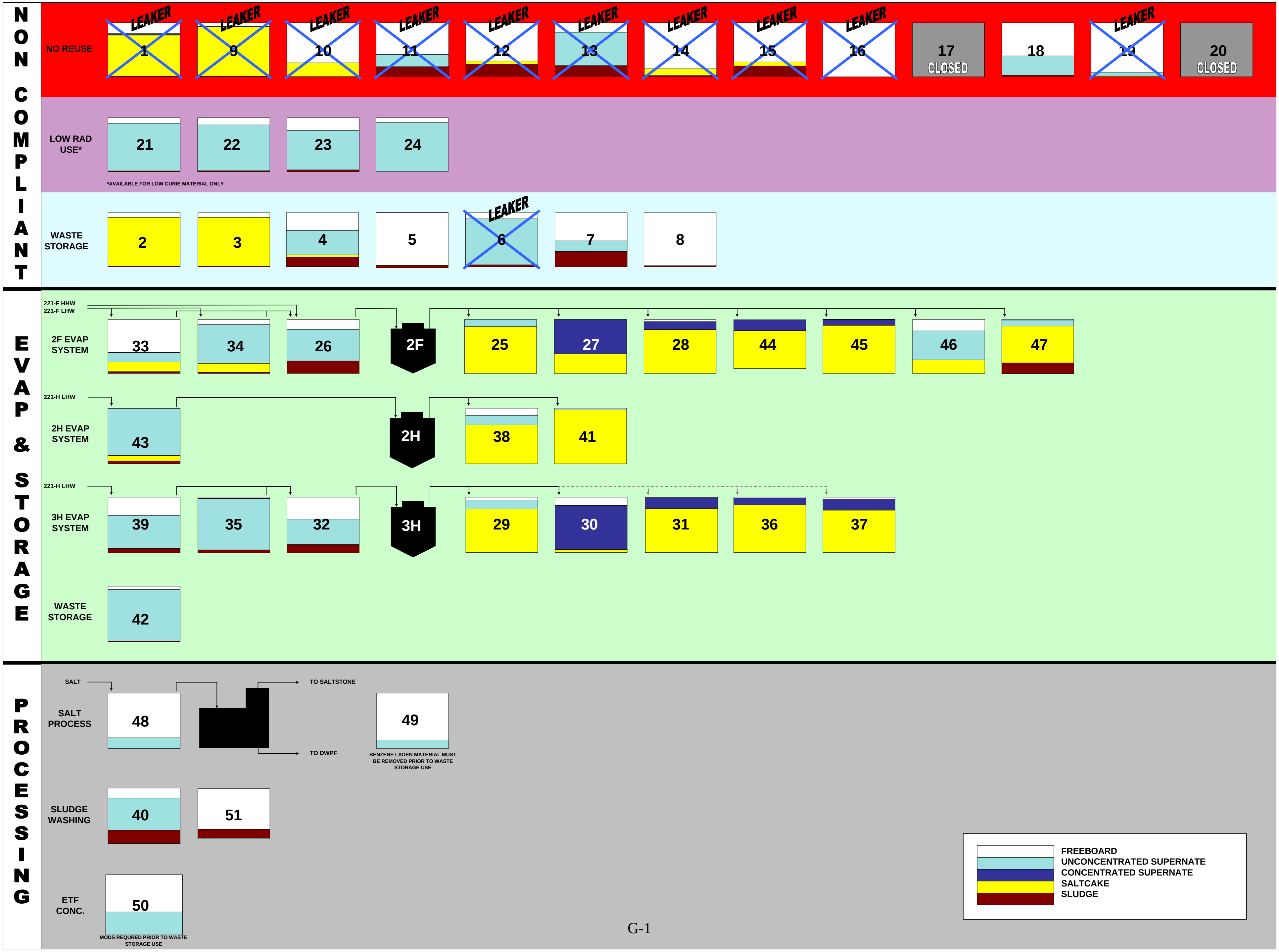
Appendix F - Historical Tank Farm Influents and Effluents





Appendix G - High Level Waste Tank Usage

DATA DATE: 3/1/01



Appendix H
Base Case

Appendix H – Base Case

Appendix H provides the detailed production planning information for the Base Case. The Base Case represents the scope and funding levels that was used to develop the FY01-FY06 contract extension between WSRC and DOE. The contract is based on fully funding the Base Case scope and the scope defined in the Base Case is defined as the minimum acceptable contractor performance as long as the funding for this case is provided. The Base Case:

1. Provides the slowest risk reduction for waste removal from "high risk" tanks,
2. Does not meet the FFA or STP regulatory commitments,
3. Starts salt processing activities by mid 2010, and
4. Processes an average of 200 canisters per year after salt processing becomes operational.

Key Scope Milestones	Rev 12 Base Case
Total Number of Canisters Produced	5,914
DWPF Sludge Production (in average canisters per year)	
• FY01	163
• FY02	111
• FY03	155
• FY04	163
• FY05	111
• FY06	147
• FY07	200
• FY08	107
• FY09	Outage
• FY10	150
• FY11 to End of Program	200
Key Risk Reduction Dates	
Date when all "high risk" tanks are emptied	FY16
Date when all "non-compliant" tanks are emptied	FY19
Date when all "non-compliant" tanks are closed	FY21
Date Salt Processing Becomes Operational	FY10
Date by which salt processing is completed	FY24
Date by which sludge processing is completed	FY29
Regulatory Commitments	
Are all STP commitments met?	No
Are all FFA regulatory commitments met?	No
Estimated Life-Cycle Costs	
• Costs in escalated dollars ($ in billions)	$20.8
• Costs in constant 1999 dollars ($ in billions)	$13.6
Canister Storage Locations	
• Make additional 450 GWSB #1 locations usable	FY05-07
• Begin work on additional Canister Storage locations 1- Privatized Module	FY07
• Place GWSB #2 or Privatized Modules into Radioactive Operations	FY10
Waste Removal	
• Tank 7 ready for sludge removal	10/03
• Tank 11 ready for sludge removal	4/08
• Tank 26 ready for sludge removal	12/10

Appendix H – Base Case

Key Scope Milestones	Rev 12 Base Case
Tank Closures	
• Complete closure of Tank 19	4/03
• Complete closure of Tank 18	4/04
• Complete closure of 5th Tank	FY10
• Complete closure of 6th Tank	FY11
• Complete closure of 7th Tank	FY13
• Complete closure of 24th Tank	FY21
Key Space Management Activities	
• Reuse Tank 49 for waste storage	7/01
• Reuse Tank 50 for waste storage	9/02
• Tank 37 modification completed for 3H Evaporator Drop Tank	9/02
Repository Activities	
• Start shipping canisters to the Federal Repository	FY10
• Complete shipping canisters to Federal Repository	FY39
Facility Deactivation Complete	FY40

This appendix provides the following data: Funding Requirements, Waste Removal and Tank Closure Schedule, Material Balance, Salt Processing Batch makeup, Sludge Batch makeup, Canister Storage requirements, Near Term Saltstone Operations, Usable Tank Space estimates, an Inventory of the amound of waste in Types I, II, III, & IV tanks, a chart of Non-Compliant Tank Closures with respect to the FFA, and a Level 1 Schedule.

Appendix H.1 - Funding (Base Case)

Budget Authority in Escalated Dollars

Project Title	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09
HL-01 H Tank Farm											
H Tank Farm Operations	85,371	89,019	95,078	93,420	100,337	106,546	108,122	110,347	113,327	113,980	117,057
LI: Replacement Evaporator	12,835	3,567	-	-	-	-	-	-	-	-	-
HL-01 Total	**98,205**	**92,586**	**95,078**	**93,420**	**100,337**	**106,546**	**108,122**	**110,347**	**113,327**	**113,980**	**117,057**
HL-02 F Tank Farm	**58,928**	**60,993**	**59,966**	**63,928**	**68,328**	**70,446**	**71,438**	**74,157**	**76,159**	**73,479**	**75,463**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	1,108	3,824	3,169	3,311	3,252	3,362	1,733	-	3,697	3,716	3,817
WR: Tank Closure	124	350	16	3,113	4,745	1,653	-	-	8,712	8,757	391
HL-03 Total	**1,232**	**4,174**	**3,185**	**6,424**	**7,996**	**5,015**	**1,733**	**-**	**12,409**	**12,474**	**4,207**
HL-04 Feed Preparations & Sludge Operations	**53,328**	**52,037**	**50,722**	**56,097**	**62,734**	**66,549**	**70,173**	**69,739**	**71,622**	**72,071**	**74,017**
HL-05 Vitrification											
Vitrification Ops	127,626	116,698	111,727	125,108	130,313	131,338	139,751	144,990	145,944	146,619	147,269
Failed Equip. Storage Vaults	-	-	1,143	-	-	-	-	-	-	-	-
HL-05 Total	**127,626**	**116,698**	**112,870**	**125,108**	**130,313**	**131,338**	**139,751**	**144,990**	**145,944**	**146,619**	**147,269**
HL-06 Glass Waste Storage	**436**	**603**	**684**	**712**	**1,426**	**784**	**1,472**	**839**	**6,156**	**16,637**	**25,074**
HL-13 Salt Disposition											
Salt Disposition Ops	15,620	10,175	17,543	4,982	-	-	-	-	-	-	-
LI: Salt Alternative	-	-	-	29,465	84,345	135,123	150,278	150,768	150,895	143,752	98,761
HL-13 Total	**15,620**	**10,175**	**17,543**	**34,447**	**84,345**	**135,123**	**150,278**	**150,768**	**150,895**	**143,752**	**98,761**
HL-09 LI: Tk Fm Services Upgrade I	**1,632**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-10 LI: Storm Water Upgrades	**2,508**	**3,533**	**138.3381**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-11 LI: Tk Fm Services Upgrade II	**838**	**2,141**	**10,455**	**6,303**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-12 LI: Waste Removal											
LI: WR from Tanks	24,739	21,796	23,046	19,244	10,113	533	-	-	29,033	45,547	71,253
LI: Vit Upgrades	12	653	616	-	-	-	7,063	7,276	14,945	15,255	15,667
LI: Pipe, Evaps & Infrastructure	-	-	-	993	5,995	15,870	12,536	-	-	-	-
HL-12 Total	**24,751**	**22,449**	**23,662**	**20,238**	**16,108**	**16,403**	**19,598**	**7,276**	**43,978**	**60,803**	**86,920**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HLW TOTAL	**385,103**	**365,388**	**374,304**	**406,675**	**471,588**	**532,204**	**562,566**	**558,117**	**620,491**	**639,815**	**628,769**
HLW w/o Salt Total	**369,483**	**355,213**	**356,760**	**372,228**	**387,243**	**397,081**	**412,288**	**407,349**	**469,596**	**496,062**	**530,007**
Solid Waste Facilities											
ETF	16,510	15,098	16,115	17,302	18,705	20,455	22,088	23,838	20,579	23,997	20,586
Saltstone	1,595	857	1,099	2,055	4,454	2,317	2,229	2,314	2,377	7,353	15,734
SW TOTAL	**18,105**	**15,955**	**17,214**	**19,356**	**23,159**	**22,772**	**24,317**	**26,152**	**22,956**	**31,351**	**36,321**
Life Cycle Cost	**403,208**	**381,344**	**391,518**	**426,032**	**494,747**	**554,976**	**586,883**	**584,269**	**643,447**	**671,166**	**665,089**

Appendix H.1 - Funding (Base Case)

Budget Authority in Escalated Dollars

Project Title	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
HL-01 H Tank Farm											
H Tank Farm Operations	119,449	121,884	125,175	126,888	130,314	132,954	130,801	134,332	132,854	136,441	137,113
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**119,449**	**121,884**	**125,175**	**126,888**	**130,314**	**132,954**	**130,801**	**134,332**	**132,854**	**136,441**	**137,113**
HL-02 F Tank Farm	**77,501**	**79,593**	**81,742**	**83,949**	**85,360**	**83,271**	**84,616**	**85,384**	**75,314**	**77,347**	**79,435**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	9,047	16,193	17,988	8,492	8,721	8,956	9,198	9,447	14,552	14,945	15,349
WR: Tank Closure	16,677	1,262	11,585	10,028	29,739	73,885	41,578	35,322	53,609	6,032	54,761
HL-03 Total	**25,724**	**17,455**	**29,573**	**18,520**	**38,459**	**82,841**	**50,777**	**44,768**	**68,162**	**20,978**	**70,110**
HL-04 Feed Preparations & Sludge Operations	**76,015**	**68,871**	**70,731**	**72,640**	**74,602**	**76,616**	**78,685**	**80,809**	**82,991**	**85,232**	**87,533**
HL-05 Vitrification											
Vitrification Ops	158,570	159,259	166,960	174,420	171,855	180,911	188,092	191,807	192,639	201,424	214,172
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**158,570**	**159,259**	**166,960**	**174,420**	**171,855**	**180,911**	**188,092**	**191,807**	**192,639**	**201,424**	**214,172**
HL-06 Glass Waste Storage	**15,324**	**7,354**	**7,595**	**7,843**	**8,100**	**8,365**	**8,639**	**8,922**	**9,215**	**9,517**	**9,829**
HL-13 Salt Disposition											
Salt Disposition Ops	43,964	77,462	79,544	83,856	80,017	79,566	81,292	84,957	94,146	98,417	105,033
LI: Salt Alternative	57,843	-	-	-	-	45,370	62,127	47,853	-	-	-
HL-13 Total	**101,807**	**77,462**	**79,544**	**83,856**	**80,017**	**124,936**	**143,419**	**132,811**	**94,146**	**98,417**	**105,033**
HL-09 LI: Tk Fm Services Upgrade I	-	-	-	-	-	-	-	-	-	-	-
HL-10 LI: Storm Water Upgrades	-	-	-	-	-	-	-	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	-	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	75,178	78,798	69,348	60,665	72,101	68,390	62,085	83,033	83,529	88,574	78,604
LI: Vit Upgrades	28,158	18,590	12,728	19,608	20,137	20,681	14,160	14,542	-	-	-
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	**103,336**	**97,388**	**82,076**	**80,273**	**92,238**	**89,071**	**76,245**	**97,575**	**83,529**	**88,574**	**78,604**
FA-24 Facility Decontamination/Decommissioning	-	-	-	-	-	**43,183**	**36,285**	-	-	-	-
HLW TOTAL	**677,726**	**629,268**	**643,396**	**648,390**	**680,945**	**822,148**	**797,558**	**776,409**	**738,848**	**717,929**	**781,829**
HLW w/o Salt Total	**575,919**	**551,805**	**563,852**	**564,534**	**600,929**	**697,212**	**654,140**	**643,598**	**644,702**	**619,511**	**676,796**
Solid Waste Facilities											
ETF	21,843	21,875	25,438	32,919	25,062	25,243	30,249	25,667	32,191	27,072	28,746
Saltstone	25,835	33,416	36,440	41,135	39,705	43,999	53,130	41,657	61,221	61,381	49,734
SW TOTAL	**47,678**	**55,291**	**61,878**	**74,053**	**64,767**	**69,242**	**83,379**	**67,324**	**93,412**	**88,453**	**78,480**
Life Cycle Cost	**725,404**	**684,559**	**705,274**	**722,443**	**745,712**	**891,390**	**880,937**	**843,732**	**832,260**	**806,382**	**860,309**

Appendix H.1 - Funding (Base Case)

Budget Authority in Escalated Dollars

Project Title	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
HL-01 H Tank Farm											
H Tank Farm Operations	133,598	135,472	139,130	141,059	142,990	142,995	146,856	150,821	115,912	61,136	-
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**133,598**	**135,472**	**139,130**	**141,059**	**142,990**	**142,995**	**146,856**	**150,821**	**115,912**	**61,136**	**-**
HL-02 F Tank Farm	**78,205**	**50,856**	**48,669**	**48,155**	**30,683**	**-**	**-**	**-**	**-**	**-**	**-**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	10,509	5,396	-	-	-	-	-	-	-	-	-
WR: Tank Closure	72,599	42,380	18,923	49,944	42,543	33,230	27,655	47,886	86,087	56,440	3,493
HL-03 Total	**83,108**	**47,776**	**18,923**	**49,944**	**42,543**	**33,230**	**27,655**	**47,886**	**86,087**	**56,440**	**3,493**
HL-04 Feed Preparations & Sludge Operations	**89,896**	**92,323**	**94,816**	**48,688**	**50,003**	**51,353**	**26,370**	**27,082**	**13,906**	**-**	**-**
HL-05 Vitrification											
Vitrification Ops	208,718	217,931	226,418	225,355	236,369	243,037	249,849	237,484	80,229	-	-
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**208,718**	**217,931**	**226,418**	**225,355**	**236,369**	**243,037**	**249,849**	**237,484**	**80,229**	**-**	**-**
HL-06 Glass Waste Storage	**10,152**	**10,485**	**10,829**	**11,185**	**3,065**	**3,148**	**3,233**	**3,320**	**3,031**	**3,113**	**3,197**
HL-13 Salt Disposition											
Salt Disposition Ops	105,053	109,901	112,197	94,389	-	-	-	-	-	-	-
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	-	-
HL-13 Total	**105,053**	**109,901**	**112,197**	**94,389**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-09 LI: Tk Fm Services Upgrade I	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-10 LI: Storm Water Upgrades	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-11 LI: Tk Fm Services Upgrade II	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-12 LI: Waste Removal											
LI: WR from Tanks	45,140	20,551	13,526	22,056	8,947	4,424	5,876	14,733	15,835	-	-
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	-	-
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	**45,140**	**20,551**	**13,526**	**22,056**	**8,947**	**4,424**	**5,876**	**14,733**	**15,835**	**-**	**-**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**22,616**	**139,358**	**71,560**	**-**	**-**	**94,555**	**173,067**	**78,386**
HLW TOTAL	**753,870**	**685,295**	**664,508**	**663,446**	**653,958**	**549,748**	**459,839**	**481,326**	**409,556**	**293,756**	**85,076**
HLW w/o Salt Total	**648,817**	**575,394**	**552,311**	**569,057**	**653,958**	**549,748**	**459,839**	**481,326**	**409,556**	**293,756**	**85,076**
Solid Waste Facilities											
ETF	40,738	31,015	30,116	30,929	31,764	32,622	33,503	44,390	11,728	-	-
Saltstone	65,588	54,998	43,886	23,985	7,324	7,522	9,757	10,024	4,424	-	-
SW TOTAL	**106,326**	**86,013**	**74,002**	**54,914**	**39,089**	**40,144**	**43,260**	**54,414**	**16,151**	**-**	**-**
Life Cycle Cost	**860,196**	**771,308**	**738,510**	**718,360**	**693,046**	**589,891**	**503,099**	**535,740**	**425,707**	**293,756**	**85,076**

Appendix H.1 - Funding (Base Case)

Budget Authority in Escalated Dollars

Project Title	FY32	FY33	FY34	FY35	FY36	FY37	FY38	FY39	FY40	Cumulative FY99-End
HL-01 H Tank Farm										
H Tank Farm Operations	-	-	-	-	-	-	-	-	-	3,870,776
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	16,402
HL-01 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3,887,178**
HL-02 F Tank Farm	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,903,367**
HL-03 Waste Removal & Tank Closures										
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	-	-	179,782
WR: Tank Closure	-	-	-	-	-	-	-	-	-	843,522
HL-03 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,023,304**
HL-04 Feed Preparations & Sludge Operations	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2,048,250**
HL-05 Vitrification										
Vitrification Ops	-	-	-	-	-	-	-	-	-	5,392,879
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	1,143
HL-05 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5,394,022**
HL-06 Glass Waste Storage	**3,283**	**3,372**	**3,463**	**3,556**	**3,652**	**3,751**	**3,852**	**3,956**		**249,171**
HL-13 Salt Disposition										
Salt Disposition Ops	-	-	-	-	-	-	-	-	-	1,378,113
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	1,156,583
HL-13 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2,534,696**
HL-09 LI: Tk Fm Services Upgrade I	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,632**
HL-10 LI: Storm Water Upgrades	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**6,179**
HL-11 LI: Tk Fm Services Upgrade II	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**19,737**
HL-12 LI: Waste Removal										
LI: WR from Tanks	-	-	-	-	-	-	-	-	-	1,216,698
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	210,090
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	35,394
HL-12 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,462,183**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**18,112**	**-**	**677,121**
HLW TOTAL	**3,283**	**3,372**	**3,463**	**3,556**	**3,652**	**3,751**	**3,852**	**22,069**	**-**	**19,206,840**
HLW w/o Salt Total	**3,283**	**3,372**	**3,463**	**3,556**	**3,652**	**3,751**	**3,852**	**22,069**	**-**	**16,672,144**
Solid Waste Facilities										
ETF	-	-	-	-	-	-	-	-	-	798,384
Saltstone	-	-	-	-	-	-	-	-	-	757,545
SW TOTAL	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,555,929**
Life Cycle Cost	**3,283**	**3,372**	**3,463**	**3,556**	**3,652**	**3,751**	**3,852**	**22,069**	**-**	**20,762,769**

Appendix H.1 - Funding (Base Case)

Budget Authority in Constant FY99 Year Dollars

Project Title	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09
HL-01 H Tank Farm											
H Tank Farm Operations	85,371	85,926	88,585	84,752	88,634	91,644	90,555	89,989	89,989	88,128	88,128
LI: Replacement Evaporator	12,835	3,443	-	-	-	-	-	-	-	-	-
HL-01 Total	**98,205**	**89,369**	**88,585**	**84,752**	**88,634**	**91,644**	**90,555**	**89,989**	**89,989**	**88,128**	**88,128**
HL-02 F Tank Farm	**58,928**	**58,873**	**55,871**	**57,996**	**60,359**	**60,593**	**59,832**	**60,475**	**60,475**	**56,814**	**56,814**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	1,108	3,691	2,953	3,004	2,873	2,892	1,451	-	2,936	2,873	2,873
WR: Tank Closure	124	338	15	2,824	4,191	1,422	-	-	6,918	6,771	294
HL-03 Total	**1,232**	**4,029**	**2,967**	**5,828**	**7,064**	**4,314**	**1,451**	**-**	**9,854**	**9,645**	**3,168**
HL-04 Feed Preparations & Sludge Operations	**53,328**	**50,229**	**47,258**	**50,892**	**55,417**	**57,241**	**58,771**	**56,873**	**56,873**	**55,724**	**55,724**
HL-05 Vitrification											
Vitrification Ops	127,626	112,643	104,097	113,499	115,114	112,969	117,045	118,241	115,889	113,365	110,873
Failed Equip. Storage Vaults	-	-	1,065	-	-	-	-	-	-	-	-
HL-05 Total	**127,626**	**112,643**	**105,162**	**113,499**	**115,114**	**112,969**	**117,045**	**118,241**	**115,889**	**113,365**	**110,873**
HL-06 Glass Waste Storage	**436**	**582**	**637**	**646**	**1,260**	**674**	**1,233**	**684**	**4,889**	**12,864**	**18,877**
HL-13 Salt Disposition											
Salt Disposition Ops	15,620	9,822	16,345	4,520	-	-	-	-	-	-	-
LI: Salt Alternative	-	-	-	26,731	74,508	116,225	125,862	122,953	119,821	111,148	74,354
HL-13 Total	**15,620**	**9,822**	**16,345**	**31,251**	**74,508**	**116,225**	**125,862**	**122,953**	**119,821**	**111,148**	**74,354**
HL-09 LI: Tk Fm Services Upgrade I	**1,632**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-10 LI: Storm Water Upgrades	**2,508**	**3,410**	**128.8910**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-11 LI: Tk Fm Services Upgrade II	**838**	**2,066**	**9,741**	**5,718**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-12 LI: Waste Removal											
LI: WR from Tanks	24,739	21,039	21,472	17,459	8,934	458	-	-	23,055	35,217	53,644
LI: Vit Upgrades	12	630	574	-	-	-	5,915	5,934	11,867	11,795	11,795
LI: Pipe, Evaps & Infrastructure	-	-	-	901	5,296	13,651	10,499	-	-	-	-
HL-12 Total	**24,751**	**21,669**	**22,046**	**18,360**	**14,229**	**14,109**	**16,414**	**5,934**	**34,922**	**47,012**	**65,439**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HLW TOTAL	**385,103**	**352,692**	**348,742**	**368,942**	**416,584**	**457,770**	**471,164**	**455,149**	**492,712**	**494,700**	**473,378**
HLW w/o Salt Total	**369,483**	**342,870**	**332,397**	**337,691**	**342,076**	**341,545**	**345,302**	**332,196**	**372,891**	**383,552**	**399,024**
Solid Waste Facilities											
ETF	16,510	14,574	15,015	15,696	16,523	17,594	18,500	19,440	16,341	18,555	15,499
Saltstone	1,595	827	1,024	1,864	3,935	1,993	1,867	1,887	1,887	5,686	11,846
SW TOTAL	**18,105**	**15,401**	**16,039**	**17,560**	**20,458**	**19,587**	**20,366**	**21,327**	**18,228**	**24,240**	**27,344**
Life Cycle Cost	**403,208**	**368,093**	**364,781**	**386,502**	**437,042**	**477,357**	**491,530**	**476,476**	**510,941**	**518,940**	**500,722**

Appendix H.1 - Funding (Base Case)

Budget Authority in Constant FY99 Year Dollars

Project Title	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
HL-01 H Tank Farm											
H Tank Farm Operations	87,565	87,001	87,001	85,873	85,873	85,309	81,721	81,721	78,697	78,697	77,005
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**87,565**	**87,001**	**87,001**	**85,873**	**85,873**	**85,309**	**81,721**	**81,721**	**78,697**	**78,697**	**77,005**
HL-02 F Tank Farm	**56,814**	**56,814**	**56,814**	**56,814**	**56,250**	**53,430**	**52,866**	**51,943**	**44,612**	**44,612**	**44,612**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	6,632	11,559	12,502	5,747	5,747	5,747	5,747	5,747	8,620	8,620	8,620
WR: Tank Closure	12,225	901	8,052	6,787	19,597	47,408	25,977	21,488	31,756	3,479	30,755
HL-03 Total	**18,857**	**12,459**	**20,554**	**12,534**	**25,344**	**53,155**	**31,724**	**27,235**	**40,376**	**12,100**	**39,375**
HL-04 Feed Preparations & Sludge Operations	**55,724**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**
HL-05 Vitrification											
Vitrification Ops	116,243	113,679	116,043	118,041	113,247	116,081	117,515	116,686	114,111	116,178	120,283
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**116,243**	**113,679**	**116,043**	**118,041**	**113,247**	**116,081**	**117,515**	**116,686**	**114,111**	**116,178**	**120,283**
HL-06 Glass Waste Storage	**11,234**	**5,249**	**5,279**	**5,308**	**5,338**	**5,367**	**5,398**	**5,428**	**5,458**	**5,489**	**5,520**
HL-13 Salt Disposition											
Salt Disposition Ops	32,229	55,293	55,286	56,750	52,728	51,053	50,789	51,684	55,768	56,766	58,988
LI: Salt Alternative	42,403	-	-	-	-	29,112	38,816	29,112	-	-	-
HL-13 Total	**74,632**	**55,293**	**55,286**	**56,750**	**52,728**	**80,165**	**89,605**	**80,795**	**55,768**	**56,766**	**58,988**
HL-09 LI: Tk Fm Services Upgrade I	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-10 LI: Storm Water Upgrades	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-11 LI: Tk Fm Services Upgrade II	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-12 LI: Waste Removal											
LI: WR from Tanks	55,111	56,246	48,199	41,056	47,512	43,882	38,789	50,513	49,479	51,088	44,145
LI: Vit Upgrades	20,642	13,270	8,847	13,270	13,270	13,270	8,847	8,847	-	-	-
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	**75,753**	**69,516**	**57,045**	**54,325**	**60,782**	**57,152**	**47,636**	**59,360**	**49,479**	**51,088**	**44,145**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**-**	**-**	**27,708**	**22,670**	**-**	**-**	**-**	**-**
HLW TOTAL	**496,821**	**449,171**	**447,181**	**438,805**	**448,721**	**527,526**	**498,295**	**472,328**	**437,661**	**414,089**	**439,090**
HLW w/o Salt Total	**422,190**	**393,878**	**391,896**	**382,054**	**395,993**	**447,362**	**408,690**	**391,533**	**381,893**	**357,324**	**380,102**
Solid Waste Facilities											
ETF	16,013	15,614	17,680	22,278	16,515	16,197	18,899	15,614	19,069	15,614	16,144
Saltstone	18,939	23,852	25,327	27,838	26,165	28,232	33,194	25,342	36,264	35,404	27,932
SW TOTAL	**34,952**	**39,467**	**43,007**	**50,116**	**42,679**	**44,429**	**52,093**	**40,956**	**55,333**	**51,018**	**44,076**
Life Cycle Cost	**531,773**	**488,638**	**490,189**	**488,921**	**491,401**	**571,955**	**550,388**	**513,284**	**492,994**	**465,107**	**483,166**

Appendix H.1 - Funding (Base Case)

Budget Authority in Constant FY99 Year Dollars

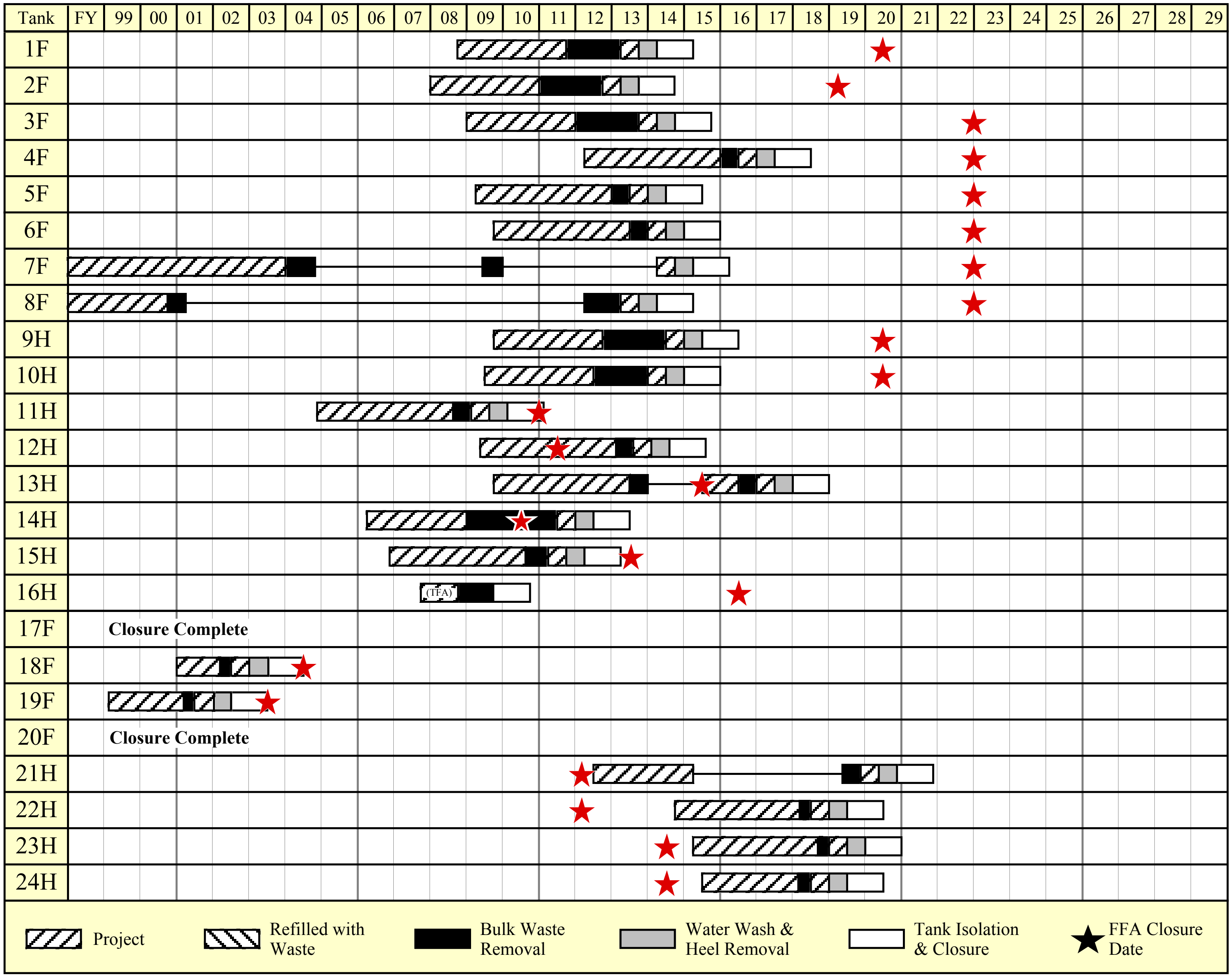
Project Title	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
HL-01 H Tank Farm											
H Tank Farm Operations	73,058	72,136	72,136	71,213	70,290	68,445	68,445	68,445	51,220	26,305	-
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**73,058**	**72,136**	**72,136**	**71,213**	**70,290**	**68,445**	**68,445**	**68,445**	**51,220**	**26,305**	**-**
HL-02 F Tank Farm	**42,767**	**27,080**	**25,234**	**24,311**	**15,083**	**-**	**-**	**-**	**-**	**-**	**-**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	5,747	2,873	-	-	-	-	-	-	-	-	-
WR: Tank Closure	39,701	22,566	9,811	25,214	20,913	15,906	12,889	21,731	38,040	24,284	1,463
HL-03 Total	**45,448**	**25,440**	**9,811**	**25,214**	**20,913**	**15,906**	**12,889**	**21,731**	**38,040**	**24,284**	**1,463**
HL-04 Feed Preparations & Sludge Operations	**49,160**	**49,160**	**49,160**	**24,580**	**24,580**	**24,580**	**12,290**	**12,290**	**6,145**	**-**	**-**
HL-05 Vitrification											
Vitrification Ops	114,139	116,043	117,393	113,770	116,193	116,330	116,447	107,774	35,452	-	-
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**114,139**	**116,043**	**117,393**	**113,770**	**116,193**	**116,330**	**116,447**	**107,774**	**35,452**	**-**	**-**
HL-06 Glass Waste Storage	**5,551**	**5,583**	**5,615**	**5,647**	**1,507**	**1,507**	**1,507**	**1,507**	**1,339**	**1,339**	**1,339**
HL-13 Salt Disposition											
Salt Disposition Ops	57,448	58,520	58,172	47,652	-	-	-	-	-	-	-
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	-	-
HL-13 Total	**57,448**	**58,520**	**58,172**	**47,652**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-09 LI: Tk Fm Services Upgrade I	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-10 LI: Storm Water Upgrades	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-11 LI: Tk Fm Services Upgrade II	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-12 LI: Waste Removal											
LI: WR from Tanks	24,685	10,943	7,013	11,135	4,398	2,117	2,739	6,686	6,997	-	-
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	-	-
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	**24,685**	**10,943**	**7,013**	**11,135**	**4,398**	**2,117**	**2,739**	**6,686**	**6,997**	**-**	**-**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**11,417**	**68,505**	**34,252**	**-**	**-**	**41,782**	**74,465**	**32,840**
HLW TOTAL	**412,257**	**364,904**	**344,533**	**334,939**	**321,469**	**263,137**	**214,316**	**218,433**	**180,976**	**126,393**	**35,643**
HLW w/o Salt Total	**354,808**	**306,384**	**286,362**	**287,287**	**321,469**	**263,137**	**214,316**	**218,433**	**180,976**	**126,393**	**35,643**
Solid Waste Facilities											
ETF	22,278	16,515	15,614	15,614	15,614	15,614	15,614	20,145	5,182	-	-
Saltstone	35,867	29,285	22,754	12,109	3,600	3,600	4,548	4,549	1,955	-	-
SW TOTAL	**58,145**	**45,800**	**38,369**	**27,723**	**19,215**	**19,215**	**20,162**	**24,694**	**7,137**	**-**	**-**
Life Cycle Cost	**470,402**	**410,704**	**382,902**	**362,662**	**340,684**	**282,352**	**234,478**	**243,127**	**188,113**	**126,393**	**35,643**

Appendix H.1 - Funding (Base Case)

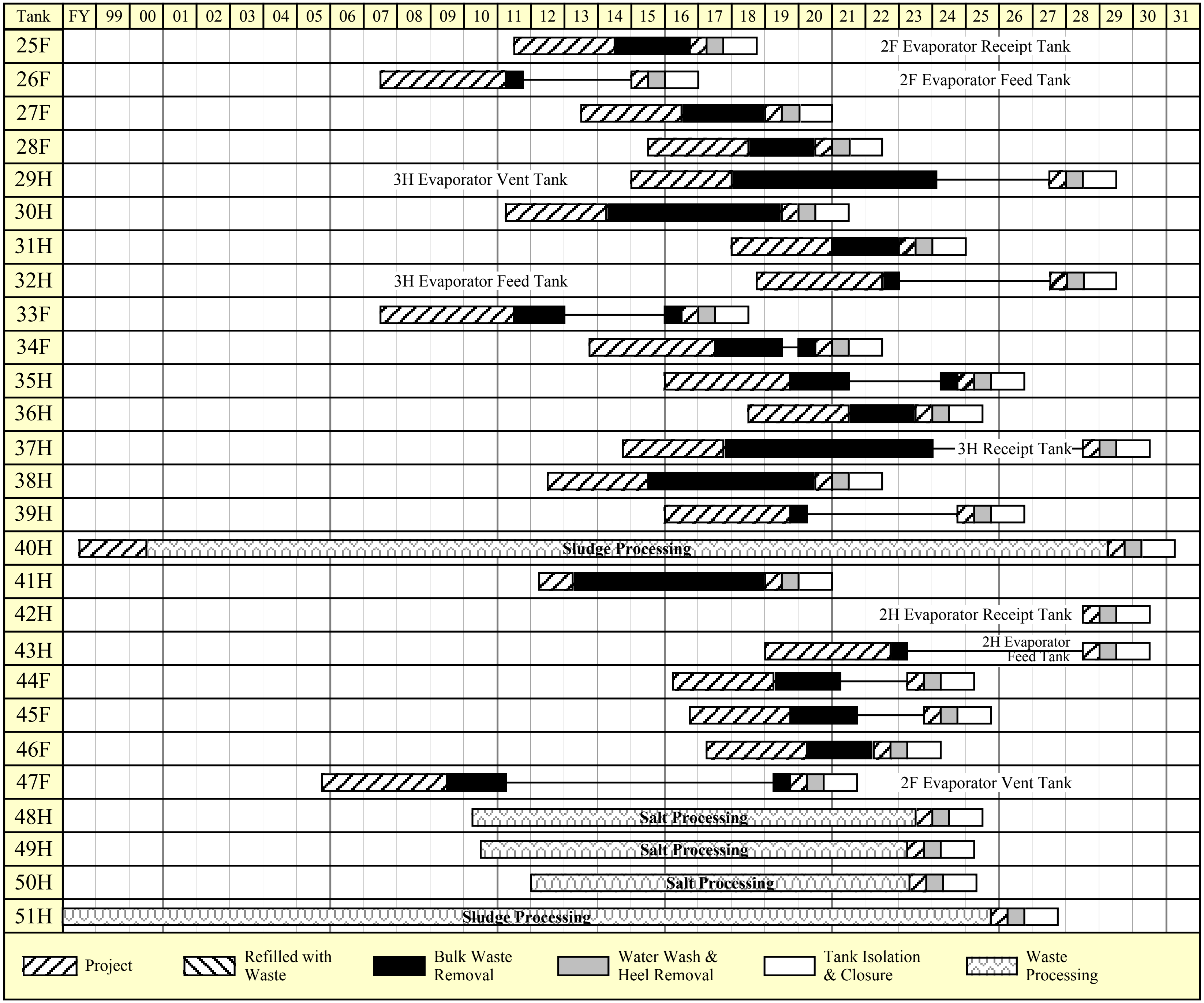
Budget Authority in Constant FY99 Year Dollars

Project Title	FY32	FY33	FY34	FY35	FY36	FY37	FY38	FY39	FY40	Cumulative FY99-End
HL-01 H Tank Farm										
H Tank Farm Operations	-	-	-	-	-	-	-	-	-	2,529,856
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	16,278
HL-01 Total	-	-	-	-	-	-	-	-	-	**2,546,133**
HL-02 F Tank Farm	-	-	-	-	-	-	-	-	-	**1,357,086**
HL-03 Waste Removal & Tank Closures										
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	-	-	120,562
WR: Tank Closure	-	-	-	-	-	-	-	-	-	463,843
HL-03 Total	-	-	-	-	-	-	-	-	-	**584,405**
HL-04 Feed Preparations & Sludge Operations	-	-	-	-	-	-	-	-	-	**1,397,604**
HL-05 Vitrification										
Vitrification Ops	-	-	-	-	-	-	-	-	-	3,493,006
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	1,065
HL-05 Total	-	-	-	-	-	-	-	-	-	**3,494,071**
HL-06 Glass Waste Storage	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	-	**151,005**
HL-13 Salt Disposition										
Salt Disposition Ops	-	-	-	-	-	-	-	-	-	845,432
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	911,044
HL-13 Total	-	-	-	-	-	-	-	-	-	**1,756,475**
HL-09 LI: Tk Fm Services Upgrade I	-	-	-	-	-	-	-	-	-	**1,632**
HL-10 LI: Storm Water Upgrades	-	-	-	-	-	-	-	-	-	**6,047**
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	-	-	**18,364**
HL-12 LI: Waste Removal										
LI: WR from Tanks	-	-	-	-	-	-	-	-	-	808,750
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	148,783
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	30,347
HL-12 Total	-	-	-	-	-	-	-	-	-	**987,880**
FA-24 Facility Decontamination/Decommissioning	-	-	-	-	-	-	-	**6,132**	-	**319,772**
HLW TOTAL	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**7,471**	-	**12,620,473**
HLW w/o Salt Total	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**7,471**	-	**10,863,997**
Solid Waste Facilities										
ETF	-	-	-	-	-	-	-	-	-	516,077
Saltstone	-	-	-	-	-	-	-	-	-	461,166
SW TOTAL	-	-	-	-	-	-	-	-	-	**977,243**
Life Cycle Cost	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**7,471**	-	**13,597,716**

Appendix H.2 Waste Removal Schedule (Base Case)



Appendix H.2 Waste Removal Schedule (Base Case)



Appendix H.3 - Material Balance (Base Case)

End of Month/Year	Influents (gallons)											Effluents (gallons)							Net-Out
	F Canyon			H Canyon			DWPF Recycle	Other	Inhibited Water	Jet Dilution	Total In	Space Recovery from Evaporation				Salt Solution to Processing	Sludge to ESP/DWPF	Tot-Out	
	LHW	HHW	F-Can Total	LHW	HHW	H-Can Total						2F Evaps	2H Evaps	3H Evaps	Total				
Oct 2000	0	32,924	32,924	1,650	12,285	13,935	144,715	50,026	62,222	12,440		105,434	-	113,303	218,737	-	19,656	Actuals	(see Note 2)
Nov 2000	0	16,883	16,883	0	17,800	17,800	119,758	11,356	83,278	56,760		1,089	-	(16,111)	(15,022)	-	21,762	Actuals	(see Note 2)
Dec 2000	0	49,491	49,491	1,439	21,376	22,815	115,928	31,692	0	14,560		(20,849)	-	(9,442)	(30,291)	-	15,795	Actuals	(see Note 2)
Jan 2001	28,500	20,625	49,125	3,828	11,025	14,853	37,917	16,875	113,410	13,207	245,387	72,376	-	34,507	106,883	-	10,038	116,921	(128,466)
Feb 2001	30,000	28,500	58,500	5,104	14,700	19,804	50,556	22,500	260,091	36,630	448,081	101,602	-	39,677	141,280	-	13,384	154,664	(293,417)
Mar 2001	28,000	25,500	53,500	5,104	15,220	20,324	43,908	22,500	-	54,625	194,857	125,909	-	-	125,909	-	13,384	139,293	(55,564)
Apr 2001	30,000	27,500	57,500	15,104	15,220	30,324	28,602	22,500	30,000	42,580	211,506	170,338	-	180,890	351,228	-	13,384	364,612	153,106
May 2001	25,000	28,500	53,500	25,104	15,220	40,324	19,287	22,500	10,000	39,745	185,356	166,684	-	-	166,684	-	13,384	180,068	(5,288)
Jun 2001	18,000	25,500	43,500	5,104	15,220	20,324	39,579	22,500	460,000	47,113	633,017	167,098	-	164,206	331,304	-	13,384	344,688	(288,329)
Jul 2001	15,000	27,500	42,500	5,104	15,220	20,324	50,556	22,500	-	25,749	161,629	85,603	-	-	85,603	-	13,384	98,987	(62,642)
Aug 2001	15,000	28,500	43,500	5,104	15,220	20,324	50,556	22,500	360,000	59,060	555,940	60,594	60,313	101,769	222,676	-	13,384	236,060	(319,879)
Sep 2001	18,000	25,500	43,500	5,104	15,220	20,324	50,556	22,500	-	58,869	195,749	86,686	199,393	-	286,079	-	13,384	299,463	103,714
FY01	207,500	336,923	544,423	77,749	183,726	261,475	751,918	289,949	1,379,001	461,338	2,831,522	1,122,564	259,706	608,799	1,991,070	-	174,323	1,934,756	(896,765)
Oct 2001	15,000	27,500	42,500	25,104	15,220	40,324	-	22,500	250,000	42,451	397,775	33,008	154,177	83,770	270,955	-	-	270,955	(126,820)
Nov 2001	15,000	28,500	43,500	5,104	15,220	20,324	-	22,500	-	41,657	127,981	86,730	154,864	-	241,594		-	241,594	113,613
Dec 2001	18,000	25,500	43,500	5,104	15,220	20,324	-	22,500	-	43,768	130,092	70,308	87,734	94,712	252,754		-	252,754	122,662
Jan 2002	24,000	5,000	29,000	13,052	15,220	28,272	26,802	22,500	-	82,798	189,372	41,947	213,214	-	255,161		-	255,161	65,790
Feb 2002	24,000	6,000	30,000	13,052	15,220	28,272	107,208	22,500	-	72,431	260,411	33,819	225,170	38,336	297,325	-	-	297,325	36,914
Mar 2002	27,000	3,000	30,000	13,052	14,700	27,752	80,406	22,500	-	50,981	211,639	63,449	184,780	-	248,229	-	-	248,229	36,590
Apr 2002	24,000	3,000	27,000	13,052	14,700	27,752	-	22,500	-	60,571	137,823	64,443	193,856	28,188	286,487	-	-	286,487	148,663
May 2002	23,000	6,000	29,000	13,052	14,700	27,752	-	22,500	-	27,245	106,497	60,788	145,217	21,876	227,882	400,000	3,100	630,982	524,484
Jun 2002	26,000	3,000	29,000	13,052	14,700	27,752	-	22,500	656,670	29,300	765,222	53,330	93,853	21,367	168,550	400,000	12,400	580,950	(184,272)
Jul 2002	8,000	18,000	26,000	13,052	14,700	27,752	-	10,000	-	30,817	94,569	45,281	55,919	20,903	122,102	40,381	7,456	169,939	75,370
Aug 2002	8,000	18,000	26,000	13,052	14,700	27,752	107,208	10,000	-	65,135	236,095	37,793	79,187	20,481	137,462	-	6,788	144,249	(91,846)
Sep 2002	8,000	3,000	11,000	13,052	14,700	27,752	107,208	10,000	-	58,042	214,002	31,918	129,025	20,101	181,044	-	6,788	187,832	(26,170)
FY02	220,000	146,500	366,500	152,780	179,000	331,780	428,832	232,500	906,670	605,196	2,871,478	622,814	1,716,996	349,734	2,689,545	840,381	36,532	3,566,457	694,978
Oct 2002	8,000	3,000	11,000	33,052	14,700	47,752	78,452	10,000	-	157,153	304,357	27,575	170,328	23,706	221,608	-	8,565	230,173	(74,184)
Nov 2002	8,000	3,000	11,000	33,052	14,700	47,752	78,452	10,000	-	49,735	196,939	23,440	183,372	24,325	231,138	-	9,478	240,616	43,677
Dec 2002	8,000	3,000	11,000	13,052	14,700	27,752	78,452	10,000	-	96,818	224,022	11,182	187,640	24,616	223,438	-	9,173	232,611	8,589
Jan 2003	8,000	3,000	11,000	5,104	14,700	19,804	78,452	10,000	297,297	78,041	494,594	101,709	188,287	25,050	315,046	-	9,478	324,524	(170,070)
Feb 2003	8,000	3,000	11,000	5,104	14,700	19,804	78,452	10,000	-	42,376	161,632	105,050	187,685	25,189	317,924	-	9,478	327,402	165,770
Mar 2003	8,000	3,000	11,000	5,104	14,700	19,804	78,452	10,000	-	20,699	139,955	84,521	170,921	25,187	280,629	-	8,561	289,190	149,236
Apr 2003	8,000	3,000	11,000	7,404	14,700	22,104	78,452	10,000	-	28,265	149,821	73,581	149,982	25,078	248,641	-	9,478	258,120	108,299
May 2003	8,000	3,000	11,000	7,404	14,700	22,104	78,452	10,000	-	29,716	151,272	83,020	134,276	24,887	242,183	-	9,173	251,356	100,084
Jun 2003	8,000	3,000	11,000	7,404	14,700	22,104	78,452	10,000	106,000	31,152	258,708	89,282	132,102	24,635	246,019	-	9,478	255,497	(3,211)
Jul 2003	8,000	3,000	11,000	6,732	13,132	19,864	78,452	10,000	-	25,640	144,956	87,871	127,995	24,337	240,203	-	9,173	249,375	104,419
Aug 2003	8,000	3,000	11,000	6,732	13,132	19,864	78,452	10,000	-	24,520	143,836	79,656	133,074	24,006	236,736	-	9,478	246,215	102,379
Sep 2003	8,000	3,000	11,000	6,732	13,132	19,864	78,452	10,000	-	26,157	145,473	61,351	124,911	23,653	209,914	-	9,478	219,393	73,920
FY03	96,000	36,000	132,000	136,876	171,696	308,572	941,424	120,000	403,297	610,272	2,515,565	828,238	1,890,573	294,669	3,013,479	-	110,991	3,124,472	608,908
Oct 2003	8,000	3,000	11,000	26,732	13,132	39,864	81,884	10,000	-	28,677	171,425	45,747	127,515	23,284	196,546	-	9,536	206,082	34,656
Nov 2003	8,000	3,000	11,000	6,732	13,132	19,864	81,884	10,000	-	27,320	150,068	35,411	121,781	22,905	180,096	-	9,968	190,064	39,996
Dec 2003	8,000	3,000	11,000	6,732	13,132	19,864	81,884	10,000	-	29,422	152,170	29,069	125,572	22,522	177,163	-	9,646	186,809	34,639
Jan 2004	8,000	3,000	11,000	6,732	13,132	19,864	81,884	10,000	-	27,778	150,526	25,351	120,390	22,138	167,880	-	9,968	177,847	27,321
Feb 2004	8,000	3,000	11,000	6,732	13,132	19,864	81,884	10,000	-	29,698	152,446	23,206	124,531	21,756	169,494	-	9,968	179,461	27,015
Mar 2004	8,000	3,000	11,000	6,732	13,132	19,864	81,884	10,000	-	103,550	226,298	29,032	119,713	21,379	170,124	-	9,003	179,126	(47,171)
Apr 2004	8,000	3,000	11,000	6,732	13,832	20,564	81,884	10,000	-	38,746	162,194	91,969	124,022	21,017	237,008	-	9,968	246,975	84,781
May 2004	8,000	3,000	11,000	26,732	13,832	40,564	81,884	10,000	-	22,368	165,816	92,658	119,473	20,692	232,823	-	9,646	242,469	76,653
Jun 2004	8,000	3,000	11,000	6,732	13,832	20,564	81,884	10,000	-	27,738	151,186	72,874	123,859	20,406	217,139	-	9,968	227,106	75,920
Jul 2004	8,000	3,000	11,000	6,732	13,832	20,564	81,884	10,000	-	26,675	150,123	53,797	119,525	20,183	193,504	-	9,646	203,150	53,027
Aug 2004	8,000	3,000	11,000	6,732	13,832	20,564	81,884	10,000	-	29,049	152,497	40,026	123,941	20,018	183,985	-	9,968	193,952	41,455
Sep 2004	8,000	3,000	11,000	6,732	13,832	20,564	81,884	10,000	-	119,833	243,281	23,995	119,785	19,907	163,687	-	9,968	173,655	(69,626)
FY04	96,000	36,000	132,000	120,784	161,784	282,568	982,608	120,000	-	510,854	2,028,030	563,135	1,470,107	256,207	2,289,449	-	117,253	2,406,696	378,666

Tank 50 emptied to Saltstone

Appendix H.3 - Material Balance (Base Case)

End of Month/Year	Influents (gallons)											Effluents (gallons)							Net-Out
	F Canyon			H Canyon			DWPF Recycle	Other	Inhibited Water	Jet Dilution	Total In	Space Recovery from Evaporation				Salt Solution to Processing	Sludge to ESP/DWPF	Tot-Out	
	LHW	HHW	F-Can Total	LHW	HHW	H-Can Total						2F Evaps	2H Evaps	3H Evaps	Total				
FY05	96,000	61,200	**157,200**	100,388	163,788	**264,176**	643,248	120,000	1,822,520	363,837	**3,370,981**	2,244,154	1,143,744	288,822	**3,676,718**	-	80,641	**3,757,356**	**386,377**
FY06	96,000	40,800	**136,800**	125,200	265,200	**390,400**	900,192	70,000	-	709,997	**2,207,389**	612,115	1,238,480	776,303	**2,626,897**	-	95,533	**2,722,429**	**515,039**
FY07	96,000	36,000	**132,000**	131,200	403,200	**534,400**	1,099,890	-	-	712,715	**2,479,005**	1,247,694	1,115,575	782,389	**3,145,659**	-	96,000	**3,241,659**	**762,653**
FY08	96,000	36,000	**132,000**	47,600	375,300	**422,900**	1,235,360	-	480,000	748,886	**3,019,146**	633,055	1,084,488	922,840	**2,640,381**	-	83,062	**2,723,447**	**(295,696)**
FY09	120,000	120,000	**240,000**	-	120,000	**120,000**	-	-	876,553	350,971	**1,587,524**	-	370,718	1,341,915	**1,712,634**	-	-	**1,712,634**	**125,113**
FY10 (mid)	60,000	60,000	**120,000**	-	60,000	**60,000**	457,824	-	154,616	160,180	**952,619**	-	298,504	167,203	**465,707**	-	51,492	**517,198**	**(435,421)**

Note:

1) Discussion of the components of the Influents and Effluents is contained in Section 8.1.3 “HLW System Material Balance”
2) Actual values for October through December 2000 are obtained from the “HLW Morning Reports”

Appendix H.4 — Salt Solution Processing (Base Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT001	48	12/24/09	Heel	-		4/1/10	59.0	4	17.6%	1,653	180	3,245	4
			21	104,000	ls								
			50	200,000	cs								
			47	900,000	ds								
SPT002	49	5/9/10	Heel	250,000		6/20/10	62.2	4	17.5%	1,696		3,001	4
			14	452,533	ds								
			21	125,000	ls								
			47	400,000	ds								
SPT003	48	6/20/10	Heel	2,160		9/25/10	61.6	4	17.6%	1,575		2,788	4
			50	250,000	cs								
			33	450,000	cs								
			47	500,000	ds								
SPT004	49	9/25/10	Heel	16,634		12/31/10	56.5	4	17.9%	1,685	180	3,301	1
			47	623,000	ds								
			21	75,000	ls								
			33	306,500	cs								
			50	200,000	cs								
SPT005	48	12/31/10	Heel	160		3/29/11	58.8	4	17.6%	1,596		2,826	2
			50	200,000	cs								
			33	400,000	cs								
			47	450,000	ds								
			42	95,000	cs								
			21	75,000	ls								
SPT006	49	3/29/11	Heel	19,314		6/30/11	58.7	4	17.4%	1,580		2,797	2
			2	998,000	ds				15.0%				
			50	110,000	cs								
			21	95,000	ls								
SPT007	48	6/30/11	Heel	18,960		9/28/11	67.4	4	15.2%	1,611		2,852	2
			2	812,977	ds								
			50	160,000	cs								
			8	230,542	cs								

Appendix H.4 — Salt Solution Processing (Base Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT008	49	9/28/11	Heel	20,434		1/6/12	68.1	4	15.3%	1,610	180	3,169	2
			33	367,419	cs			5					
			21	70,000	ls								
			26	730,000	cs								
			50	20,000	cs								
SPT009	50	11/1/11	Heel	14,040		4/15/12	64.4	5	15.0%	1,698		3,005	3
			1	1,100,000	ds								
			30	90,000	cs								
			21	18,000	ls								
SPT010	48	1/6/12	Heel	20,620		7/22/12	71.2	5	15.6%	1,629		2,883	3
			1	570,082	ds								
			30	200,000	cs								
			8	373,934	cs								
			21	50,000	ls								
SPT011	49	4/15/12	Heel	5,350		11/1/12	58.8	5	15.0%	1,575		2,787	3
			3	850,000	ds								
			26	315,000	cs								
			21	50,000	ls								
SPT012	50	7/22/12	Heel	20,360		1/30/13	55.7	5	14.8%	1,613	180	3,173	3
			3	964,473	ds								
			26	218,600	cs								
			21	18,000	ls								
SPT013	48	11/1/12	Heel	12,397		4/28/13	64.3	5	15.5%	1,498		2,651	5
			10	708,727	ds								
			30	200,000	cs								
			21	190,000	ls								
SPT014	49	1/30/13	Heel	18,950		7/30/13	57.3	5	14.8%	1,674		2,963	5
			9	1,050,000	ds								
			30	103,000	cs								
			21	50,000	ls								

Appendix H.4 — Salt Solution Processing (Base Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT015	50	4/28/13	Heel	19,476		10/28/13	63.9	5	15.3%	1,565		2,771	5
			9	858,273	ds								
			26	250,000	cs								
			21	50,000	ls								
SPT016	48	7/30/13	Heel	-		1/31/14	41.1	5	13.7%	1,638		2,900	5
			41	995,997	ds								
			26	200,000	cs								
SPT017	49	10/28/13	Heel	20,069		4/15/14	46.3	5	14.1%	1,677	180	3,286	6
			41	965,058	ds								
			26	237,395	cs								
SPT018	50	1/31/14	Heel	-		7/3/14	52.8	5	14.5%	1,692		2,994	6
			41	850,000	ds			6	11.8%				
			30	220,000	cs								
			21	150,000	ls								
SPT019	48	4/15/14	Heel	-		10/17/14	55.3	6	12.1%	1,653		2,926	6
			41	781,000	ds								
			30	239,965	cs								
			21	200,000	ls								
SPT020	49	7/3/14	Heel	20,620		2/1/15	18.6	6	9.2%	1,658		2,934	7
			41	814,600	ds								
			30	387,000	ds								
SPT021	50	10/17/14	Heel	18,800		4/5/15	48.4	6	11.7%	1,730		3,062	7
			30	391,129	cs								
			25	710,000	ds								
			35	100,000	cs								
SPT022	48	2/1/15	Heel	19,804		7/14/15	48.1	6	11.7%	1,671	180	3,276	7
			25	870,000	ds								
			38	129,892	cs								
			42	202,816	cs								

Appendix H.4 — Salt Solution Processing (Base Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT023	49	4/5/15	Heel	20,284		10/21/15	37.4	6	11.1%	1,642		2,907	7
			25	1,129,990	ds								
			42	72,256	cs								
SPT024	50	7/14/15	Heel	17,974		1/13/16	47.3	6	11.7%	1,643		2,908	8
			25	935,692	ds								
			42	268,776	cs								
SPT025	48	10/21/15	Heel	20,620		4/19/16	43.0	6	11.3%	1,659		2,937	8
			38	875,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			21	65,000	ls								
SPT026	49	1/13/16	Heel	20,620		7/21/16	42.8	6	11.4%	1,659	180	3,255	8
			38	875,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			21	65,000	ls								
SPT027	50	4/19/16	Heel	20,620		10/22/16	41.1	6	11.4%	1,643		2,908	9
			38	875,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			21	65,000	ls								
SPT028	48	7/21/16	Heel	20,620		1/19/17	40.7	6	11.4%	1,633		2,890	9
			38	875,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			21	65,000	ls								

Appendix H.4 — Salt Solution Processing (Base Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT029	49	10/22/16	Heel	12,220		4/17/17	39.8	6	11.2%	1,653	180	3,244	9
			38	415,604	ds								
			27	475,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			23	65,000	ls								
SPT030	50	1/19/17	Heel	12,220		7/15/17	38.7	6	11.1%	1,625		2,876	9
			27	870,000	ds			7	17.3%				
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			23	65,000	ls								
SPT031	48	4/17/17	Heel	3,820		10/9/17	38.0	7	17.2%	1,646	180	3,233	10
			34	100,000	cs								
			27	900,000	ds								
			35	75,000	cs								
			30	75,000	cs								
			23	65,000	ls								
SPT032	49	7/15/17	Heel	20,048		12/4/17	38.5	7	17.2%	1,670		2,956	10
			34	100,000	cs								
			27	900,000	ds								
			35	75,000	cs								
			30	75,000	cs								
			41	65,000	ls								
SPT033	50	10/9/17	Heel	-		1/29/18	42.9	7	17.7%	1,673		2,961	10
			27	594,140	cs								
			29	295,000	ds								
			34	128,674	ds								
			35	75,000	cs								
			41	65,000	ls								
			30	63,936	cs								

Appendix H.4 — Salt Solution Processing (Base Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT034	48	12/4/17	Heel	-		3/30/18	46.5	7	18.0%	1,638		2,900	10
			37	1,221,750	ds								
SPT035	49	1/29/18	Heel	-		5/31/18	40.4	7	18.0%	1,519		2,689	11
			29	900,000	ds								
			35	150,000	cs								
			23	106,720	ls								
SPT036	50	3/30/18	Heel	20,620		7/25/18	36.4	7	17.1%	1,697		3,004	11
			29	445,000	ds								
			34	628,142	ds								
			37	48,870	ds								
			35	79,911	cs								
SPT037	48	5/31/18	Heel	20,620		9/17/18	43.5	7	17.7%	1,726		3,055	11
			29	930,000	ds								
			30	50,000	cs								
			35	125,000	cs								
			42	96,923	cs								
SPT038	49	7/25/18	Heel	-		11/17/18	32.8	7	16.6%	1,727	180	3,375	12
			29	839,980	ds								
			42	360,000	cs								
SPT039	50	9/17/18	Heel	20,620		1/8/19	46.6	7	18.0%	1,604		2,840	12
			28	850,000	ds								
			42	270,000	cs								
			35	60,000	cs								
SPT040	48	11/17/18	Heel	20,620		3/11/19	43.7	7	18.0%	1,566		2,772	12
			28	850,000	ds								
			42	168,725	cs								
			38	100,000	ls								
			35	50,000	cs								
SPT041	49	1/8/19	Heel	-		5/9/19	43.0	7	18.0%	1,624		2,874	12
			28	965,000	ds								
			38	175,000	ls								
			35	60,000	cs								

Appendix H.4 — Salt Solution Processing (Base Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A	B	C	D	E	F	G	H	I	J	K	L	M	N
Salt Batch	Feed Tank	Date to Begin Blending	Source Tank	Feed Volume (kgal)	Feed Type	Start Feed to Salt Processing	TPB Used (kgal)	Sludge Batch	PHA Waste Loading (wt%)	Decontaminated Salt Solution to Saltstone (kgal)	ETF to Saltstone (kgal)	Grout Produced (kgal)	Vault #s
SPT042	50	3/11/19	Heel	-		7/6/19	48.0	7	18.2%	1,543		2,732	13
			28	340,000	ds								
			38	800,000	ls								
			35	60,000	cs								
SPT043	48	5/9/19	Heel	-		9/6/19	47.7	7	18.0%	1,672		2,959	13
			28	394,000	ds								
			43	805,000	cs								
SPT044	49	7/6/19	Heel	-		11/9/19	49.9	7	18.2%	1,647		2,915	13
			43	275,012	cs								
			44	865,000	ds								
			35	50,000	cs								
SPT045	50	9/6/19	Heel	-		1/13/20	46.9	7	18.0%	1,666	180	3,267	13
			44	1,170,000	ds								
			35	50,000	cs								
SPT046	48	11/9/19	Heel	-		3/15/20	46.4	7	18.0%	1,646		2,913	14
			44	1,155,000	ds								
			35	50,000	cs								
SPT047	49	1/13/20	Heel	-		5/16/20	50.3	7	18.0%	1,642		2,907	14
			44	138,665	ds								
			45	1,015,000	ds								
			35	50,000	cs								
SPT048	50	3/15/20	heel	18,800		7/21/20	49.6	7	18.0%	1,650		2,921	14
			45	1,098,000	ds			8	17.9%				
			35	50,000	cs								
			43	55,000	cs								
SPT049	48	5/16/20	heel	3,200		9/25/20	50.3	8	17.9%	1,637		2,898	15
			45	1,150,000	ds								
			29	50,000	cs								
SPT050	49	7/21/20	heel	1,812		11/30/20	45.9	8	18.2%	1,681		2,975	15
			45	508,018	ds								
			46	595,000	ds								
			29	100,000	cs								

Appendix H.4 — Salt Solution Processing (Base Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT051	50	9/25/20	heel	19,920		1/30/21	45.5	8	18.2%	1,740		3,080	15
			46	1,050,000	ds								
			29	150,000	cs								
SPT052	48	11/30/20	heel	1,200		4/1/21	44.8	8	18.3%	1,716	180	3,356	15
			46	1,050,000	ds								
			29	150,000	cs								
SPT053	49	1/30/21	heel	2,950		5/31/21	35.9	8	19.4%	1,723		3,050	16
			46	1,116,857	ds								
			29	102,056	cs								
SPT054	50	4/1/21	heel	17,920		7/18/21	45.4	8	19.0%	1,735		3,070	16
			31	1,075,000	ds								
			29	129,520	cs								
SPT055	48	5/31/21	heel	-		9/14/21	50.7	8	18.7%	1,753		3,103	16
			31	1,060,000	ds								
			29	161,750	cs								
SPT056	49	7/18/21	heel	20,620		11/18/21	47.5	8	18.7%	1,742		3,083	17
			31	1,060,000	ds								
			29	141,923	cs								
SPT057	50	9/14/21	heel	20,620		1/19/22	47.1	8	18.7%	1,715		3,036	17
			31	443,361	ds								
			36	685,000	ds								
			29	73,562	cs								
SPT058	48	11/18/21	heel	20,620		3/21/22	46.8	8	18.7%	1,702		3,013	17
			36	1,160,000	ds								
			29	41,923	cs								
SPT059	49	1/19/22	heel	20,620		5/20/22	47.0	8	18.7%	1,712	180	3,349	17
			36	1,160,000	ds								
			29	41,923	cs								
SPT060	50	3/21/22	heel	20,620		7/20/22	44.7	8	18.7%	1,715		3,036	18
			36	817,240	ds				18.7%				
			29	44,683	cs								
			37	340,000	ds								

Appendix H.4 — Salt Solution Processing (Base Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT061	48	5/20/22	heel	20,620		9/16/22	48.6	8	18.5%	1,722		3,047	18
			37	1,100,000	ds			9					
			29	101,923	cs								
SPT062	49	7/20/22	heel	20,620		11/19/22	16.5	9	17.6%	1,681	180	3,294	18
			37	681,000	ds								
			42	520,851	cs								
SPT063	50	9/16/22	heel	20,620		12/20/22	41.6	9	18.5%	1,699		3,007	19
			37	1,134,270	ds								
			29	67,653	cs								
SPT064	48	11/19/22	heel	20,620		2/14/23	35.5	9	19.6%	1,780		3,151	19
			43	1,000,000	cs								
			29	150,000	cs								
			IW	54,000									
SPT065	49	12/20/22	heel	20,620		4/2/23	136.4	9	15.9%	1,963		3,475	19
			32	948,909	cs								
			IW	263,135									
SPT066	50	2/14/23	heel	20,620		9/30/23	156.5	9	15.4%	2,065	180	3,974	19
			39	980,000	cs								
			IW	230,000									
SPT067	48	4/2/23	heel	20,620		4/28/24	22.5	9	15.4%	284		503	20
			39	137,546	cs								
			IW	3,190									

Appendix H.4 — Salt Solution Processing (Base Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s

Notes:

A) Each Salt Batch consists of a tank of blended dissolved salt solution to comprise a consistent feed stock. Each batch is individually tested and confirmed to meet processing qualification specifications.

B) Tank that is filled with a blended solution of feed stock ready for salt processing. The feed tanks for salt processing include Tanks 48, 49, and 50. Because of limited tank space at the time of initial salt processing, only Tanks 48 and 49 are available to feed.

C) Date when the first supernate solution is transferred into the salt processing feed tank.

D) The primary source of the supernate solution. The "heel" is the volume that is left over from the previous batch. "IW" refers to inhibited water.

E) The volume that is transferred from the source tank.

F) "cs" - Concentrated supernate. Does not originate from a solid salt cake.
"ls" - Light supernate. Generally supernate with a specific gravity of less than 1.2. Usually applied to DWPF recycle water.
"ds" - Dissolved salt solution. Originates from a salt cake dissolution process.

G) Date when the first salt solution is fed to the Salt Processing Facility.

H) Tetra-phenyl borate solution required to precipate the cesium to below Salt Stone waste acceptance criteria limits.

I) Sludge Batch number which is coupled with the salt processing batch.

J) Canister waste loading of precipitate hydrolysis aqueous (PHA).

K) Liquid volume of decontaminated salt solution from the Salt Processing Facility sent to Saltstone. Volume is shown for first salt batch in a fiscal year. This forecast volume would actually be received over the entire year at a rate of ~15 kgal per year.

L) Liquid volume of ETF concentrate sent to Saltstone.

M) Volume of grout that occupies vault storage space.

N) Corresponding Saltstone vault ID numbers. With a permanent roof, each cell measures 98.5 x 98.5 x 25 feet = 242,500 cu-ft. Existing Vault #1 has 6 cells, of which 3.5 are filled. Vault #4 has 12 cells, of which 1 is filled. New vaults will have 6 cells each. Vault # fill sequence to be 4, 1, 2, 3, 5, 6, 7, ... etc.

Appendix H.5 – Sludge Processing (Base Case)

	Waste Removal		ESP Pretreatment							DWPF Vitrification						
A Sludge Batch	B Source Tanks	C Sludge Content (kg)	D Feed Prep Start Date	E Feed Prep Total Dur. (months)	F Total ESP Water Vol. (kgal)	G Na (wt% dry)	H Hg (wt% dry)	I Total Solids (wt%)	J Pretreated Volume (kgal)	K Feed Volume (kgal)	L Start Feed	M Canister Yield	N Feed Duration (years)	O Finish Feed	P Feed Tank	Q Sludge Loading (wt %)
1A	51	298,000			na	8.80		16.4	491	491	3/1/96	492	2.75	8/30/98	51	25.0
										-140	(Tk 51 heel @ 40 ")					
										351						
1B	42	420,861			na	7.77	0.30	16.5	460	460	10/1/98	658	3.67	5/31/02	51	25.0
	total	420,861								(Tk 51 heel @ 40 " and assumes DWPF outage in 1stQ and 2ndQ FY02)						
2	8	182,451			1,977	8.75	0.30	16.0	456	456	5/31/02	471	3.05	6/15/05	40	28.0
	40	179,098								-140	(Tk 40 heel @ 40 ")					
	total	361,549								316						
3	7(70%)	288,957	2/21/04	16	3,156	8.70	0.10	16.0	540	540	6/15/05	486	2.79	3/29/08	51	29.0
	18(70%)	14,777								(Assume DWPF outage 3rdQ FY08 - FY09 for extended maintenance)						
	19(70%)	1,956														
	total	305,690														
4	7(30%)	123,839	9/6/08	13	1,199	9.44	1.60	16.0	451	451	10/1/09	413	2.32	1/23/12	40	30.5
	11	124,380								(Assume coupled salt and sludge feed starts in April 2010)						
	18(30%)	6,333														
	19(30%)	838														
	total	255,390														
5	15	165,818	8/31/10	17	2,285	11.51	1.50	16.0	567	567	1/23/12	494	2.47	7/13/14	51	31.3
	26	154,896														
	total	320,714														
6	5	57,630	2/18/13	17	2,815	8.70	2.20	16.0	727	727	7/13/14	598	2.99	7/8/17	40	32.8
	6	38,708														
	12	189,715														
	13(30%)	125,280														
	total	411,333														
7	13(70%)	292,320	2/14/16	17	2,862	9.08	1.90	16.0	743	743	7/8/17	652	3.26	10/10/20	51	29.5
	4	65,477														
	33	62,401														
	total	420,198														
8	21	6,393	6/18/19	16	2,034	8.76	1.30	16.0	677	677	10/10/20	584	2.92	9/11/23	40	29.5
	22	13,265														
	23	59,110														
	34	77,119														
	39	89,474														
	47	137,763														
	total	383,124														

Appendix H.5 – Sludge Processing (Base Case)

	Waste Removal		ESP Pretreatment							DWPF Vitrification						
A Sludge Batch	B Source Tanks	C Sludge Content (kg)	D Feed Prep Start Date	E Feed Prep Total Dur. (months)	F Total ESP Water Vol. (kgal)	G Na (wt% dry)	H Hg (wt% dry)	I Total Solids (wt%)	J Pretreated Volume (kgal)	K Feed Volume (kgal)	L Start Feed	M Canister Yield	N Feed Duration (years)	O Finish Feed	P Feed Tank	Q Sludge Loading (wt %)
9	32	214,886	5/19/22	16	1,846	10.06	4.90	16.0	472	472	9/11/23	387	1.94	8/17/25	51	31.0
	43	51,940														
		266,826														
10	ESP Heels (Tks 40,42,51)	158,377	5/24/24	15	1,877	8.24	4.90	16.0	913	913	8/17/25	679	3.40	1/8/29	40	30.2
	35	138,956														
	Other Insoluble Solids	219,000														
	total	516,333														
Totals		3,662,018			20,051	Total Estimated Washwater						5,914	Total Estimated Cans			

Notes:

General) Above based on the following yearly canister production values: FY01 163 cans/yr, FY02 111 cans/yr, FY03 155 cans/yr, FY04 163 cans/yr, FY05 111 cans/yr, FY06 147 cans/yr, FY07 200 cans/yr, FY08 107 cans/yr, FY09 DWPF Outage, FY10 150 cans/yr, FY11-End 200 cans/yr.

A) Each Sludge Batch must be individually tested and confirmed to meet waste qualification spedicfications

B) Sludge in these tanks will comprise the batch. Note: 100% of the sludge from Tanks 7, 18&19 will be moved to ESP to support Sludge Batch 3. However, 30% of this sludge will be combined with Tank 11 sludge to make Sludge Batch 4.

C) Amount of sludge from each source tank in the batch obtained from WCS data base

D) Feed Prep start date is the date that sludge is first moved into the the ESP feed tank (40 or 51) to begin preparation of the sludge batch (i.e. obtain proper alkali composition of the sludge slurry for feed to DWPF)

E) Total planned duration of transfers, washing, sampling, test glass production, and associated decants for the preparation of a sludge batch for feed to DWPF

F) Total estimated volume of sludge transfer water and wash water decants to obtain target soluble Na concentration for feed to DWPF

G) Amount of total Na in washed sludge (dry basis)

H) Amount of total Hg in washed sludge (dry basis)

I) Total solids (soluble and insoluble) in washed sludge

J) Volume of sludge at given wt% total solids before heel effects (Batch 1B is actual. Batch 2 is projected from detailed analysis. Batch 3 and beyond are based on ratio of batch sludge kg values converted to gallons and adjusted from an estimated 25 wt% solids to 16 wt% solids)

K) Volume of sludge available for feed after adding or subtracting pump heel

L) Start feed date based on depletion of previous batch down to pump heel

M) Estimated number of canisters produced given the pretreatment as shown. Numbers are actual for Batch 1A and estimated for remaining batches. Coupled Salt and Sludge Feed assumed to start with Batch 4.

N) Column O divided by the planned canister production during the period in which the batch is vitrified. See production note under General Section above.

O) Column N plus column P. Finish Feed means when the last transfer of feed is sent from the Feed Tank. The last canister for the batch will be poured later. The DWPF has approximately 25 canisters of feed in process. Therefore 25 more canisters will be produced from the batch after the last feed is sent to DWPF.

P) Batch feed tank

Q) Weight % of glass comprised of sludge oxides.

Appendix H.6 - Canister Storage (Base Case)

End of FY	SRS Cans Produced		SRS Cans in GWSB #1 (2,159 max)			SRS Cans in Modular Storage (1 building @ 585)			SRS Cans Shipped to Repository		Net Cans Stored At SRS
	Yearly	Cum.	Added	Shipped	Cum.	Added	Shipped	Cum.	Each Year	Cumulative	
1996	64	64	64		64						64
1997	169	233	169		233						233
1998	250	483	250		483						483
1999	236	719	236		719						719
2000	231	950	231		950						950
2001	163	1,113	163		1,113						1,113
2002	111	1,224	111		1,224						1,224
2003	155	1,379	155		1,379						1,379
2004	163	1,542	163		1,542						1,542
2005	111	1,653	111		1,653	0		0			1,653
2006	147	1,800	147		1,800	0		0			1,800
2007	200	2,000	200		2,000	0		0			2,000
2008	107	2,107	107		2,107	0		0			2,107
2009	0	2,107			2,107	0		0			2,107
2010	150	2,257	57	(105)	2,059	93		93	105	105	2,152
2011	200	2,457		(205)	1,854	200		293	205	310	2,147
2012	200	2,657		(205)	1,649	200		493	205	515	2,142
2013	200	2,857	110	(205)	1,554	90		583	205	720	2,137
2014	200	3,057	200	(205)	1,549	0		583	205	925	2,132
2015	200	3,257	200	(205)	1,544	0		583	205	1,130	2,127
2016	200	3,457	200	(205)	1,539	0		583	205	1,335	2,122
2017	200	3,657	200	(205)	1,534	0	0	583	205	1,540	2,117
2018	200	3,857	200	(205)	1,529	0	0	583	205	1,745	2,112
2019	200	4,057	200	(205)	1,524	0	0	583	205	1,950	2,107
2020	200	4,257	200	(205)	1,519	0	0	583	205	2,155	2,102
2021	200	4,457	200	(205)	1,514	0	0	583	205	2,360	2,097
2022	200	4,657	200	(205)	1,509	0	0	583	205	2,565	2,092
2023	200	4,857	200	(205)	1,504	0	0	583	205	2,770	2,087
2024	200	5,057	200	(205)	1,499	0	0	583	205	2,975	2,082
2025	200	5,257	200	(205)	1,494	0	0	583	205	3,180	2,077
2026	200	5,457	200	(90)	1,604	0	(115)	468	205	3,385	2,072
2027	200	5,657	200	0	1,804	0	(205)	263	205	3,590	2,067
2028	200	5,857	200	0	2,004	0	(205)	58	205	3,795	2,062
2029	57	5,914	200	(147)	2,057	0	(58)	0	205	4,000	1,914
2030	0	5,914		(205)	1,852	0	0	0	205	4,205	1,709
2031	0	5,914		(205)	1,647	0	0	0	205	4,410	1,504

Appendix H.6 - Canister Storage (Base Case)

End of FY	SRS Cans Produced		SRS Cans in GWSB #1 (2,159 max)			SRS Cans in Modular Storage (1 building @ 585)			SRS Cans Shipped to Repository		Net Cans Stored At SRS
	Yearly	Cum.	Added	Shipped	Cum.	Added	Shipped	Cum.	Each Year	Cumulative	
2032	0	5,914		(205)	1,442	0	0	0	205	4,615	1,299
2033	0	5,914		(205)	1,237	0	0	0	205	4,820	1,094
2034	0	5,914		(205)	1,032	0	0	0	205	5,025	889
2035	0	5,914		(205)	827	0	0	0	205	5,230	684
2036	0	5,914		(205)	622	0	0	0	205	5,435	479
2037	0	5,914		(205)	417	0	0	0	205	5,640	274
2038	0	5,914		(205)	212	0	0	0	205	5,845	69
2039	0	5,914		(69)	143	0	0	0	69	5,914	0
2040	0	5,914			143			0	0	5,914	

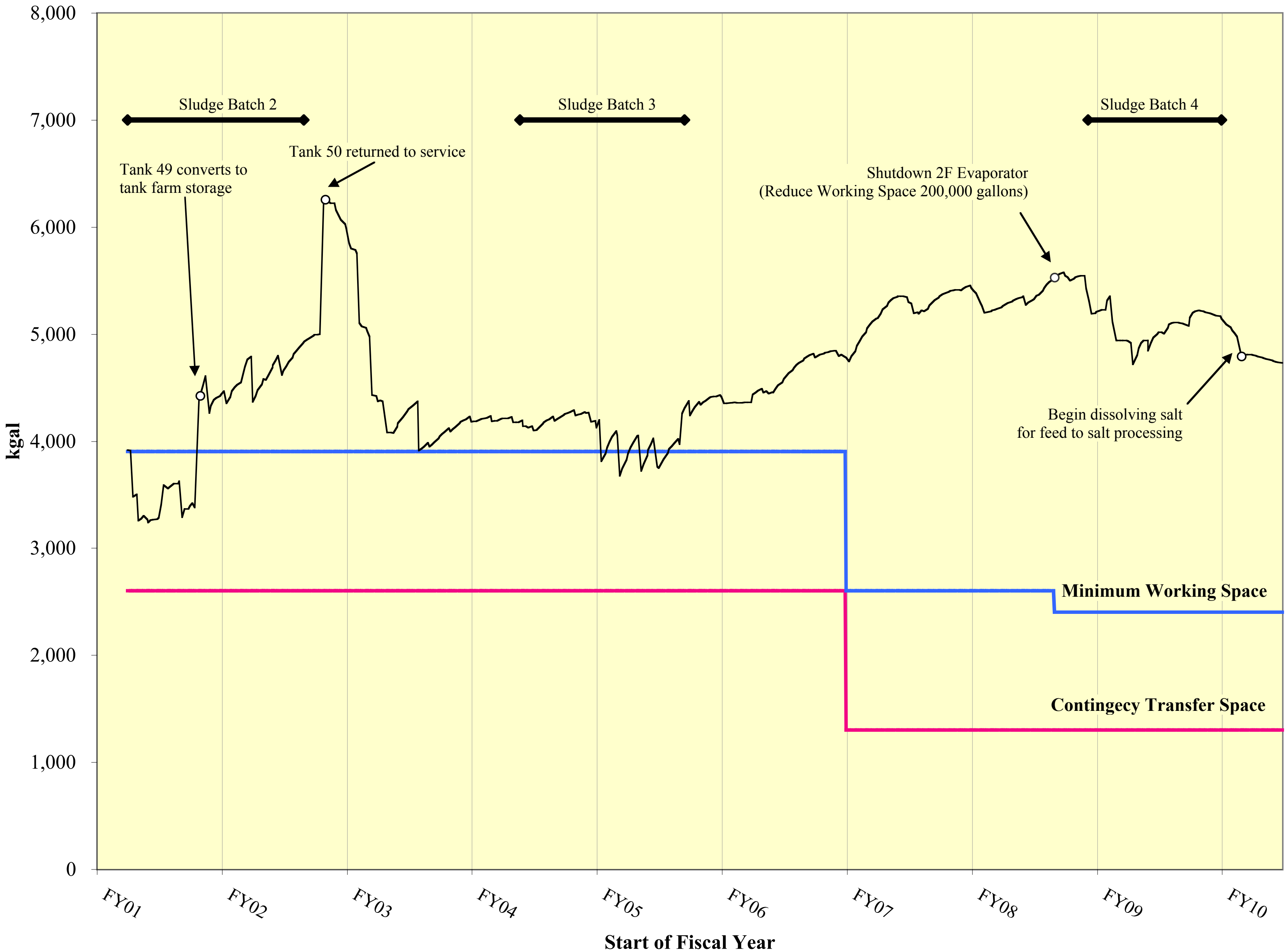
Notes:

1) GWSB #1 filling began in May 1996. Of its 2,286 canister storage locations, 5 positions store non-radioactive test canisters and 122 are unuseable with no viable repair technique. This yields a capacity of 2,159 usable storage locations, including 450 presently unusable location that require modification per an existing plan before they will be useable.
2) GWSB #1 is expected to reach maximum capacity in FY10.
3) Additional glass waste storage locations will be built as privatized modularized buildings, which will be $^{1}/_{4}$ of the size of GWSB #1. The first building, GWSB #2A, will be needed in 2010. Unless additional canisters are required to complete the program or shipments are delayed to the Federal Repository, this one modularized building should meet the programs needs.
4) This Plan assumes that canisters can be transported to the Federal Repository starting in FY10 at a rate of 105 canisters in FY10 and 205 canisters/yr thereafter, until the end of the program.
5) A canister load-out facility will be required to move the canisters from the GWSBs to a railcar. Assume one year for design (FY07) and three years for construction (FY08-10).
6) GWSB #1 will be emptied and available for D&D in FY39.
7) GWSB #2A will be emptied and available for D&D in FY29
8) This Plan does not include possible can-in-canister disposition of excess plutonium.
9) The Plan does not include additional locations in GWSB #2A for spent fuels materials. These materials could be added and included in these buildings, but would result in the overall need to build one additional privatized modularized building. As information becomes available on the needed locations for Spent Fuel material it will be added into the privatized proposal.

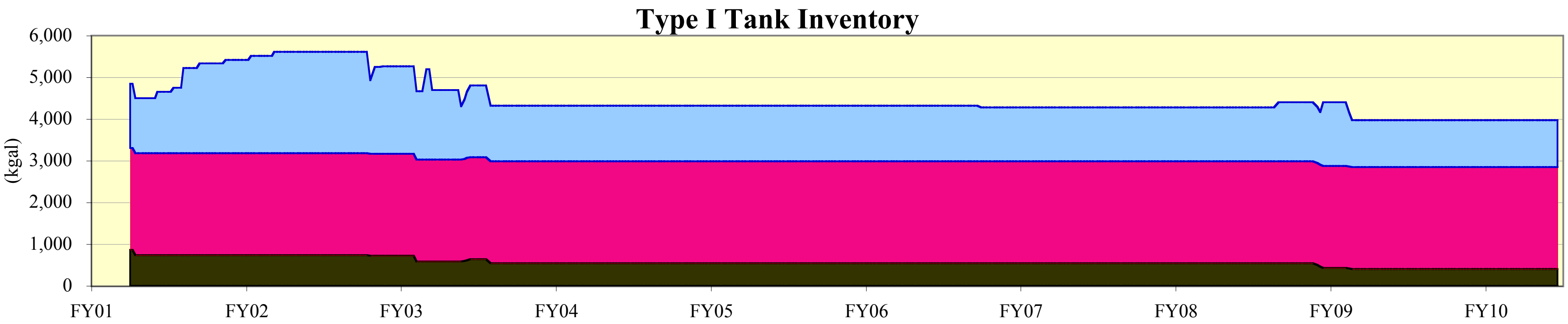
Appendix H.7 — Near Term Saltstone Operations (Base Case)

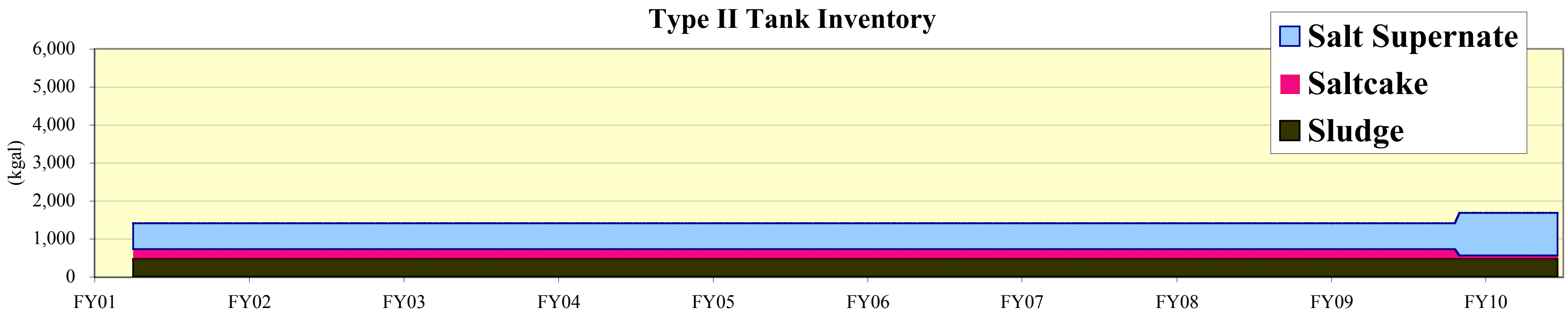
FY	Beginning of year Tk 50 Inventory (Kgal)	ETF Conc (Kgal)	Material Fed to Saltstone (Kgal)	End of year Tk 50 Inven. (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled	Active Vault #	Notes:
FY01	(as of 3/1/01) 482	355 (Includes 250 kgal moved from Tank 49)	0	837	0	3.50	---	3.5 cells already filled at the start of FY01. (3.0 cells in Vault 1 and 0.5 cells in Vault 4) Saltstone Facility in partial lay-up (not operating).
FY02	837	180	(1,017)	0	1,800	4.49	4	Saltstone Facility operates to de-inventory Tank 50. Tank 50 mods required for return to waste storage in FY02
FY03	0	180	(180)	0	319	4.67	4	Saltstone Facility operates as required to support ETF.
FY04	0	180	(180)	0	319	4.84	4	Saltstone Facility operates as required to support ETF.
FY05	0	180	(180)	0	319	5.02	4	Saltstone Facility operates as required to support ETF.
FY06	0	180	(180)	0	319	5.19	4	Saltstone Facility operates as required to support ETF.
FY07	0	180	(180)	0	319	5.37	4	Saltstone Facility operates as required to support ETF.
FY08	0	180	(180)	0	319	5.55	4	Saltstone Facility operates as required to support ETF.
FY09	0	180	(180)	0	319	5.72	4	Saltstone Facility operates as required to support ETF.

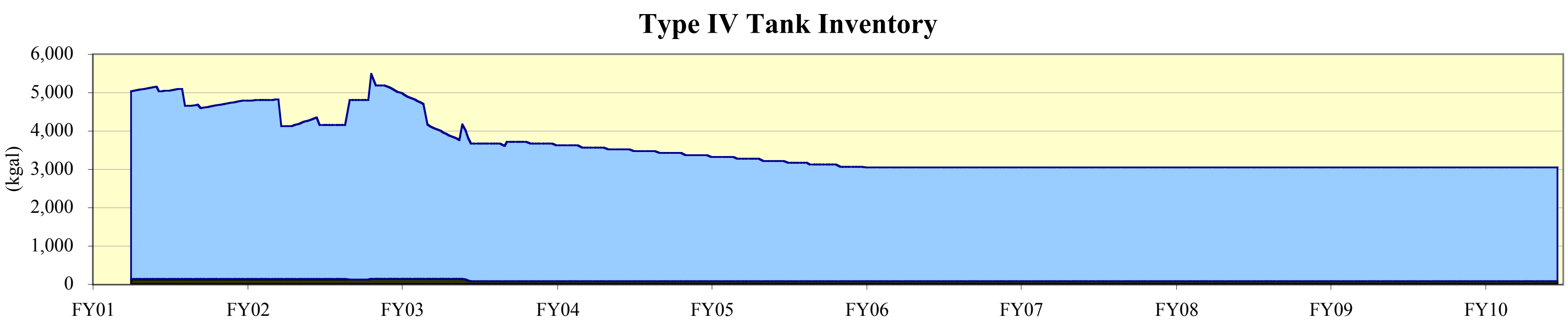
Appendix H.8 Useable Tank Space (Base Case)



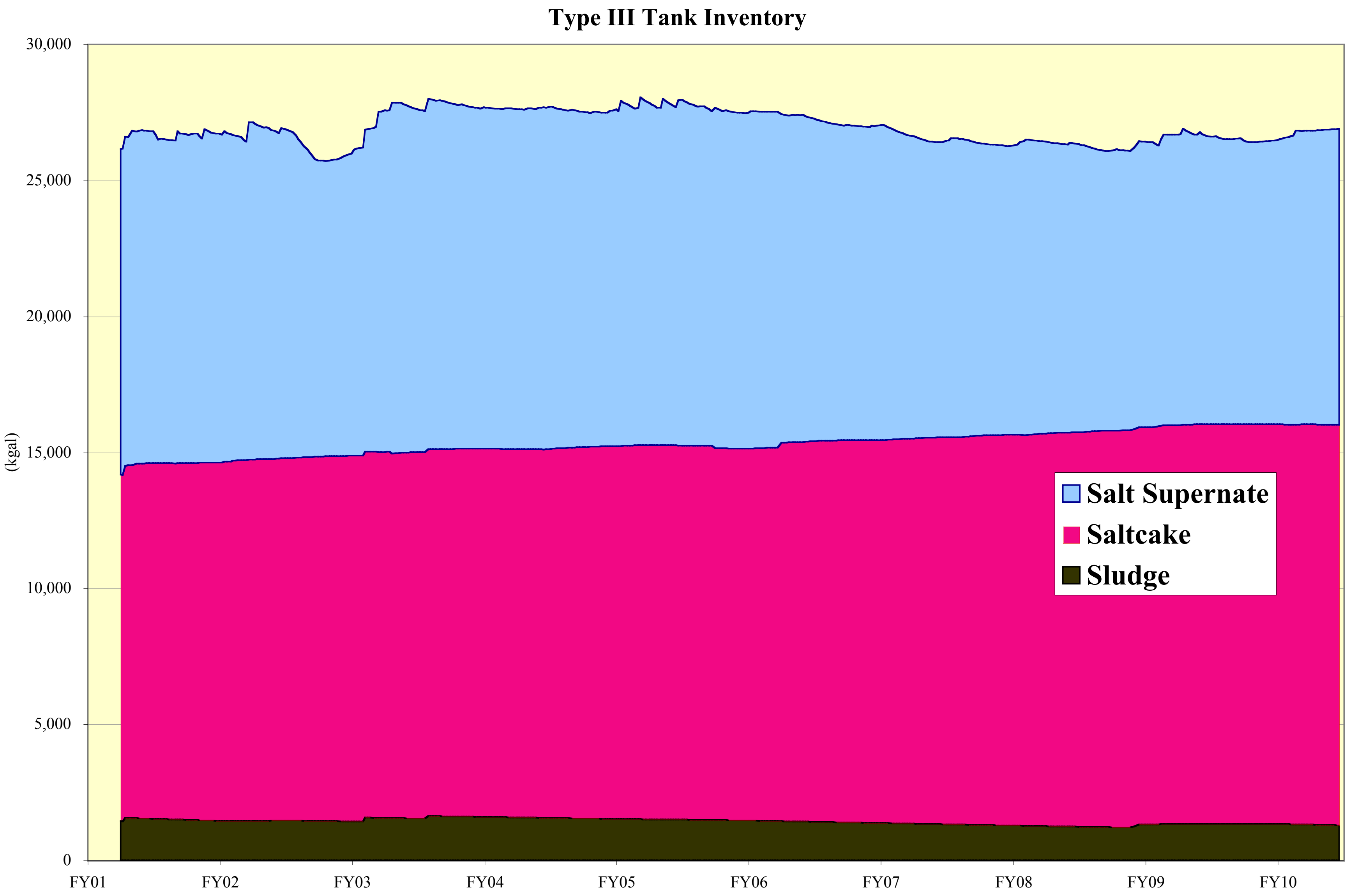
Appendix H.9 — Tank Inventory (Base Case)



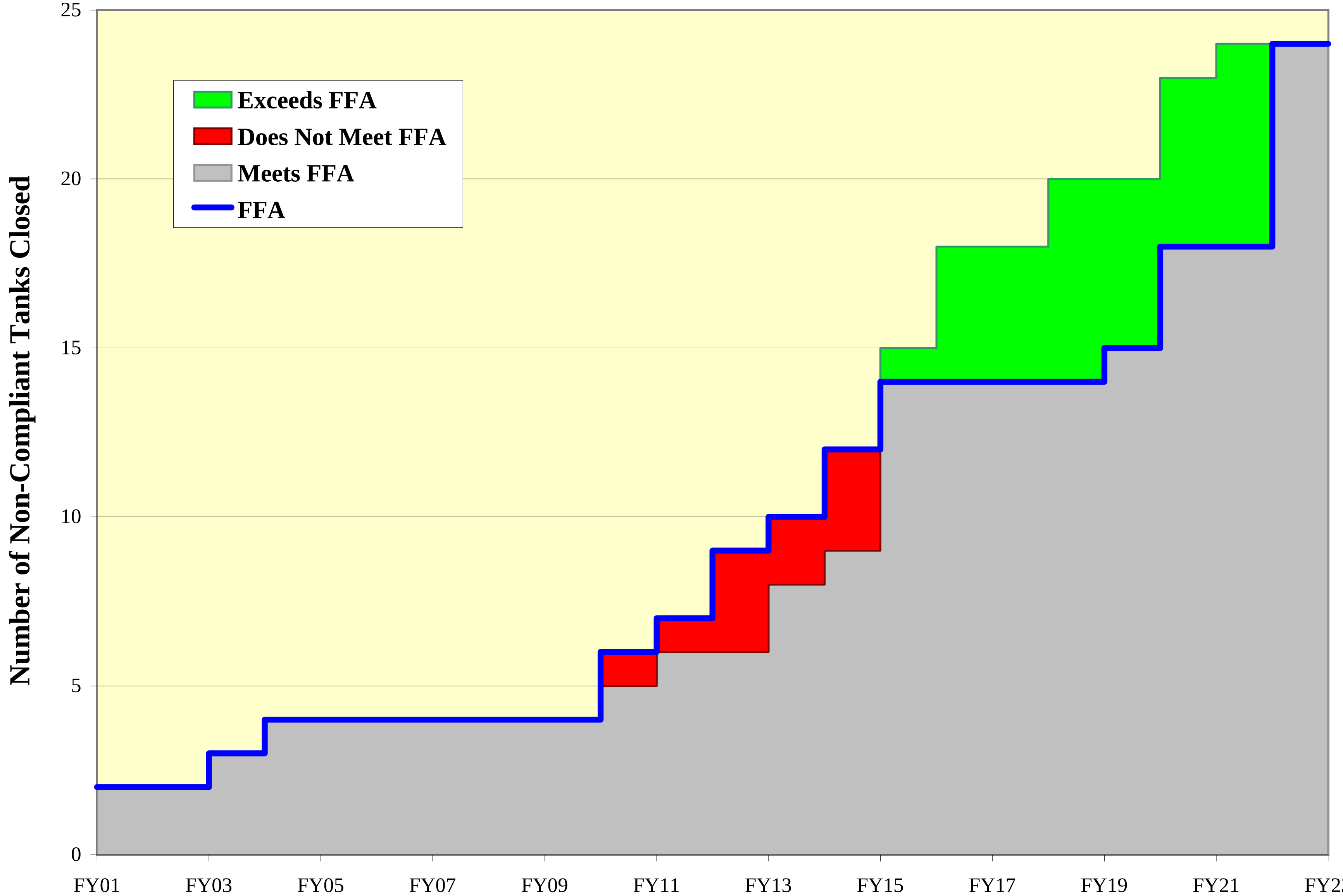




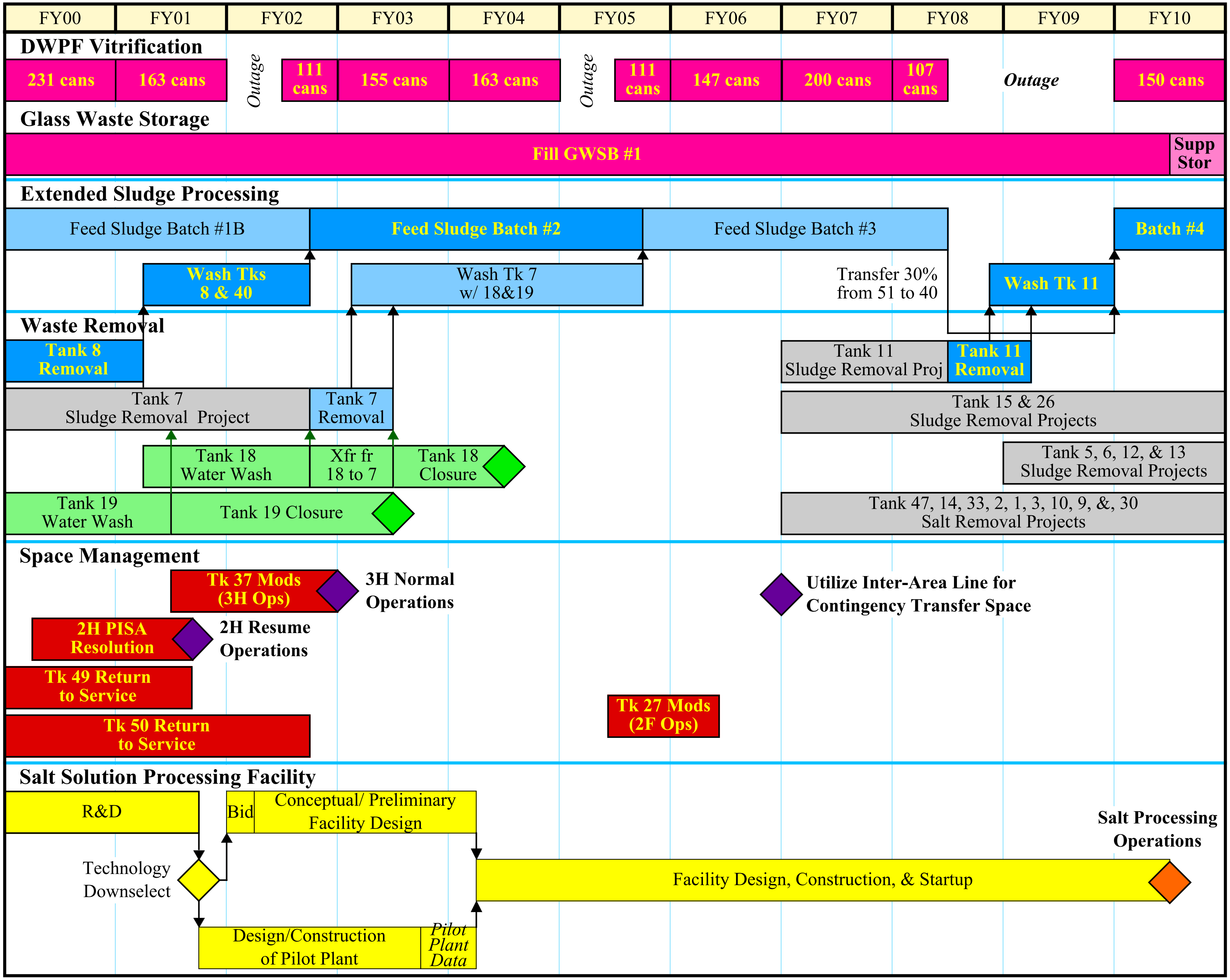
Appendix H.9 — Tank Inventory (Base Case)



Appendix H.10 - Tank Closures (Base Case)



Appendix H.11 - Level 1 Schedule (Base Case)



Appendix I
Stretch Case

Appendix I – Stretch Case

Appendix I provides the detailed production planning information for the Stretch Case. In the contract extension, WSRC committed to attempt to implement savings, which would be used to execute additional scope. DOE defined the additional scope requested and place incentives on these items. These scope items added to the Base Case becomes the second strategy — the Stretch Case — which:

1. Provides acceptable risk reduction for waste removal from "high risk" tanks,
2. Meets the Site Treatment Plan regulatory commitments,
3. Comes Close to meeting the Federal Facility Agreement regulatory commitments,
4. Starts salt processing activities by mid 2010, and
5. Processes an average of 225 canisters per year after salt processing becomes operational.

Key Milestone	Rev 12 Stretch Case
Total Number of Canisters Produced	5,914
DWPF Sludge Production (in average canisters per year)	
• FY01	220
• FY02	150
• FY03	210
• FY04	220
• FY05	150
• FY06	200
• FY07	Outage
• FY08	Outage
• FY09	Outage
• FY10	100
• FY11 to End of Program	230
Key Risk Reduction Dates	
Date when all "high risk" tanks are emptied	FY16
Date when all "non-compliant" tanks are emptied	FY17
Date when all "non-compliant" tanks are closed	FY20
Date Salt Processing Becomes Operational	FY10
Date by which salt processing is completed	FY22
Date by which sludge processing is completed	FY27
Regulatory Commitments	
Are all STP commitments met?	Yes
Are all FFA regulatory commitments met?	No
Estimated Life-Cycle Costs	
• Costs in escalated dollars ($ in billions)	$19.2
• Costs in constant 1999 dollars ($ in billions)	$12.9
Canister Storage Locations	
• Make additional 450 GWSB #1 locations usable	FY03-05
• Begin work on additional Canister Storage locations - 1 Privatized Module	FY11
• Place GWSB #2 or Privatized Modules into Radioactive Operations	FY13
Waste Removal	
• Tank 7 ready for sludge removal	7/02
• Tank 11 ready for sludge removal	4/08
• Tank 26 ready for sludge removal	1/11

Appendix I – Stretch Case

Key Milestone	Rev 12 Stretch Case
Tank Closures	
• Complete closure of Tank 19	4/03
• Complete closure of Tank 18	4/04
• Complete closure of 5th Tank	FY10
• Complete closure of 6th Tank	FY11
• Complete closure of 7th Tank	FY13
• Complete closure of 24th Tank	FY20
Key Space Management Activities	
• Reuse Tank 49 for waste storage	7/01
• Reuse Tank 50 for waste storage	9/02
• Tank 37 modification completed for 3H Evaporator Drop Tank	9/02
Repository Activities	
• Start shipping canisters to the Federal Repository	FY10
• Complete shipping canisters to Federal Repository	FY39
Facility Deactivation Complete	FY40

This appendix provides the following data: Funding Requirements, Waste Removal and Tank Closure Schedule, Material Balance, Salt Processing Batch makeup, Sludge Batch makeup, Canister Storage requirements, Near Term Saltstone Operations, Usable Tank Space estimates, an Inventory of the amound of waste in Types I, II, III, & IV tanks, a chart of Non-Compliant Tank Closures with respect to the FFA, and a Level 1 Schedule.

Appendix I.1 - Funding (Stretch Case)

Budget Authority in Escalated Dollars

Project Title	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09
HL-01 H Tank Farm											
H Tank Farm Operations	85,371	89,019	95,078	93,420	100,337	106,546	108,122	110,347	113,327	113,980	117,057
LI: Replacement Evaporator	12,835	3,567	-	-	-	-	-	-	-	-	-
HL-01 Total	**98,205**	**92,586**	**95,078**	**93,420**	**100,337**	**106,546**	**108,122**	**110,347**	**113,327**	**113,980**	**117,057**
HL-02 F Tank Farm	**58,928**	**60,993**	**59,966**	**63,928**	**68,328**	**70,471**	**71,464**	**74,184**	**76,187**	**73,509**	**75,493**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	1,108	3,824	3,169	3,311	3,552	3,673	-	-	4,038	4,059	4,168
WR: Tank Closure	124	350	16	3,113	4,745	1,653	-	-	8,712	8,757	391
HL-03 Total	**1,232**	**4,174**	**3,185**	**6,424**	**8,297**	**5,326**	**-**	**-**	**12,750**	**12,816**	**4,559**
HL-04 Feed Preparations & Sludge Operations	**53,328**	**52,037**	**50,722**	**56,097**	**62,734**	**66,549**	**70,173**	**69,739**	**71,622**	**72,071**	**74,017**
HL-05 Vitrification											
Vitrification Ops	127,626	116,698	111,727	126,400	132,185	133,344	141,166	146,986	145,944	150,235	155,255
Failed Equip. Storage Vaults	-	-	1,143	-	-	-	-	-	-	-	-
HL-05 Total	**127,626**	**116,698**	**112,870**	**126,400**	**132,185**	**133,344**	**141,166**	**146,986**	**145,944**	**150,235**	**155,255**
HL-06 Glass Waste Storage	**436**	**603**	**684**	**712**	**2,056**	**2,078**	**1,472**	**839**	**5,941**	**16,421**	**24,851**
HL-13 Salt Disposition											
Salt Disposition Ops	15,620	10,175	17,543	4,982	-	-	-	-	-	-	-
LI: Salt Alternative	-	-	-	29,465	84,345	135,123	150,278	150,768	150,895	143,752	98,761
HL-13 Total	**15,620**	**10,175**	**17,543**	**34,447**	**84,345**	**135,123**	**150,278**	**150,768**	**150,895**	**143,752**	**98,761**
HL-09 LI: Tk Fm Services Upgrade I	**1,632**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-10 LI: Storm Water Upgrades	**2,508**	**3,533**	**138.3381**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-11 LI: Tk Fm Services Upgrade II	**838**	**2,141**	**10,455**	**6,303**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-12 LI: Waste Removal											
LI: WR from Tanks	24,739	21,796	23,046	25,458	3,688	11,196	12,300	1,827	33,060	46,395	78,879
LI: Vit Upgrades	12	653	616	-	-	-	7,063	7,276	14,945	15,255	15,667
LI: Pipe, Evaps & Infrastructure	-	-	-	993	5,995	15,870	12,536	-	-	-	-
HL-12 Total	**24,751**	**22,449**	**23,662**	**26,452**	**9,683**	**27,066**	**31,899**	**9,103**	**48,005**	**61,651**	**94,546**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HLW TOTAL	**385,103**	**365,388**	**374,304**	**414,182**	**467,965**	**546,502**	**574,574**	**561,967**	**624,670**	**644,434**	**644,540**
HLW w/o Salt Total	**369,483**	**355,213**	**356,760**	**379,735**	**383,619**	**411,379**	**424,296**	**411,199**	**473,775**	**500,682**	**545,779**
Solid Waste Facilities											
ETF	16,510	15,098	16,115	17,302	18,705	20,455	22,088	23,838	20,579	23,997	20,586
SS	1,595	857	1,099	2,055	4,454	2,317	2,229	2,314	2,377	7,353	15,734
SW TOTAL	**18,105**	**15,955**	**17,214**	**19,356**	**23,159**	**22,772**	**24,317**	**26,152**	**22,956**	**31,351**	**36,321**
Life Cycle Cost	**403,208**	**381,344**	**391,518**	**433,538**	**491,123**	**569,274**	**598,891**	**588,119**	**647,626**	**675,785**	**680,861**

Appendix I.1 - Funding (Stretch Case)

Budget Authority in Escalated Dollars

Project Title	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
HL-01 H Tank Farm											
H Tank Farm Operations	119,449	121,885	125,176	126,890	130,316	132,077	130,807	134,339	132,865	133,522	130,107
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**119,449**	**121,885**	**125,176**	**126,890**	**130,316**	**132,077**	**130,807**	**134,339**	**132,865**	**133,522**	**130,107**
HL-02 F Tank Farm	**77,532**	**79,625**	**81,775**	**83,983**	**85,395**	**83,308**	**83,179**	**74,895**	**75,360**	**77,395**	**76,200**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	13,689	25,357	23,265	13,911	14,287	14,673	15,069	15,476	5,298	5,441	5,588
WR: Tank Closure	16,677	1,262	10,845	11,870	53,794	68,725	33,204	56,055	25,896	52,498	73,618
HL-03 Total	**30,366**	**26,619**	**34,109**	**25,781**	**68,081**	**83,398**	**48,273**	**71,530**	**31,194**	**57,938**	**79,205**
HL-04 Feed Preparations & Sludge Operations	**76,015**	**68,871**	**70,731**	**72,640**	**74,602**	**76,616**	**78,685**	**80,809**	**82,991**	**85,232**	**87,533**
HL-05 Vitrification											
Vitrification Ops	160,620	160,312	168,042	175,531	172,995	182,082	189,295	193,042	193,907	202,727	215,510
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**160,620**	**160,312**	**168,042**	**175,531**	**172,995**	**182,082**	**189,295**	**193,042**	**193,907**	**202,727**	**215,510**
HL-06 Glass Waste Storage	**10,030**	**1,876**	**1,927**	**7,844**	**8,101**	**8,366**	**8,640**	**8,923**	**9,216**	**9,518**	**9,830**
HL-13 Salt Disposition											
Salt Disposition Ops	45,821	79,791	84,288	86,322	80,006	82,458	83,648	97,864	101,945	104,750	108,222
LI: Salt Alternative	57,843	-	-	-	-	45,370	62,127	47,853	-	-	-
HL-13 Total	**103,664**	**79,791**	**84,288**	**86,322**	**80,006**	**127,829**	**145,775**	**145,718**	**101,945**	**104,750**	**108,222**
HL-09 LI: Tk Fm Services Upgrade I	-	-	-	-	-	-	-	-	-	-	-
HL-10 LI: Storm Water Upgrades	-	-	-	-	-	-	-	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	-	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	79,058	87,912	69,532	71,273	88,983	73,598	87,587	99,917	83,321	71,891	37,161
LI: Vit Upgrades	28,158	18,590	12,728	19,608	20,137	20,681	14,160	14,542	-	-	-
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	**107,216**	**106,502**	**82,260**	**90,881**	**109,120**	**94,278**	**101,746**	**114,459**	**83,321**	**71,891**	**37,161**
FA-24 Facility Decontamination/Decommissioning	-	-	-	-	-	**43,183**	**36,285**	-	-	-	-
HLW TOTAL	**684,891**	**645,482**	**648,307**	**669,872**	**728,616**	**831,137**	**822,685**	**823,716**	**710,799**	**742,974**	**743,768**
HLW w/o Salt Total	**581,228**	**565,690**	**564,019**	**583,550**	**648,611**	**703,308**	**676,910**	**677,998**	**608,854**	**638,224**	**635,546**
Solid Waste Facilities											
ETF	21,843	21,875	25,438	32,919	25,062	25,243	30,249	25,667	32,191	27,072	28,746
SS	24,306	35,875	53,592	42,606	39,905	55,953	56,416	52,257	61,883	62,422	69,203
SW TOTAL	**46,150**	**57,751**	**79,030**	**75,525**	**64,967**	**81,196**	**86,664**	**77,924**	**94,074**	**89,494**	**97,949**
Life Cycle Cost	**731,041**	**703,232**	**727,337**	**745,397**	**793,584**	**912,333**	**909,350**	**901,640**	**804,873**	**832,468**	**841,717**

Appendix I.1 - Funding (Stretch Case)

Budget Authority in Escalated Dollars

Project Title	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
HL-01 H Tank Farm											
H Tank Farm Operations	131,934	135,496	135,599	137,435	135,521	77,245	79,331	54,085	-	-	-
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**131,934**	**135,496**	**135,599**	**137,435**	**135,521**	**77,245**	**79,331**	**54,085**	**-**	**-**	**-**
HL-02 F Tank Farm	**49,586**	**28,415**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	5,739	-	-	-	-	-	-	-	-	-	-
WR: Tank Closure	56,324	33,610	28,025	39,253	79,511	75,545	31,596	37,813	1,622	-	-
HL-03 Total	**62,063**	**33,610**	**28,025**	**39,253**	**79,511**	**75,545**	**31,596**	**37,813**	**1,622**	**-**	**-**
HL-04 Feed Preparations & Sludge Operations	**89,896**	**92,323**	**47,408**	**48,688**	**50,003**	**51,353**	**7,911**	**-**	**-**	**-**	**-**
HL-05 Vitrification											
Vitrification Ops	210,093	219,342	227,868	226,638	223,911	226,014	34,258	-	-	-	-
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**210,093**	**219,342**	**227,868**	**226,638**	**223,911**	**226,014**	**34,258**	**-**	**-**	**-**	**-**
HL-06 Glass Waste Storage	**10,153**	**10,486**	**10,831**	**11,186**	**11,554**	**11,934**	**12,326**	**3,320**	**3,031**	**3,113**	**3,197**
HL-13 Salt Disposition											
Salt Disposition Ops	110,447	107,014	11,141	-	-	-	-	-	-	-	-
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	-	-
HL-13 Total	**110,447**	**107,014**	**11,141**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-09 LI: Tk Fm Services Upgrade I	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-10 LI: Storm Water Upgrades	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-11 LI: Tk Fm Services Upgrade II	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-12 LI: Waste Removal											
LI: WR from Tanks	16,201	12,572	19,883	14,803	16,540	3,648	10,653	4,478	-	-	-
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	-	-
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	**16,201**	**12,572**	**19,883**	**14,803**	**16,540**	**3,648**	**10,653**	**4,478**	**-**	**-**	**-**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**-**	**-**	**-**	**218,584**	**256,231**	**-**	**-**	**-**
HLW TOTAL	**680,374**	**639,259**	**480,754**	**478,003**	**517,040**	**445,739**	**394,660**	**355,928**	**4,653**	**3,113**	**3,197**
HLW w/o Salt Total	**569,926**	**532,245**	**469,613**	**478,003**	**517,040**	**445,739**	**394,660**	**355,928**	**4,653**	**3,113**	**3,197**
Solid Waste Facilities											
ETF	40,738	31,015	30,116	30,929	31,764	32,622	5,025	-	-	-	-
SS	46,219	30,205	7,016	7,205	7,400	7,601	4,970	528	-	-	-
SW TOTAL	**86,957**	**61,220**	**37,132**	**38,134**	**39,164**	**40,223**	**9,996**	**528**	**-**	**-**	**-**
Life Cycle Cost	**767,331**	**700,479**	**517,886**	**516,138**	**556,204**	**485,962**	**404,655**	**356,455**	**4,653**	**3,113**	**3,197**

Appendix I.1 - Funding (Stretch Case)

Budget Authority in Escalated Dollars

Project Title	FY32	FY33	FY34	FY35	FY36	FY37	FY38	FY39	FY40	Cumulative FY99-End
HL-01 H Tank Farm										
H Tank Farm Operations	-	-	-	-	-	-	-	-	-	3,436,682
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	16,402
HL-01 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3,453,083**
HL-02 F Tank Farm	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,710,098**
HL-03 Waste Removal & Tank Closures										
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	-	-	188,693
WR: Tank Closure	-	-	-	-	-	-	-	-	-	815,603
HL-03 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,004,297**
HL-04 Feed Preparations & Sludge Operations	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,941,395**
HL-05 Vitrification										
Vitrification Ops	-	-	-	-	-	-	-	-	-	4,869,753
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	1,143
HL-05 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4,870,896**
HL-06 Glass Waste Storage	**3,283**	**3,372**	**3,463**	**3,556**	**3,652**	**3,751**	**3,852**	**3,956**		**260,383**
HL-13 Salt Disposition										
Salt Disposition Ops	-	-	-	-	-	-	-	-	-	1,232,038
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	1,156,583
HL-13 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2,388,621**
HL-09 LI: Tk Fm Services Upgrade I	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,632**
HL-10 LI: Storm Water Upgrades	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**6,179**
HL-11 LI: Tk Fm Services Upgrade II	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**19,737**
HL-12 LI: Waste Removal										
LI: WR from Tanks	-	-	-	-	-	-	-	-	-	1,231,395
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	210,090
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	35,394
HL-12 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,476,880**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**18,112**	**-**	**572,395**
HLW TOTAL	**3,283**	**3,372**	**3,463**	**3,556**	**3,652**	**3,751**	**3,852**	**22,069**	**-**	**17,705,595**
HLW w/o Salt Total	**3,283**	**3,372**	**3,463**	**3,556**	**3,652**	**3,751**	**3,852**	**22,069**	**-**	**15,316,974**
Solid Waste Facilities										
ETF	-	-	-	-	-	-	-	-	-	713,789
SS	-	-	-	-	-	-	-	-	-	707,946
SW TOTAL	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,421,735**
Life Cycle Cost	**3,283**	**3,372**	**3,463**	**3,556**	**3,652**	**3,751**	**3,852**	**22,069**	**-**	**19,127,330**

Appendix I.1 - Funding (Stretch Case)

Budget Authority in Constant FY99 Year Dollars

Project Title	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09
HL-01 H Tank Farm											
H Tank Farm Operations	85,371	85,926	88,585	84,752	88,634	91,644	90,555	89,989	89,989	88,128	88,128
LI: Replacement Evaporator	12,835	3,443	-	-	-	-	-	-	-	-	-
HL-01 Total	**98,205**	**89,369**	**88,585**	**84,752**	**88,634**	**91,644**	**90,555**	**89,989**	**89,989**	**88,128**	**88,128**
HL-02 F Tank Farm	**58,928**	**58,873**	**55,871**	**57,996**	**60,359**	**60,615**	**59,853**	**60,497**	**60,497**	**56,836**	**56,836**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	1,108	3,691	2,953	3,004	3,138	3,159	-	-	3,206	3,138	3,138
WR: Tank Closure	124	338	15	2,824	4,191	1,422	-	-	6,918	6,771	294
HL-03 Total	**1,232**	**4,029**	**2,967**	**5,828**	**7,329**	**4,581**	**-**	**-**	**10,124**	**9,909**	**3,432**
HL-04 Feed Preparations & Sludge Operations	**53,328**	**50,229**	**47,258**	**50,892**	**55,417**	**57,241**	**58,771**	**56,873**	**56,873**	**55,724**	**55,724**
HL-05 Vitrification											
Vitrification Ops	127,626	112,643	104,097	114,672	116,767	114,695	118,230	119,869	115,889	116,161	116,886
Failed Equip. Storage Vaults	-	-	1,065	-	-	-	-	-	-	-	-
HL-05 Total	**127,626**	**112,643**	**105,162**	**114,672**	**116,767**	**114,695**	**118,230**	**119,869**	**115,889**	**116,161**	**116,886**
HL-06 Glass Waste Storage	**436**	**582**	**637**	**646**	**1,816**	**1,787**	**1,233**	**684**	**4,718**	**12,696**	**18,710**
HL-13 Salt Disposition											
Salt Disposition Ops	15,620	9,822	16,345	4,520	-	-	-	-	-	-	-
LI: Salt Alternative	-	-	-	26,731	74,508	116,225	125,862	122,953	119,821	111,148	74,354
HL-13 Total	**15,620**	**9,822**	**16,345**	**31,251**	**74,508**	**116,225**	**125,862**	**122,953**	**119,821**	**111,148**	**74,354**
HL-09 LI: Tk Fm Services Upgrade I	**1,632**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-10 LI: Storm Water Upgrades	**2,508**	**3,410**	**128.8910**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-11 LI: Tk Fm Services Upgrade II	**838**	**2,066**	**9,741**	**5,718**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-12 LI: Waste Removal											
LI: WR from Tanks	24,739	21,039	21,472	23,096	3,258	9,630	10,302	1,490	26,252	35,873	59,385
LI: Vit Upgrades	12	630	574	-	-	-	5,915	5,934	11,867	11,795	11,795
LI: Pipe, Evaps & Infrastructure	-	-	-	901	5,296	13,651	10,499	-	-	-	-
HL-12 Total	**24,751**	**21,669**	**22,046**	**23,997**	**8,553**	**23,281**	**26,716**	**7,423**	**38,119**	**47,668**	**71,180**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HLW TOTAL	**385,103**	**352,692**	**348,742**	**375,752**	**413,383**	**470,069**	**481,221**	**458,288**	**496,031**	**498,272**	**485,252**
HLW w/o Salt Total	**369,483**	**342,870**	**332,397**	**344,501**	**338,875**	**353,843**	**355,359**	**335,336**	**376,210**	**387,123**	**410,898**
Solid Waste Facilities											
ETF	16,510	14,574	15,015	15,696	16,523	17,594	18,500	19,440	16,341	18,555	15,499
SS	1,595	827	1,024	1,864	3,935	1,993	1,867	1,887	1,887	5,686	11,846
SW TOTAL	**18,105**	**15,401**	**16,039**	**17,560**	**20,458**	**19,587**	**20,366**	**21,327**	**18,228**	**24,240**	**27,344**
Life Cycle Cost	**403,208**	**368,093**	**364,781**	**393,312**	**433,841**	**489,656**	**501,587**	**479,616**	**514,259**	**522,512**	**512,596**

Appendix I.1 - Funding (Stretch Case)

Budget Authority in Constant FY99 Year Dollars

Project Title	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
HL-01 H Tank Farm											
H Tank Farm Operations	87,565	87,001	87,001	85,874	85,874	84,747	81,725	81,725	78,703	77,013	73,070
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**87,565**	**87,001**	**87,001**	**85,874**	**85,874**	**84,747**	**81,725**	**81,725**	**78,703**	**77,013**	**73,070**
HL-02 F Tank Farm	**56,836**	**56,836**	**56,836**	**56,836**	**56,273**	**53,454**	**51,968**	**45,563**	**44,640**	**44,640**	**42,796**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	10,035	18,100	16,170	9,415	9,415	9,415	9,415	9,415	3,138	3,138	3,138
WR: Tank Closure	12,225	901	7,537	8,033	35,449	44,097	20,745	34,101	15,340	30,280	41,345
HL-03 Total	**22,260**	**19,001**	**23,707**	**17,448**	**44,863**	**53,512**	**30,160**	**43,516**	**18,478**	**33,418**	**44,483**
HL-04 Feed Preparations & Sludge Operations	**55,724**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**
HL-05 Vitrification											
Vitrification Ops	117,746	114,431	116,795	118,792	113,998	116,832	118,267	117,437	114,862	116,929	121,034
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**117,746**	**114,431**	**116,795**	**118,792**	**113,998**	**116,832**	**118,267**	**117,437**	**114,862**	**116,929**	**121,034**
HL-06 Glass Waste Storage	**7,353**	**1,339**	**1,339**	**5,309**	**5,338**	**5,368**	**5,398**	**5,429**	**5,459**	**5,490**	**5,521**
HL-13 Salt Disposition											
Salt Disposition Ops	33,590	56,955	58,583	58,419	52,721	52,909	52,261	59,536	60,388	60,418	60,780
LI: Salt Alternative	42,403	-	-	-	-	29,112	38,816	29,112	-	-	-
HL-13 Total	**75,993**	**56,955**	**58,583**	**58,419**	**52,721**	**82,021**	**91,077**	**88,647**	**60,388**	**60,418**	**60,780**
HL-09 LI: Tk Fm Services Upgrade I	-	-	-	-	-	-	-	-	-	-	-
HL-10 LI: Storm Water Upgrades	-	-	-	-	-	-	-	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	-	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	57,955	62,751	48,327	48,235	58,637	47,223	54,722	60,785	49,355	41,466	20,870
LI: Vit Upgrades	20,642	13,270	8,847	13,270	13,270	13,270	8,847	8,847	-	-	-
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	**78,597**	**76,021**	**57,173**	**61,504**	**71,907**	**60,493**	**63,568**	**69,631**	**49,355**	**41,466**	**20,870**
FA-24 Facility Decontamination/Decommissioning	-	-	-	-	-	**27,708**	**22,670**	-	-	-	-
HLW TOTAL	**502,075**	**460,744**	**450,595**	**453,343**	**480,135**	**533,294**	**513,993**	**501,107**	**421,046**	**428,535**	**417,714**
HLW w/o Salt Total	**426,082**	**403,789**	**392,012**	**394,924**	**427,414**	**451,274**	**422,917**	**412,460**	**360,658**	**368,117**	**356,935**
Solid Waste Facilities											
ETF	16,013	15,614	17,680	22,278	16,515	16,197	18,899	15,614	19,069	15,614	16,144
SS	17,818	25,608	37,248	28,834	26,296	35,902	35,247	31,791	36,657	36,004	38,866
SW TOTAL	**33,831**	**41,222**	**54,928**	**51,112**	**42,811**	**52,099**	**54,146**	**47,405**	**55,725**	**51,619**	**55,010**
Life Cycle Cost	**535,906**	**501,967**	**505,523**	**504,456**	**522,947**	**585,393**	**568,139**	**548,512**	**476,772**	**480,153**	**472,724**

Appendix I.1 - Funding (Stretch Case)

Budget Authority in Constant FY99 Year Dollars

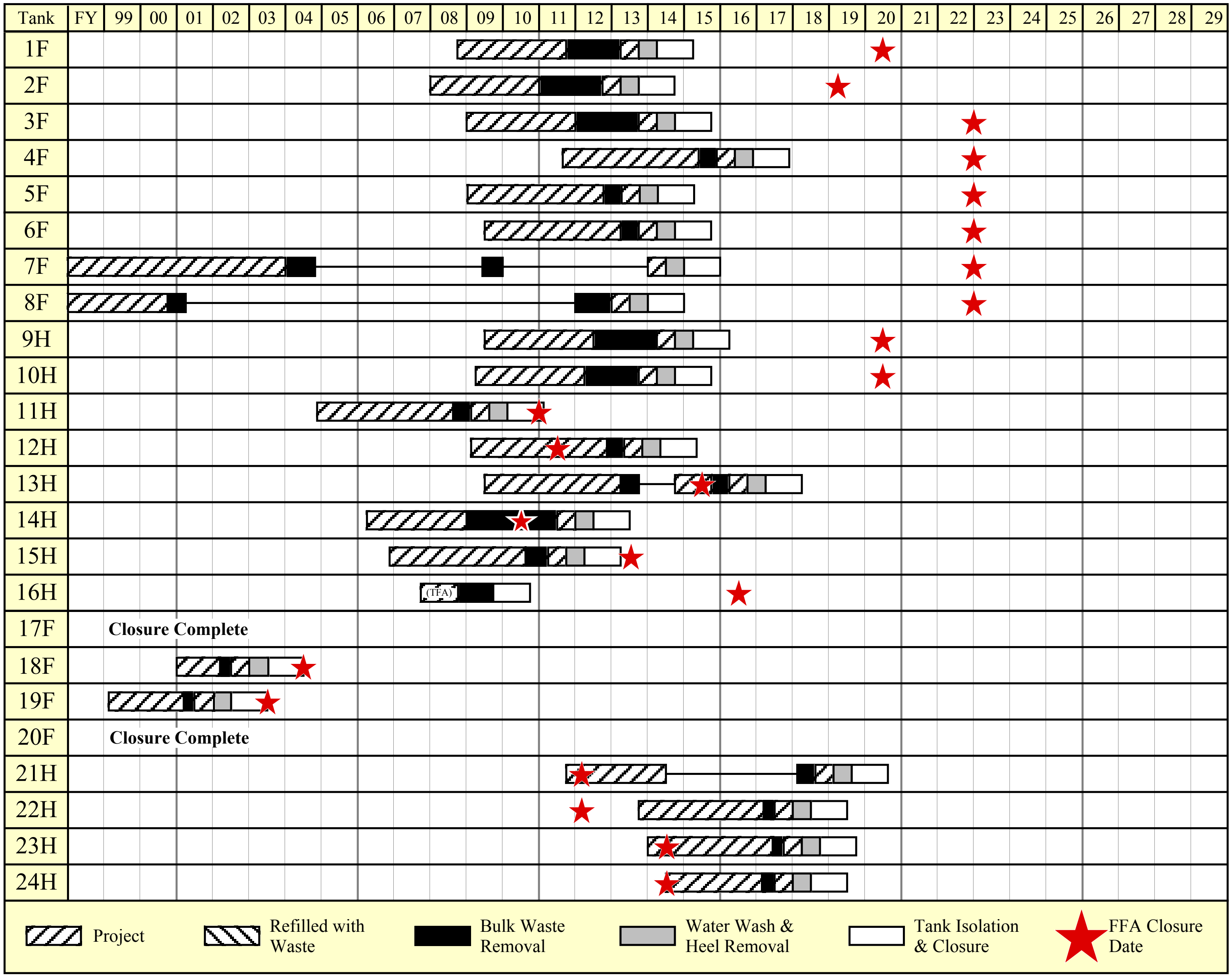
Project Title	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
HL-01 H Tank Farm											
H Tank Farm Operations	72,149	72,149	70,305	69,384	66,619	36,974	36,974	24,544	-	-	-
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**72,149**	**72,149**	**70,305**	**69,384**	**66,619**	**36,974**	**36,974**	**24,544**	**-**	**-**	**-**
HL-02 F Tank Farm	**27,116**	**15,130**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	3,138	-	-	-	-	-	-	-	-	-	-
WR: Tank Closure	30,801	17,897	14,530	19,817	39,086	36,160	14,726	17,160	-	-	-
HL-03 Total	**33,939**	**17,897**	**14,530**	**19,817**	**39,086**	**36,160**	**14,726**	**17,160**	**717**	**-**	**-**
HL-04 Feed Preparations & Sludge Operations	**49,160**	**49,160**	**24,580**	**24,580**	**24,580**	**24,580**	**3,687**	**-**	**-**	**-**	**-**
HL-05 Vitrification											
Vitrification Ops	114,890	116,795	118,144	114,418	110,069	108,182	15,967	-	-	-	-
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**114,890**	**116,795**	**118,144**	**114,418**	**110,069**	**108,182**	**15,967**	**-**	**-**	**-**	**-**
HL-06 Glass Waste Storage	**5,552**	**5,584**	**5,615**	**5,647**	**5,680**	**5,712**	**5,745**	**1,507**	**1,339**	**1,339**	**1,339**
HL-13 Salt Disposition											
Salt Disposition Ops	60,399	56,982	5,776	-	-	-	-	-	-	-	-
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	-	-
HL-13 Total	**60,399**	**56,982**	**5,776**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-09 LI: Tk Fm Services Upgrade I	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-10 LI: Storm Water Upgrades	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-11 LI: Tk Fm Services Upgrade II	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-12 LI: Waste Removal											
LI: WR from Tanks	8,860	6,694	10,309	7,473	8,131	1,746	4,965	2,032	-	-	-
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	-	-
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	**8,860**	**6,694**	**10,309**	**7,473**	**8,131**	**1,746**	**4,965**	**2,032**	**-**	**-**	**-**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**-**	**-**	**-**	**101,875**	**116,281**	**-**	**-**	**-**
HLW TOTAL	**372,065**	**340,391**	**249,261**	**241,319**	**254,164**	**213,354**	**183,938**	**161,525**	**2,056**	**1,339**	**1,339**
HLW w/o Salt Total	**311,667**	**283,408**	**243,484**	**241,319**	**254,164**	**213,354**	**183,938**	**161,525**	**2,056**	**1,339**	**1,339**
Solid Waste Facilities											
ETF	22,278	16,515	15,614	15,614	15,614	15,614	2,342	-	-	-	-
SS	25,275	16,083	3,638	3,638	3,638	3,638	2,316	239	-	-	-
SW TOTAL	**47,553**	**32,598**	**19,252**	**19,252**	**19,252**	**19,253**	**4,659**	**239**	**-**	**-**	**-**
Life Cycle Cost	**419,618**	**372,989**	**268,513**	**260,571**	**273,416**	**232,606**	**188,597**	**161,765**	**2,056**	**1,339**	**1,339**

Appendix I.1 - Funding (Stretch Case)

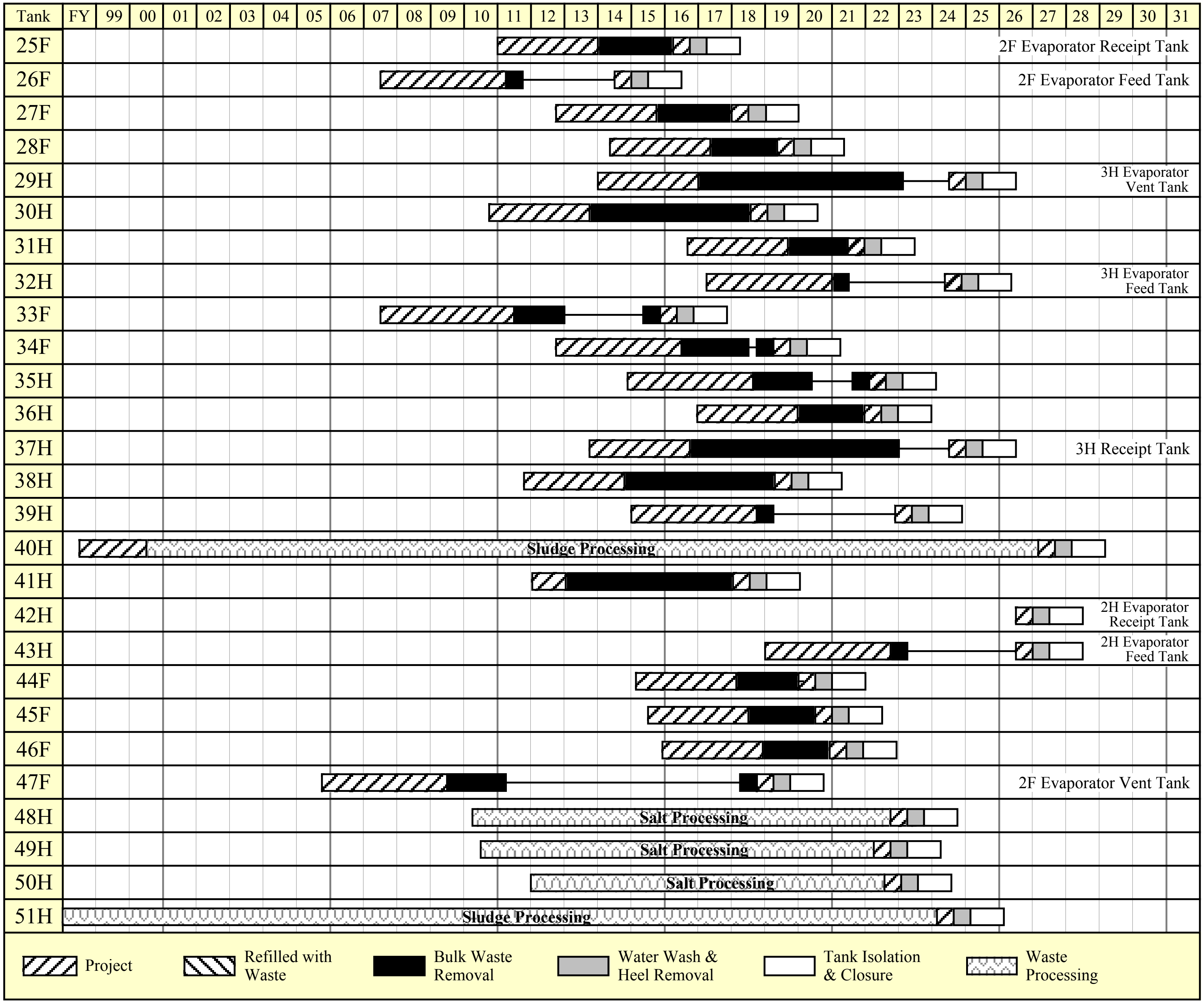
Budget Authority in Constant FY99 Year Dollars

Project Title	FY32	FY33	FY34	FY35	FY36	FY37	FY38	FY39	FY40	Cumulative FY99-End
HL-01 H Tank Farm										
H Tank Farm Operations	-	-	-	-	-	-	-	-	-	2,331,097
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	16,278
HL-01 Total	-	-	-	-	-	-	-	-	-	**2,347,375**
HL-02 F Tank Farm	-	-	-	-	-	-	-	-	-	**1,256,087**
HL-03 Waste Removal & Tank Closures										
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	-	-	130,466
WR: Tank Closure	-	-	-	-	-	-	-	-	-	463,127
HL-03 Total	-	-	-	-	-	-	-	-	-	**594,309**
HL-04 Feed Preparations & Sludge Operations	-	-	-	-	-	-	-	-	-	**1,345,986**
HL-05 Vitrification										
Vitrification Ops	-	-	-	-	-	-	-	-	-	3,263,123
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	1,065
HL-05 Total	-	-	-	-	-	-	-	-	-	**3,264,188**
HL-06 Glass Waste Storage	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	-	**153,063**
HL-13 Salt Disposition										
Salt Disposition Ops	-	-	-	-	-	-	-	-	-	776,023
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	911,044
HL-13 Total	-	-	-	-	-	-	-	-	-	**1,687,067**
HL-09 LI: Tk Fm Services Upgrade I	-	-	-	-	-	-	-	-	-	**1,632**
HL-10 LI: Storm Water Upgrades	-	-	-	-	-	-	-	-	-	**6,047**
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	-	-	**18,364**
HL-12 LI: Waste Removal										
LI: WR from Tanks	-	-	-	-	-	-	-	-	-	837,072
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	148,783
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	30,347
HL-12 Total	-	-	-	-	-	-	-	-	-	**1,016,202**
FA-24 Facility Decontamination/Decommissioning	-	-	-	-	-	-	-	**6,132**	-	**274,666**
HLW TOTAL	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**7,471**	-	**11,964,985**
HLW w/o Salt Total	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**7,471**	-	**10,277,918**
Solid Waste Facilities										
ETF	-	-	-	-	-	-	-	-	-	477,477
SS	-	-	-	-	-	-	-	-	-	443,146
SW TOTAL	-	-	-	-	-	-	-	-	-	**920,624**
Life Cycle Cost	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**1,339**	**7,471**	-	**12,885,608**

Appendix I.2 Waste Removal Schedule (Stretch Case)



Appendix I.2 Waste Removal Schedule (Stretch Case)



Appendix I.3 - Material Balance (Stretch Case)

End of Month/Year	Influents (gallons)											Effluents (gallons)							Net-Out
	F Canyon			H Canyon								Space Recovery from Evaporation							
	LHW	HHW	F-Can Total	LHW	HHW	H-Can Total	DWPF Recycle	Other	Inhibited Water	Jet Dilution	Total In	2F Evaps	2H Evaps	3H Evaps	Total	Salt Solution to Processing	Sludge to ESP/DWPF	Tot-Out	
Oct 2000	0	32,924	**32,924**	1,650	12,285	**13,935**	144,715	50,026	62,222	12,440		105,434	-	113,303	**218,737**	-	19,656	**Actuals**	**(see Note 2)**
Nov 2000	0	16,883	**16,883**	0	17,800	**17,800**	119,758	11,356	83,278	56,760		1,089	-	(16,111)	**(15,022)**	-	21,762	**Actuals**	**(see Note 2)**
Dec 2000	0	49,491	**49,491**	1,439	21,376	**22,815**	115,928	31,692	0	14,560		(20,849)	-	(9,442)	**(30,291)**	-	15,795	**Actuals**	**(see Note 2)**
Jan 2001	28,500	20,625	**49,125**	3,828	11,025	**14,853**	70,320	16,875	113,410	13,207	**277,790**	72,376	-	34,507	**106,883**	-	8,635	**115,518**	**(162,272)**
Feb 2001	30,000	28,500	**58,500**	5,104	14,700	**19,804**	93,760	22,500	260,091	36,630	**491,285**	101,602	-	39,677	**141,280**	-	13,384	**154,664**	**(336,621)**
Mar 2001	28,000	25,500	**53,500**	5,104	15,220	**20,324**	79,567	22,500	-	54,625	**230,516**	125,909	-	-	**125,909**	-	12,220	**138,129**	**(92,387)**
Apr 2001	30,000	27,500	**57,500**	15,104	15,220	**30,324**	53,045	22,500	30,000	42,580	**235,949**	170,338	-	180,890	**351,228**	-	13,384	**364,612**	**128,663**
May 2001	25,000	28,500	**53,500**	25,104	15,220	**40,324**	32,687	22,500	10,000	39,745	**198,756**	166,684	-	-	**166,684**	-	13,088	**179,772**	**(18,984)**
Jun 2001	18,000	25,500	**43,500**	5,104	15,220	**20,324**	73,402	22,500	460,000	47,113	**666,840**	167,098	-	164,206	**331,304**	-	13,384	**344,688**	**(322,152)**
Jul 2001	15,000	27,500	**42,500**	5,104	15,220	**20,324**	93,760	22,500	-	25,749	**204,833**	85,603	-	-	**85,603**	-	13,088	**98,691**	**(106,141)**
Aug 2001	15,000	28,500	**43,500**	5,104	15,220	**20,324**	93,760	22,500	360,000	59,060	**599,144**	60,594	60,313	101,769	**222,676**	-	13,384	**236,060**	**(363,083)**
Sep 2001	18,000	25,500	**43,500**	5,104	15,220	**20,324**	93,760	22,500	-	58,869	**238,953**	86,686	199,393	-	**286,079**	-	13,384	**299,463**	**60,510**
FY01	207,500	336,923	**544,423**	77,749	183,726	**261,475**	1,064,462	289,949	1,379,001	461,338	**3,144,066**	1,122,564	259,706	608,799	**1,991,070**	-	171,164	**1,931,597**	**(1,212,467)**
Oct 2001	15,000	27,500	**42,500**	25,104	15,220	**40,324**	-	22,500	250,000	42,451	**397,775**	33,008	154,177	83,770	**270,955**	-	-	**270,955**	**(126,820)**
Nov 2001	15,000	28,500	**43,500**	5,104	15,220	**20,324**	-	22,500	-	41,657	**127,981**	86,730	154,864	-	**241,594**		-	**241,594**	**113,613**
Dec 2001	18,000	25,500	**43,500**	5,104	15,220	**20,324**	-	22,500	-	43,768	**130,092**	70,308	87,734	94,712	**252,754**		-	**252,754**	**122,662**
Jan 2002	24,000	5,000	**29,000**	13,052	15,220	**28,272**	-	22,500	297,297	93,061	**470,130**	41,947	213,214	-	**255,161**		-	**255,161**	**(214,968)**
Feb 2002	24,000	6,000	**30,000**	13,052	15,220	**28,272**	-	22,500	-	72,453	**153,225**	33,819	224,608	-	**258,427**	-	-	**258,427**	**105,202**
Mar 2002	27,000	3,000	**30,000**	13,052	14,700	**27,752**	-	22,500	-	51,104	**131,356**	63,449	181,697	-	**245,146**		-	**245,146**	**113,789**
Apr 2002	24,000	3,000	**27,000**	13,052	14,700	**27,752**	140,688	22,500	-	106,190	**324,130**	64,443	189,838	15,932	**270,213**	-	12,400	**282,613**	**(41,516)**
May 2002	23,000	6,000	**29,000**	13,052	14,700	**27,752**	140,688	22,500	182,520	34,443	**436,903**	62,249	236,054	18,779	**317,083**	400,000	12,400	**729,483**	**292,580**
Jun 2002	26,000	3,000	**29,000**	13,052	14,700	**27,752**	140,688	22,500	656,670	24,636	**901,246**	60,747	198,823	21,947	**281,517**	400,000	9,655	**691,172**	**(210,075)**
Jul 2002	8,000	18,000	**26,000**	13,052	14,700	**27,752**	140,688	10,000	-	38,561	**243,001**	57,423	203,289	23,699	**284,411**	40,381	8,877	**333,668**	**90,667**
Aug 2002	8,000	18,000	**26,000**	13,052	14,700	**27,752**	140,688	10,000	-	60,579	**265,019**	53,421	193,102	23,069	**269,591**	-	9,173	**278,764**	**13,745**
Sep 2002	8,000	3,000	**11,000**	13,052	14,700	**27,752**	140,688	10,000	-	72,163	**261,603**	49,258	184,848	22,475	**256,582**	-	9,173	**265,755**	**4,152**
FY02	220,000	146,500	**366,500**	152,780	179,000	**331,780**	844,128	232,500	1,386,487	681,066	**3,842,461**	676,802	2,222,248	304,383	**3,203,434**	840,381	61,678	**4,105,492**	**263,031**
Oct 2002	8,000	3,000	**11,000**	33,052	14,700	**47,752**	102,056	10,000	-	94,481	**265,289**	44,929	168,490	72,791	**286,210**	-	11,371	**297,581**	**32,292**
Nov 2002	8,000	3,000	**11,000**	33,052	14,700	**47,752**	102,056	10,000	-	42,599	**213,407**	38,058	159,369	123,856	**321,283**	-	12,400	**333,683**	**120,277**
Dec 2002	8,000	3,000	**11,000**	13,052	14,700	**27,752**	102,056	10,000	-	127,702	**278,510**	31,794	145,988	111,427	**289,208**	-	12,400	**301,608**	**23,098**
Jan 2003	8,000	3,000	**11,000**	5,104	14,700	**19,804**	102,056	-	-	61,416	**194,276**	67,797	142,939	103,871	**314,607**	-	12,400	**327,007**	**132,732**
Feb 2003	8,000	3,000	**11,000**	5,104	14,700	**19,804**	102,056	7,500	-	74,512	**214,872**	78,699	134,335	118,308	**331,343**	-	12,400	**343,743**	**128,871**
Mar 2003	8,000	3,000	**11,000**	5,104	14,700	**19,804**	102,056	10,000	-	62,763	**205,623**	74,696	136,224	119,639	**330,560**	-	12,400	**342,960**	**137,337**
Apr 2003	8,000	3,000	**11,000**	7,404	14,700	**22,104**	102,056	10,000	-	58,763	**203,923**	58,448	135,224	96,184	**289,856**	-	12,400	**302,256**	**98,332**
May 2003	8,000	3,000	**11,000**	7,404	14,700	**22,104**	102,056	10,000	-	46,061	**191,221**	78,409	143,819	168,220	**390,448**	-	12,400	**402,848**	**211,628**
Jun 2003	8,000	3,000	**11,000**	7,404	14,700	**22,104**	102,056	10,000	-	43,706	**188,866**	61,264	138,750	107,330	**307,343**	-	12,400	**319,743**	**130,877**
Jul 2003	8,000	3,000	**11,000**	6,732	13,132	**19,864**	102,056	10,000	106,000	60,129	**309,049**	55,229	141,977	110,772	**307,978**	-	12,400	**320,378**	**11,329**
Aug 2003	8,000	3,000	**11,000**	6,732	13,132	**19,864**	102,056	10,000	450,000	40,708	**633,628**	60,483	137,444	184,364	**382,291**	-	12,400	**394,691**	**(238,937)**
Sep 2003	8,000	3,000	**11,000**	6,732	13,132	**19,864**	102,056	10,000	-	58,931	**201,851**	55,331	140,978	157,615	**353,924**	-	12,400	**366,324**	**164,473**
FY03	96,000	36,000	**132,000**	136,876	171,696	**308,572**	1,224,672	107,500	556,000	771,771	**3,100,515**	705,137	1,725,537	1,474,377	**3,905,051**	-	147,771	**4,052,822**	**952,309**
Oct 2003	8,000	3,000	**11,000**	26,732	13,132	**39,864**	106,352	10,000	450,000	41,733	**658,949**	61,615	137,496	208,525	**407,636**	-	12,400	**420,036**	**(238,913)**
Nov 2003	8,000	3,000	**11,000**	6,732	13,132	**19,864**	106,352	10,000	400,000	59,690	**606,906**	63,620	141,941	190,171	**395,731**	-	12,400	**408,131**	**(198,775)**
Dec 2003	8,000	3,000	**11,000**	6,732	13,132	**19,864**	106,352	10,000	-	52,346	**199,562**	60,685	138,738	163,002	**362,425**	-	12,400	**374,825**	**175,263**
Jan 2004	8,000	3,000	**11,000**	6,732	13,132	**19,864**	106,352	10,000	340,000	51,615	**538,831**	64,229	142,814	148,016	**355,058**	-	12,400	**367,458**	**(171,373)**
Feb 2004	8,000	3,000	**11,000**	6,732	13,132	**19,864**	106,352	10,000	-	45,520	**192,736**	49,784	139,601	115,792	**305,177**	-	12,400	**317,577**	**124,840**
Mar 2004	8,000	3,000	**11,000**	6,732	13,132	**19,864**	106,352	10,000	-	135,143	**282,359**	39,200	143,484	106,180	**288,863**	-	12,400	**301,263**	**18,904**
Apr 2004	8,000	3,000	**11,000**	6,732	13,832	**20,564**	106,352	10,000	-	51,854	**199,770**	196,430	140,334	112,874	**449,638**	-	12,400	**462,038**	**262,268**
May 2004	8,000	3,000	**11,000**	26,732	13,832	**40,564**	106,352	10,000	-	40,505	**208,421**	199,045	144,090	94,227	**437,363**	-	8,000	**445,363**	**236,942**
Jun 2004	8,000	3,000	**11,000**	6,732	13,832	**20,564**	106,352	10,000	-	53,534	**201,450**	170,442	141,009	82,413	**393,863**	-	8,000	**401,863**	**200,413**
Jul 2004	8,000	3,000	**11,000**	6,732	13,832	**20,564**	106,352	10,000	-	43,679	**191,595**	140,066	144,649	73,318	**358,032**	-	8,000	**366,032**	**174,437**
Aug 2004	8,000	3,000	**11,000**	6,732	13,832	**20,564**	106,352	10,000	-	55,892	**203,808**	111,282	141,598	64,616	**317,496**	-	8,000	**325,496**	**121,687**
Sep 2004	8,000	3,000	**11,000**	6,732	13,832	**20,564**	106,352	10,000	-	45,933	**193,849**	100,718	145,094	55,874	**301,685**	-	8,000	**309,685**	**115,837**
FY04	96,000	36,000	**132,000**	120,784	161,784	**282,568**	1,276,224	120,000	1,190,000	677,444	**3,678,236**	1,257,116	1,700,848	1,415,008	**4,372,967**	-	126,800	**4,499,767**	**821,530**

Tank 50 emptied to Saltstone

Appendix I.3 - Material Balance (Stretch Case)

End of Month/Year	Influents (gallons)											Effluents (gallons)							Net-Out
	F Canyon			H Canyon			DWPF Recycle	Other	Inhibited Water	Jet Dilution	**Total In**	Space Recovery from Evaporation				Salt Solution to Processing	Sludge to ESP/DWPF	**Tot-Out**	
	LHW	HHW	**F-Can Total**	LHW	HHW	**H-Can Total**						2F Evaps	2H Evaps	3H Evaps	**Total**				
FY05	96,000	61,200	**157,200**	100,388	163,788	**264,176**	844,128	120,000	495,436	716,722	**2,597,662**	671,531	1,308,234	339,933	**2,319,699**	-	96,000	**2,415,699**	**(181,962)**
FY06	96,000	40,800	**136,800**	124,600	263,287	**387,887**	1,173,216	70,000	-	627,416	**2,395,319**	658,033	1,565,781	728,250	**2,952,063**	-	96,000	**3,048,063**	**652,746**
FY07	96,000	36,000	**132,000**	131,200	403,200	**534,400**	-	-	-	782,265	**1,448,665**	883,915	695,286	856,780	**2,435,980**	-	-	**2,435,980**	**987,316**
FY08	96,000	36,000	**132,000**	47,600	375,300	**422,900**	-	-	480,000	705,054	**1,739,954**	894,255	460,007	679,329	**2,033,590**	-	-	**2,033,590**	**293,637**
FY09	120,000	120,000	**240,000**	-	120,000	**120,000**	-	-	876,553	528,114	**1,764,667**	219,367	399,529	1,504,662	**2,123,556**	-	-	**2,123,556**	**358,889**
FY10 (mid)	60,000	60,000	**120,000**	-	60,000	**60,000**	329,040	-	154,616	233,890	**897,545**	-	268,613	161,469	**430,080**	-	42,969	**473,051**	**(424,496)**

Notes:

1) Discussion of the components of the Influents and Effluents is contained in Section 8.1.3 “HLW System Material Balance”
2) Actual values for October through December 2000 are obtained from the “HLW Morning Reports”

Appendix I.4 — Salt Solution Processing (Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT001	48	12/24/09	heel	-		4/1/10	59.0	4	17.6%	1,653	180	3,245	4
			21	104,000	ls								
			50	200,000	cs								
			47	900,000	ds								
SPT002	49	5/9/10	heel	250,000		6/20/10	62.2	4	17.5%	1,696		3,001	4
			14	452,533	ds								
			21	125,000	ls								
			47	400,000	ds								
SPT003	48	6/20/10	heel	2,160		9/12/10	61.6	4	17.6%	1,575		2,788	4
			50	250,000	cs								
			33	450,000	cs								
			47	500,000	ds								
SPT004	49	9/12/10	heel	16,634		12/6/10	56.5	4	17.9%	1,685	180	3,301	1
			47	623,000	ds								
			21	75,000	ls								
			33	306,500	cs								
			50	200,000	cs								
SPT005	48	12/6/10	heel	160		2/20/11	58.8	4	17.6%	1,596		2,826	2
			50	200,000	cs								
			33	400,000	cs								
			47	450,000	ds								
			42	95,000	cs								
			21	75,000	ls								
SPT006	49	2/20/11	heel	19,314		5/12/11	58.7	4	17.4%	1,580		2,797	2
			2	998,000	ds				15.0%				
			50	110,000	cs								
			21	95,000	ls								
SPT007	48	5/12/11	heel	18,960		7/29/11	67.4	4	15.2%	1,611		2,852	2
			2	812,977	ds								
			50	160,000	cs								
			8	230,542	cs								

Appendix I.4 — Salt Solution Processing (Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT008	49	7/29/11	heel	20,434		10/24/11	68.1	4	15.3%	1,610	180	3,169	2
			33	367,419	cs								
			21	70,000	ls								
			26	730,000	cs								
			50	20,000	cs								
SPT009	50	9/1/11	heel	14,040		1/19/12	64.4	4	15.0%	1,698		3,005	3
			1	1,100,000	ds			5					
			30	90,000	cs								
			21	18,000	ls								
SPT010	48	10/24/11	heel	20,620		4/14/12	71.2	5	15.6%	1,629		2,883	3
			1	570,082	ds								
			30	200,000	cs								
			8	373,934	cs								
			21	50,000	ls								
SPT011	49	1/19/12	heel	5,350		7/11/12	58.8	5	15.0%	1,575		2,787	3
			3	850,000	ds								
			26	315,000	cs								
			21	50,000	ls								
SPT012	50	4/14/12	heel	20,360		9/28/12	55.7	5	14.8%	1,613	180	3,173	3
			3	964,473	ds								
			26	218,600	cs								
			21	18,000	ls								
SPT013	48	7/11/12	heel	12,397		12/13/12	64.3	5	15.5%	1,498		2,651	5
			10	708,727	ds								
			30	200,000	cs								
			21	190,000	ls								
SPT014	49	9/28/12	heel	18,950		3/4/13	57.3	5	14.8%	1,674		2,963	5
			9	1,050,000	ds								
			30	103,000	cs								
			21	50,000	ls								

Appendix I.4 — Salt Solution Processing (Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT015	50	12/13/12	heel	19,476		5/21/13	63.9	5	15.3%	1,565		2,771	5
			9	858,273	ds								
			26	250,000	cs								
			21	50,000	ls								
SPT016	48	3/4/13	heel	-		8/11/13	41.1	5	13.7%	1,638		2,900	5
			41	995,997	ds								
			26	200,000	cs								
SPT017	49	5/21/13	heel	20,069		10/15/13	46.3	5	14.1%	1,677	180	3,286	6
			41	965,058	ds								
			26	237,395	cs								
SPT018	50	8/11/13	heel	-		12/23/13	52.8	5	14.5%	1,692		2,994	6
			41	850,000	ds				11.8%				
			30	220,000	cs								
			21	150,000	ls								
SPT019	48	10/15/13	heel	-		3/25/14	55.3	5	12.1%	1,653		2,926	6
			41	781,000	ds			6					
			30	239,965	cs								
			21	200,000	ls								
SPT020	49	12/23/13	heel	20,620		6/26/14	18.6	6	9.2%	1,658		2,934	7
			41	814,600	ds								
			30	387,000	ds								
SPT021	50	3/25/14	heel	18,800		8/20/14	48.4	6	11.7%	1,730		3,062	7
			30	391,129	cs								
			25	710,000	ds								
			35	100,000	cs								
SPT022	48	6/26/14	heel	19,804		11/15/14	48.1	6	11.7%	1,671	180	3,276	7
			25	870,000	ds								
			38	129,892	cs								
			42	202,816	cs								

Appendix I.4 — Salt Solution Processing (Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT023	49	8/20/14	heel	20,284		2/8/15	37.4	6	11.1%	1,642		2,907	7
			25	1,129,990	ds								
			42	72,256	cs								
SPT024	50	11/15/14	heel	17,974		4/23/15	47.3	6	11.7%	1,643		2,908	8
			25	935,692	ds								
			42	268,776	cs								
SPT025	48	2/8/15	heel	20,620		7/16/15	43.0	6	11.3%	1,659		2,937	8
			38	875,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			21	65,000	ls								
SPT026	49	4/23/15	heel	20,620		10/5/15	42.8	6	11.4%	1,659	180	3,255	8
			38	875,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			21	65,000	ls								
SPT027	50	7/16/15	heel	20,620		12/25/15	41.1	6	11.4%	1,643		2,908	9
			38	875,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			21	65,000	ls								
SPT028	48	10/5/15	heel	20,620		3/11/16	40.7	6	11.4%	1,633		2,890	9
			38	875,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			21	65,000	ls								

Appendix I.4 — Salt Solution Processing (Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT029	49	12/25/15	heel	12,220		5/27/16	39.8	6	11.2%	1,653		2,925	9
			38	415,604	ds								
			27	475,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			23	65,000	ls								
SPT030	50	3/11/16	heel	12,220		8/12/16	38.7	6	11.1%	1,625		2,876	9
			27	870,000	ds				17.3%				
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			23	65,000	ls								
SPT031	48	5/27/16	heel	3,820		10/26/16	38.0	6	17.2%	1,646	180	3,233	10
			34	100,000	cs			7					
			27	900,000	ds								
			35	75,000	cs								
			30	75,000	cs								
			23	65,000	ls								
SPT032	49	8/12/16	heel	20,048		12/13/16	38.5	7	17.2%	1,670		2,956	10
			34	100,000	cs								
			27	900,000	ds								
			35	75,000	cs								
			30	75,000	cs								
			41	65,000	ls								
SPT033	50	10/26/16	heel	-		1/31/17	42.9	7	17.7%	1,673		2,961	10
			27	594,140	cs								
			29	295,000	ds								
			34	128,674	ds								
			35	75,000	cs								
			41	65,000	ls								
			30	63,936	cs								

Appendix I.4 — Salt Solution Processing (Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT034	48	12/13/16	heel	-		3/24/17	46.5	7	18.0%	1,638		2,900	10
			37	1,221,750	ds								
SPT035	49	1/31/17	heel	-		5/17/17	40.4	7	18.0%	1,519		2,689	11
			29	900,000	ds								
			35	150,000	cs								
			23	106,720	ls								
SPT036	50	3/24/17	heel	20,620		7/4/17	36.4	7	17.1%	1,697		3,004	11
			29	445,000	ds								
			34	628,142	ds								
			37	48,870	ds								
			35	79,911	cs								
SPT037	48	5/17/17	heel	20,620		8/20/17	43.5	7	17.7%	1,726		3,055	11
			29	930,000	ds								
			30	50,000	cs								
			35	125,000	cs								
			42	96,923	cs								
SPT038	49	7/4/17	heel	-		10/12/17	32.8	7	16.6%	1,727	180	3,375	12
			29	839,980	ds								
			42	360,000	cs								
SPT039	50	8/20/17	heel	20,620		11/27/17	46.6	7	18.0%	1,604		2,840	12
			28	850,000	ds								
			42	270,000	cs								
			35	60,000	cs								
SPT040	48	10/12/17	heel	20,620		1/19/18	43.7	7	18.0%	1,566		2,772	12
			28	850,000	ds								
			42	168,725	cs								
			38	100,000	ls								
			35	50,000	cs								
SPT041	49	11/27/17	heel	-		3/11/18	43.0	7	18.0%	1,624		2,874	12
			28	965,000	ds								
			38	175,000	ls								
			35	60,000	cs								

Appendix I.4 — Salt Solution Processing (Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT042	50	1/19/18	heel	-		5/1/18	48.0	7	18.2%	1,543		2,732	13
			28	340,000	ds								
			38	800,000	ls								
			35	60,000	cs								
SPT043	48	3/11/18	heel	-		6/24/18	47.7	7	18.0%	1,672		2,959	13
			28	394,000	ds								
			43	805,000	cs								
SPT044	49	5/1/18	heel	-		8/19/18	49.9	7	18.2%	1,647		2,915	13
			43	275,012	cs								
			44	865,000	ds								
			35	50,000	cs								
SPT045	50	6/24/18	heel	-		10/14/18	46.9	7	18.0%	1,666	180	3,267	13
			44	1,170,000	ds								
			35	50,000	cs								
SPT046	48	8/19/18	heel	-		12/7/18	46.4	7	18.0%	1,646		2,913	14
			44	1,155,000	ds								
			35	50,000	cs								
SPT047	49	10/14/18	heel	-		1/30/19	50.3	7	18.0%	1,642		2,907	14
			44	138,665	ds								
			45	1,015,000	ds								
			35	50,000	cs								
SPT048	50	12/7/18	heel	18,800		3/29/19	49.6	7	18.0%	1,650		2,921	14
			45	1,098,000	ds				17.9%				
			35	50,000	cs								
			43	55,000	cs								
SPT049	48	1/30/19	heel	3,200		5/25/19	50.3	7	17.9%	1,637		2,898	14
			45	1,150,000	ds								
			29	50,000	cs								
SPT050	49	3/29/19	heel	1,812		7/21/19	45.9	7	18.2%	1,681		2,975	15
			45	508,018	ds								
			46	595,000	ds								
			29	100,000	cs								

Appendix I.4 — Salt Solution Processing (Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT051	50	5/25/19	heel	19,920		9/12/19	45.5	7	18.2%	1,740		3,080	15
			46	1,050,000	ds								
			29	150,000	cs								
SPT052	48	7/21/19	heel	1,200		11/4/19	44.8	7	18.3%	1,716	180	3,356	15
			46	1,050,000	ds			8					
			29	150,000	cs								
SPT053	49	9/12/19	heel	2,950		12/26/19	35.9	8	19.4%	1,723		3,050	16
			46	1,116,857	ds								
			29	102,056	cs								
SPT054	50	11/4/19	heel	17,920		2/6/20	45.4	8	19.0%	1,735		3,070	16
			31	1,075,000	ds								
			29	129,520	cs								
SPT055	48	12/26/19	heel	-		3/28/20	50.7	8	18.7%	1,753		3,103	16
			31	1,060,000	ds								
			29	161,750	cs								
SPT056	49	2/6/20	heel	20,620		5/23/20	47.5	8	18.7%	1,742		3,083	16
			31	1,060,000	ds								
			29	141,923	cs								
SPT057	50	3/28/20	heel	20,620		7/16/20	47.1	8	18.7%	1,715		3,036	17
			31	443,361	ds								
			36	685,000	ds								
			29	73,562	cs								
SPT058	48	5/23/20	heel	20,620		9/7/20	46.8	8	18.7%	1,702		3,013	17
			36	1,160,000	ds								
			29	41,923	cs								
SPT059	49	7/16/20	heel	20,620		10/29/20	47.0	8	18.7%	1,712	180	3,349	17
			36	1,160,000	ds								
			29	41,923	cs								
SPT060	50	9/7/20	heel	20,620		12/21/20	44.7	8	18.7%	1,715		3,036	18
			36	817,240	ds				18.7%				
			29	44,683	cs								
			37	340,000	ds								

Appendix I.4 — Salt Solution Processing (Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A	B	C	D	E	F	G	H	I	J	K	L	M	N
Salt Batch	Feed Tank	Date to Begin Blending	Source Tank	Feed Volume (kgal)	Feed Type	Start Feed to Salt Processing	TPB Used (kgal)	Sludge Batch	PHA Waste Loading (wt%)	Decontaminated Salt Solution to Saltstone (kgal)	ETF to Saltstone (kgal)	Grout Produced (kgal)	Vault #s
SPT061	48	10/29/20	heel	20,620		2/10/21	48.6	8	18.5%	1,722		3,047	18
			37	1,100,000	ds								
			29	101,923	cs								
SPT062	49	12/21/20	heel	20,620		4/6/21	16.5	8	17.6%	1,681		2,975	18
			37	681,000	ds			9					
			42	520,851	cs								
SPT063	50	2/10/21	heel	20,620		5/3/21	41.6	9	18.5%	1,699		3,007	18
			37	1,134,270	ds								
			29	67,653	cs								
SPT064	48	4/6/21	heel	20,620		6/21/21	35.5	9	19.6%	1,780		3,151	19
			43	1,000,000	cs								
			29	150,000	cs								
			IW	54,000									
SPT065	49	5/3/21	heel	20,620		8/1/21	136.4	9	15.9%	1,963		3,475	19
			32	948,909	cs								
			IW	263,135									
SPT066	50	6/21/21	heel	20,620		1/5/22	156.5	9	15.4%	2,065	180	3,974	19
			39	980,000	cs								
			IW	230,000									
SPT067	48	8/1/21	heel	20,620		7/8/22	22.5	9	15.4%	284		503	19
			39	137,546	cs								
			IW	3,190									

Appendix I.4 — Salt Solution Processing (Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s

Notes:

A) Each Salt Batch consists of a tank of blended dissolved salt solution to comprise a consistent feed stock. Each batch is individually tested and confirmed to meet processing qualification specifications.

B) Tank that is filled with a blended solution of feed stock ready for salt processing. The feed tanks for salt processing include Tanks 48, 49, and 50. Because of limited tank space at the time of initial salt processing, only Tanks 48 and 49 are available to feed.

C) Date when the first supernate solution is transferred into the salt processing feed tank.

D) The primary source of the supernate solution. The "heel" is the volume that is left over from the previous batch. "IW" refers to inhibited water.

E) The volume that is transferred from the source tank.

F) "cs" - Concentrated supernate. Does not originate from a solid salt cake.
"ls" - Light supernate. Generally supernate with a specific gravity of less than 1.2. Usually applied to DWPF recycle water.
"ds" - Dissolved salt solution. Originates from a salt cake dissolution process.

G) Date when the first salt solution is fed to the Salt Processing Facility.

H) Tetra-phenyl borate solution required to precipate the cesium to below Salt Stone waste acceptance criteria limits.

I) Sludge Batch number which is coupled with the salt processing batch.

J) Canister waste loading of precipitate hydrolysis aqueous (PHA).

K) Liquid volume of decontaminated salt solution from the Salt Processing Facility sent to Saltstone. Volume is shown for first salt batch in a fiscal year. This forecast volume would actually be received over the entire year at a rate of ~15 kgal per year.

L) Liquid volume of ETF concentrate sent to Saltstone.

M) Volume of grout that occupies vault storage space.

N) Corresponding Saltstone vault ID numbers. With a permanent roof, each cell measures 98.5 x 98.5 x 25 feet = 242,500 cu-ft. Existing Vault #1 has 6 cells, of which 3.5 are filled. Vault #4 has 12 cells, of which 1 is filled. New vaults will have 6 cells each. Vault # fill sequence to be 4, 1, 2, 3, 5, 6, 7, ... etc.

Appendix I.5 – Sludge Processing (Stretch Case)

	Waste Removal		ESP Pretreatment							DWPF Vitrification						
A Sludge Batch	B Source Tanks	C Sludge Content (kg)	D Feed Prep Start Date	E Feed Prep Total Dur. (months)	F Total ESP Water Vol. (kgal)	G Na (wt% dry)	H Hg (wt% dry)	I Total Solids (wt%)	J Pretreated Volume (kgal)	K Feed Volume (kgal)	L Start Feed	M Canister Yield	N Feed Duration (years)	O Finish Feed	P Feed Tank	Q Sludge Loading (wt %)
1A	51	298,000			na	8.80		16.4	491	491	3/1/96	492	2.75	8/30/98	51	25.0
										-140	(Tk 51 heel @ 40 ")					
										351						
1B	42	420,861			na	7.77	0.30	16.5	460	460	10/1/98	678	3.00	9/30/01	51	25.0
	total	420,861									(Includes use of 20 cans of Tank 51 heel)					
2	8	182,451			1,977	8.75	0.30	16.0	456	456	4/1/02	471	2.00	4/1/04	40	28.0
	40	179,098								-140	(Assumes DWPF outage in 1stQ and 2ndQ FY02)					
	total	361,549								316						
3	7(70%)	288,957	12/8/02	16	3,156	8.70	0.10	16.0	540	540	4/1/04	459	2.50	9/29/06	51	29.0
	18(70%)	14,777														
	19(70%)	1,956														
	total	305,690														
4	7(30%)	123,839	9/6/08	13	1,199	9.44	1.60	16.0	451	451	10/1/09	420	2.39	2/20/12	40	30.5
	11	124,380								(Assume DWPF outage from FY07 - FY09 due to lack of feed)						
	18(30%)	6,333								(Assume coupled salt and sludge feed starts in April 2010)						
	19(30%)	838														
	total	255,390														
5	15	165,818	9/28/10	17	2,285	11.51	1.50	16.0	567	567	2/20/12	494	2.15	4/14/14	51	29.4
	26	154,896														
	total	320,714														
6	5	57,630	11/20/12	17	2,815	8.70	2.20	16.0	727	727	4/14/14	598	2.60	11/18/16	40	31.6
	6	38,708														
	12	189,715														
	13(30%)	125,280														
	total	411,333														
7	13(70%)	292,320	6/27/15	17	2,862	9.08	1.90	16.0	743	743	11/18/16	652	2.83	9/19/19	51	29.8
	4	65,477														
	33	62,401														
	total	420,198														
8	21	6,393	5/27/18	16	2,034	8.76	1.30	16.0	677	677	9/19/19	584	2.54	4/3/22	40	27.8
	22	13,265														
	23	59,110														
	34	77,119														
	39	89,474														
	47	137,763														
	total	383,124														
9	32	214,886	12/9/20	16	1,846	10.06	4.90	16.0	472	472	4/3/22	387	1.68	12/8/23	51	28.8
	43	51,940														
		266,826														

Appendix I.5 – Sludge Processing (Stretch Case)

	Waste Removal		ESP Pretreatment							DWPF Vitrification						
A Sludge Batch	B Source Tanks	C Sludge Content (kg)	D Feed Prep Start Date	E Feed Prep Total Dur. (months)	F Total ESP Water Vol. (kgal)	G Na (wt% dry)	H Hg (wt% dry)	I Total Solids (wt%)	J Pretreated Volume (kgal)	K Feed Volume (kgal)	L Start Feed	M Canister Yield	N Feed Duration (years)	O Finish Feed	P Feed Tank	Q Sludge Loading (wt %)
10	ESP Heels (Tks 40,42,51)	158,377	9/14/22	15	1,877	8.24	4.90	16.0	913	913	12/8/23	679	2.95	11/19/26	40	31.6
	35	138,956														
	Other Insoluble Solids	219,000														
	total	516,333														
Totals		3,662,018			20,051	Total Estimated Washwater						5,914	Total Estimated Cans			

Notes:

General) Above based on the following yearly canister production values: FY01 220 cans/yr, FY02 150 cans/yr, FY03 210 cans/yr, FY04 220 cans/yr, FY05 150 cans/yr, FY06 200 cans/yr, FY07-FY09 DWPF Outage, FY10 100 cans/yr, FY11-End 230 cans/yr.

A) Each Sludge Batch must be individually tested and confirmed to meet waste qualification spedicfications

B) Sludge in these tanks will comprise the batch. Note: 100% of the sludge from Tanks 7, 18&19 will be moved to ESP to support Sludge Batch 3. However, 30% of this sludge will be combined with Tank 11 sludge to make Sludge Batch 4.

C) Amount of sludge from each source tank in the batch obtained from WCS data base

D) Feed Prep start date is the date that sludge is first moved into the the ESP feed tank (40 or 51) to begin preparation of the sludge batch (i.e. obtain proper alkali composition of the sludge slurry for feed to DWPF)

E) Total planned duration of transfers, washing, sampling, test glass production, and associated decants for the preparation of a sludge batch for feed to DWPF

F) Total estimated volume of sludge transfer water and wash water decants to obtain target soluble Na concentration for feed to DWPF

G) Amount of total Na in washed sludge (dry basis)

H) Amount of total Hg in washed sludge (dry basis)

I) Total solids (soluble and insoluble) in washed sludge

J) Volume of sludge at given wt% total solids before heel effects (Batch 1B is actual. Batch 2 is projected from detailed analysis. Batch 3 and beyond are based on ratio of batch sludge kg values converted to gallons and adjusted from an estimated 25 wt% solids to 16 wt% solids)

K) Volume of sludge available for feed after adding or subtracting pump heel

L) Start feed date based on depletion of previous batch down to pump heel

M) Estimated number of canisters produced given the pretreatment as shown. Numbers are actual for Batch 1A and estimated for remaining batches. Coupled Salt and Sludge Feed assumed to start with Batch 4.

N) Column O divided by the planned canister production during the period in which the batch is vitrified. See production note under General Section above.

O) Column N plus column P. Finish Feed means when the last transfer of feed is sent from the Feed Tank. The last canister for the batch will be poured later. The DWPF has approximately 25 canisters of feed in process. Therefore 25 more canisters will be produced from the batch after the last feed is sent to DWPF.

P) Batch feed tank

Q) Weight % of glass comprised of sludge oxides.

Appendix I.6 - Canister Storage (Stretch Case)

End of FY	SRS Cans Produced		SRS Cans in GWSB #1 (2,159 max)			SRS Cans in Modular Storage (1 building @ 585)			SRS Cans Shipped to Repository		Net Cans Stored At SRS
	Yearly	Cum.	Added	Shipped	Cum.	Added	Shipped	Cum.	Each Year	Cumulative	
1996	64	64	64		64						64
1997	169	233	169		233						233
1998	250	483	250		483						483
1999	236	719	236		719						719
2000	231	950	231		950						950
2001	220	1,170	220		1,170						1,170
2002	150	1,320	150		1,320						1,320
2003	210	1,530	210		1,530						1,530
2004	220	1,750	220		1,750						1,750
2005	150	1,900	150		1,900	0		0			1,900
2006	200	2,100	200		2,100	0		0			2,100
2007	0	2,100	0		2,100	0		0			2,100
2008	0	2,100			2,100	0		0			2,100
2009	0	2,100			2,100	0		0			2,100
2010	100	2,200	100	(105)	2,095	0		0	105	105	2,095
2011	230	2,430	230	(205)	2,120	0	0	0	205	310	2,120
2012	230	2,660	230	(205)	2,145	0	0	0	205	515	2,145
2013	230	2,890	180	(205)	2,120	50	0	50	205	720	2,170
2014	230	3,120		(205)	1,915	230	0	280	205	925	2,195
2015	230	3,350		(205)	1,710	230	0	510	205	1,130	2,220
2016	230	3,580	159	(205)	1,664	71	0	581	205	1,335	2,245
2017	230	3,810	230	(205)	1,689	0	0	581	205	1,540	2,270
2018	230	4,040	230	(205)	1,714	0	0	581	205	1,745	2,295
2019	230	4,270	230	(205)	1,739	0	0	581	205	1,950	2,320
2020	230	4,500	230	(205)	1,764	0	0	581	205	2,155	2,345
2021	230	4,730	230	(205)	1,789	0	0	581	205	2,360	2,370
2022	230	4,960	230	(205)	1,814	0	0	581	205	2,565	2,395
2023	230	5,190	230	(205)	1,839	0	0	581	205	2,770	2,420
2024	230	5,420	230	(205)	1,864	0	0	581	205	2,975	2,445
2025	230	5,650	230	(205)	1,889	0	0	581	205	3,180	2,470
2026	230	5,880	230	(10)	2,109	0	(195)	386	205	3,385	2,495
2027	34	5,914	34	0	2,143	0	(205)	181	205	3,590	2,324
2028	0	5,914		(24)	2,119	0	(181)	0	205	3,795	2,119
2029	0	5,914		(205)	1,914	0	0	0	205	4,000	1,914
2030	0	5,914		(205)	1,709	0	0	0	205	4,205	1,709
2031	0	5,914		(205)	1,504	0	0	0	205	4,410	1,504
2032	0	5,914		(205)	1,299	0	0	0	205	4,615	1,299

Appendix I.6 - Canister Storage (Stretch Case)

End of FY	SRS Cans Produced		SRS Cans in GWSB #1 (2,159 max)			SRS Cans in Modular Storage (1 building @ 585)			SRS Cans Shipped to Repository		Net Cans Stored At SRS
	Yearly	Cum.	Added	Shipped	Cum.	Added	Shipped	Cum.	Each Year	Cumulative	
2033	0	5,914		(205)	1,094	0	0	0	205	4,820	1,094
2034	0	5,914		(205)	889	0	0	0	205	5,025	889
2035	0	5,914		(205)	684	0	0	0	205	5,230	684
2036	0	5,914		(205)	479	0	0	0	205	5,435	479
2037	0	5,914		(205)	274	0	0	0	205	5,640	274
2038	0	5,914		(205)	69	0	0	0	205	5,845	69
2039	0	5,914		(69)	0	0	0	0	69	5,914	0
2040	0	5,914			0		0	0	0	5,914	

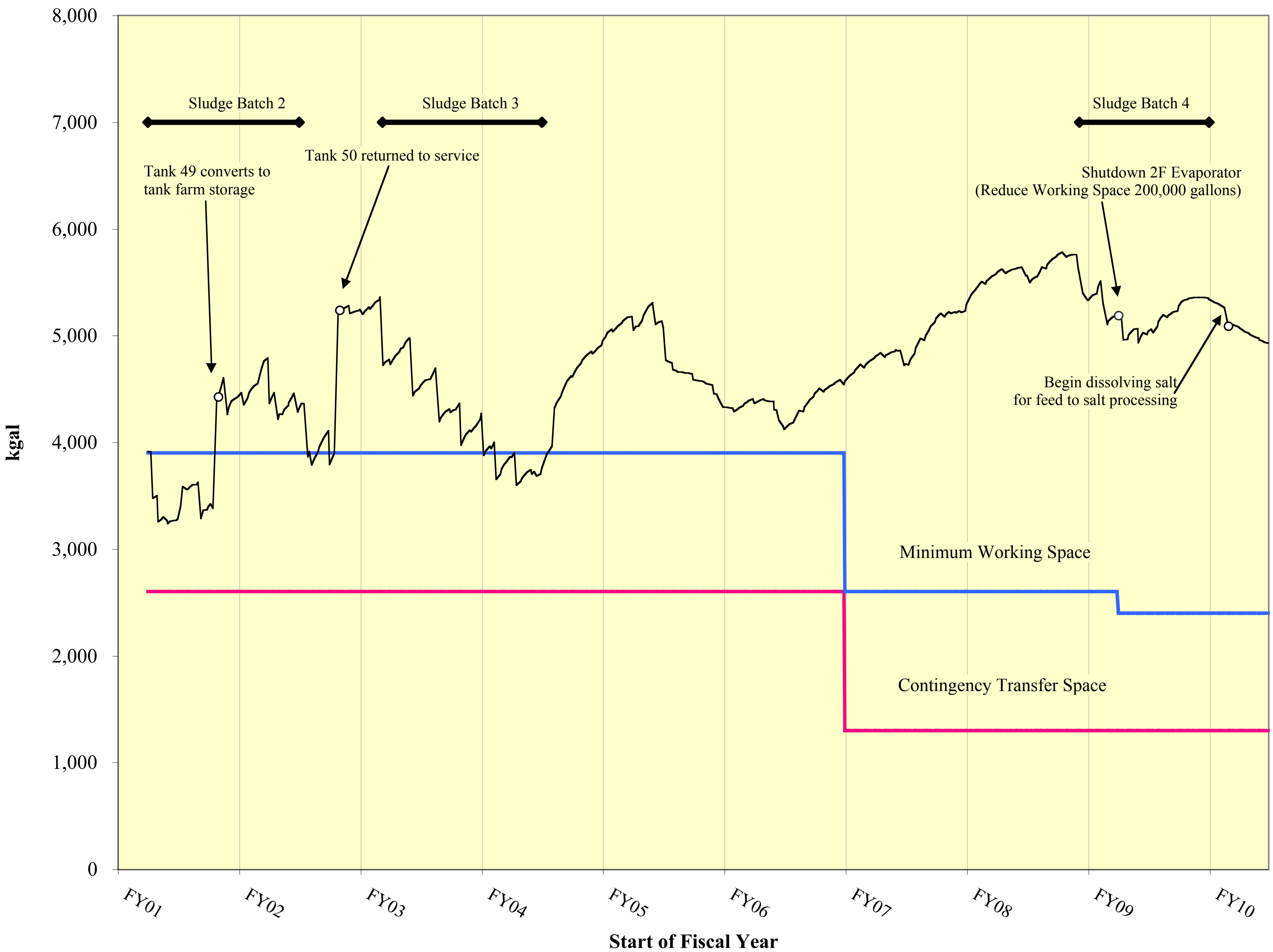
Notes:

1) GWSB #1 filling began in May 1996. Of its 2,286 canister storage locations, 5 positions store non-radioactive test canisters and 122 are unuseable with no viable repair technique. This yields a capacity of 2,159 usable storage locations, including 450 presently unusable location that require modification per an existing plan before they will be useable.
2) GWSB #1 is expected to reach maximum capacity in FY13.
3) Additional glass waste storage locations will be built as privatized modularized buildings, which will be $^{1}/_{4}$ of the size of GWSB #1. The first building, GWSB #2A, will be needed in 2013. Unless additional canisters are required to complete the program or shipments are delayed to the Federal Repository, this one modularized building should meet the programs needs.
4) This Plan assumes that canisters can be transported to the Federal Repository starting in FY10 at a rate of 105 canisters in FY10 and 205 canisters/yr thereafter, until the end of the program.
5) A canister load-out facility will be required to move the canisters from the GWSBs to a railcar. Assume one year for design (FY07) and three years for construction (FY08-10).
6) GWSB #1 will be emptied and available for D&D in FY39
7) GWSB #2A will be emptied and available for D&D in FY29.
8) This Plan does not include possible can-in-canister disposition of excess plutonium.
9) The Plan does not include additional locations in GWSB #2A for spent fuels materials. These materials could be added and included in these buildings, but would result in the overall need to build one additional privatized modularized building. As information becomes available on the needed locations for Spent Fuel materials needed locations would be included in the privatization proposals.

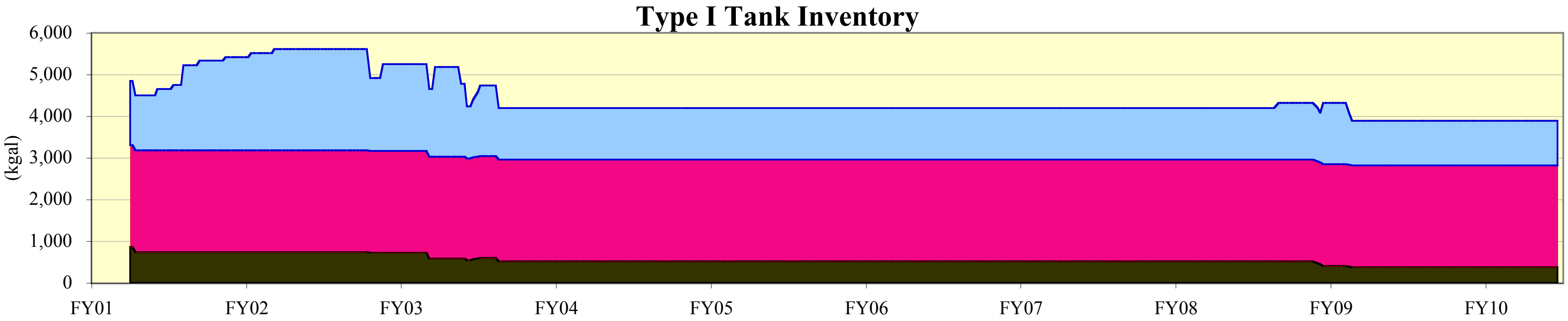
Appendix I.7 — Near Term Saltstone Operations (Stretch Case)

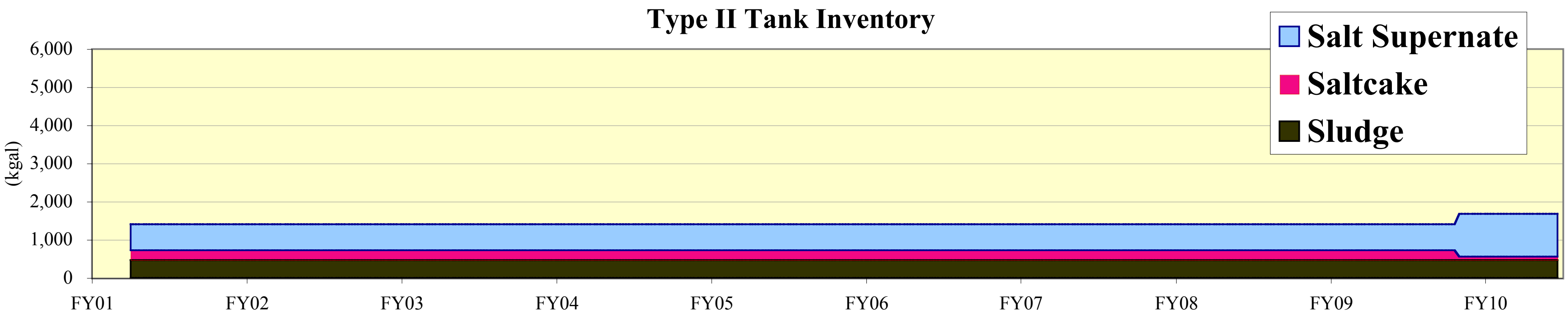
FY	Beginning of year Tk 50 Inventory (Kgal)	ETF Conc (Kgal)	Material Fed to Saltstone (Kgal)	End of year Tk 50 Inven. (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled	Active Vault #	Notes:
FY01	(as of 3/1/01) 482	355 (Includes 250 kgal moved from Tank 49)	0	837	0	3.50	---	3.5 cells already filled at the start of FY01. (3.0 cells in Vault 1 and 0.5 cells in Vault 4) Saltstone Facility in partial lay-up (not operating).
FY02	837	180	(1,017)	0	1,800	4.49	4	Saltstone Facility operates to de-inventory Tank 50. Tank 50 mods required for return to waste storage in FY02
FY03	0	180	(180)	0	319	4.67	4	Saltstone Facility operates as required to support ETF.
FY04	0	180	(180)	0	319	4.84	4	Saltstone Facility operates as required to support ETF.
FY05	0	180	(180)	0	319	5.02	4	Saltstone Facility operates as required to support ETF.
FY06	0	180	(180)	0	319	5.19	4	Saltstone Facility operates as required to support ETF.
FY07	0	180	(180)	0	319	5.37	4	Saltstone Facility operates as required to support ETF.
FY08	0	180	(180)	0	319	5.55	4	Saltstone Facility operates as required to support ETF.
FY09	0	180	(180)	0	319	5.72	4	Saltstone Facility operates as required to support ETF.

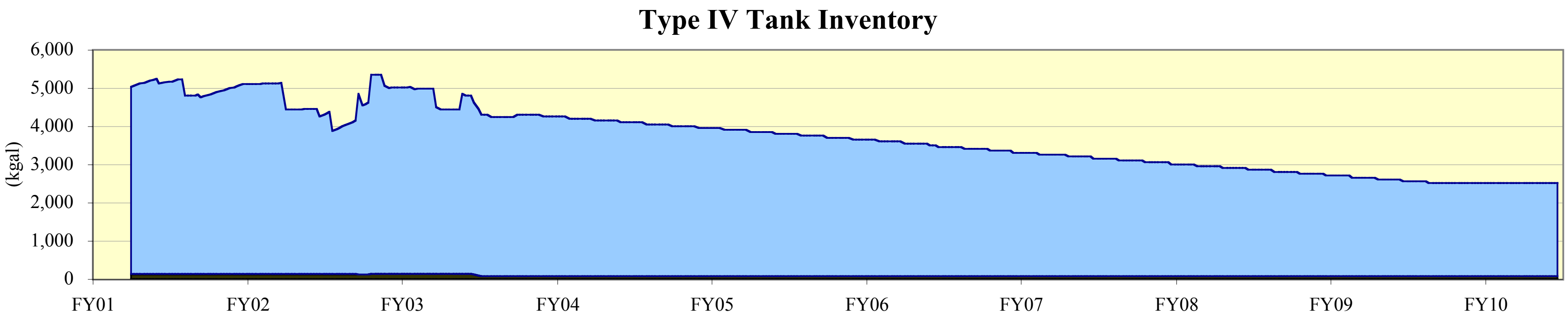
Appendix I.8 Useable Tank Space (Stretch Case)



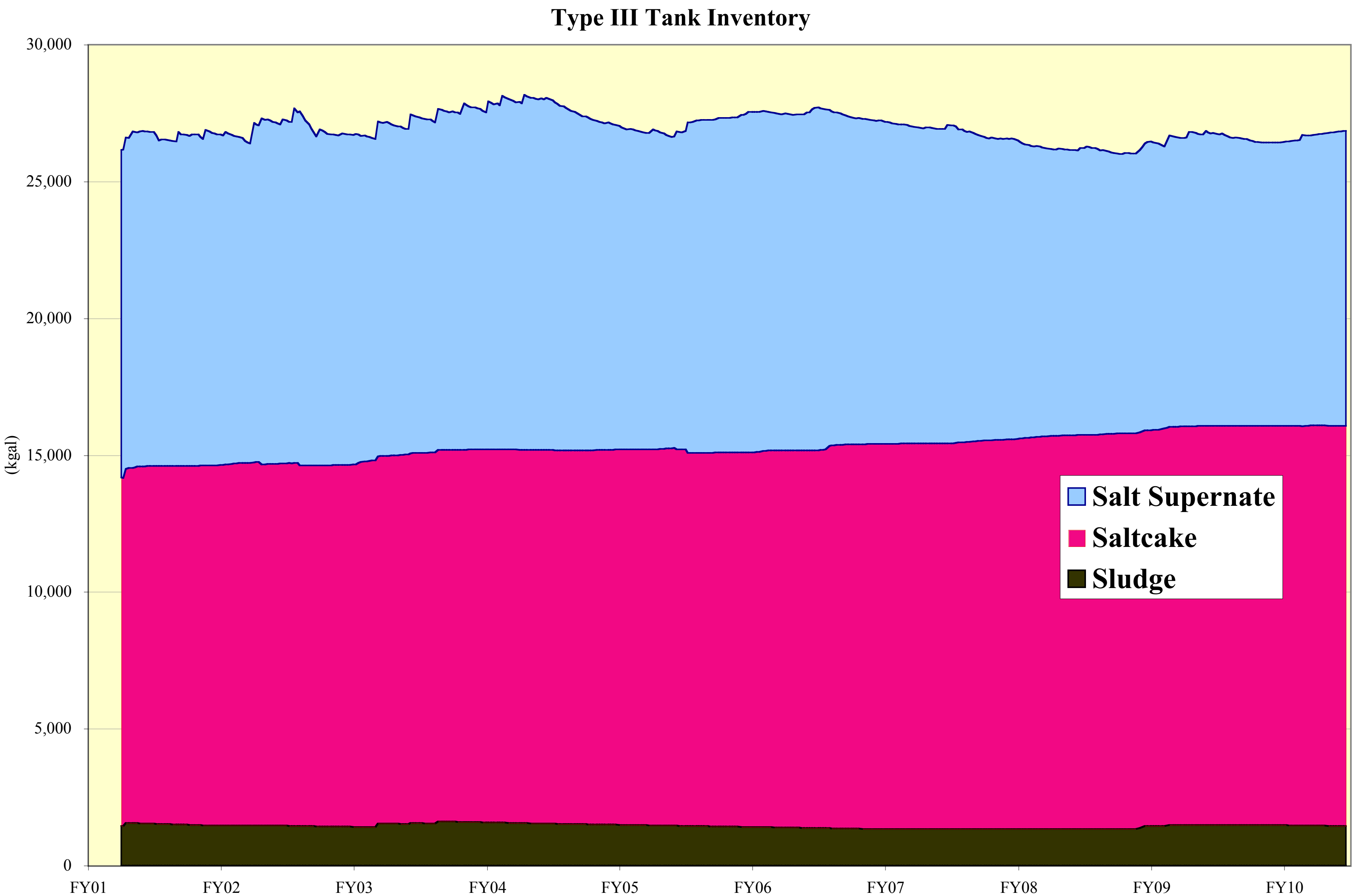
Appendix I.9 — Tank Inventory (Stretch Case)



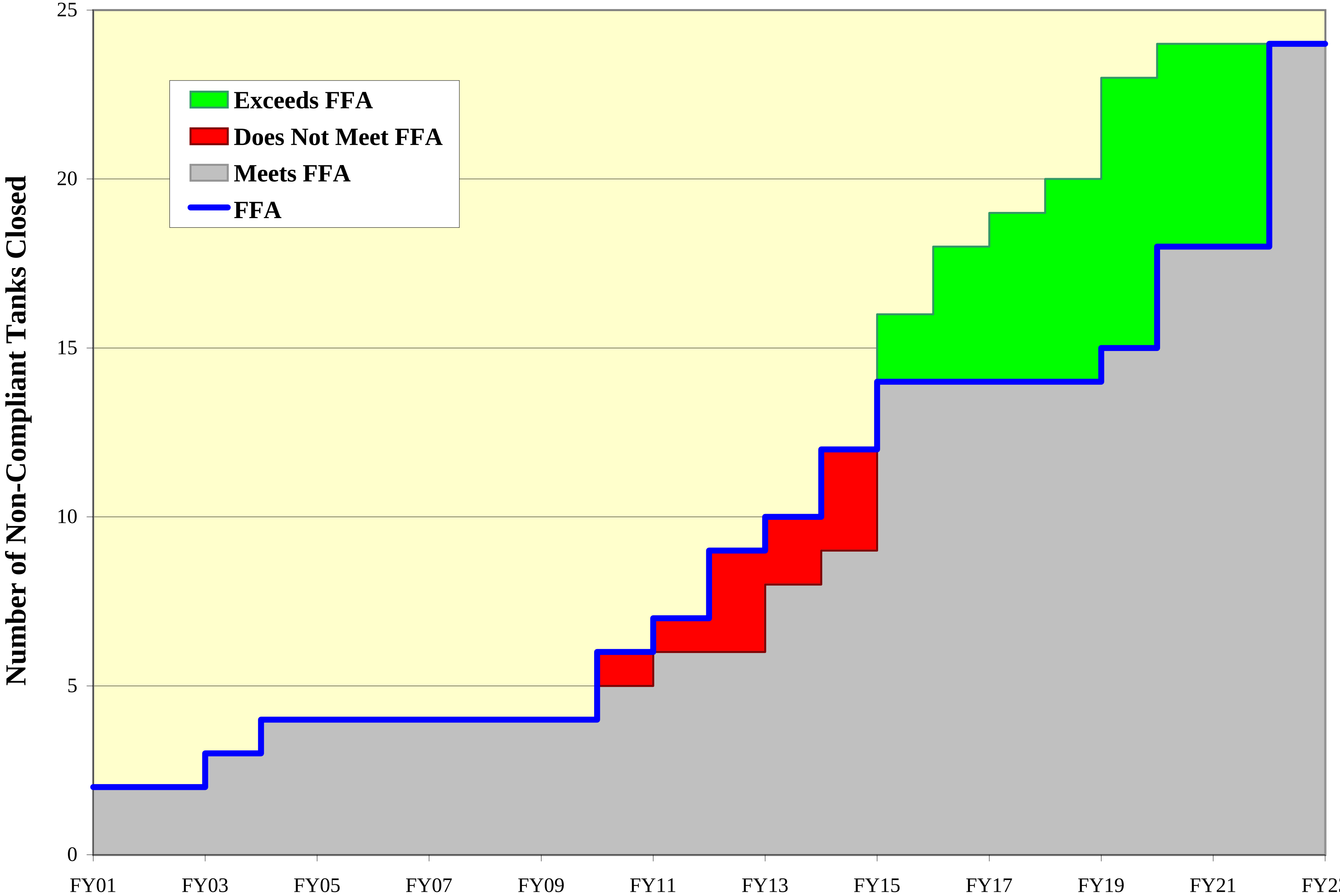




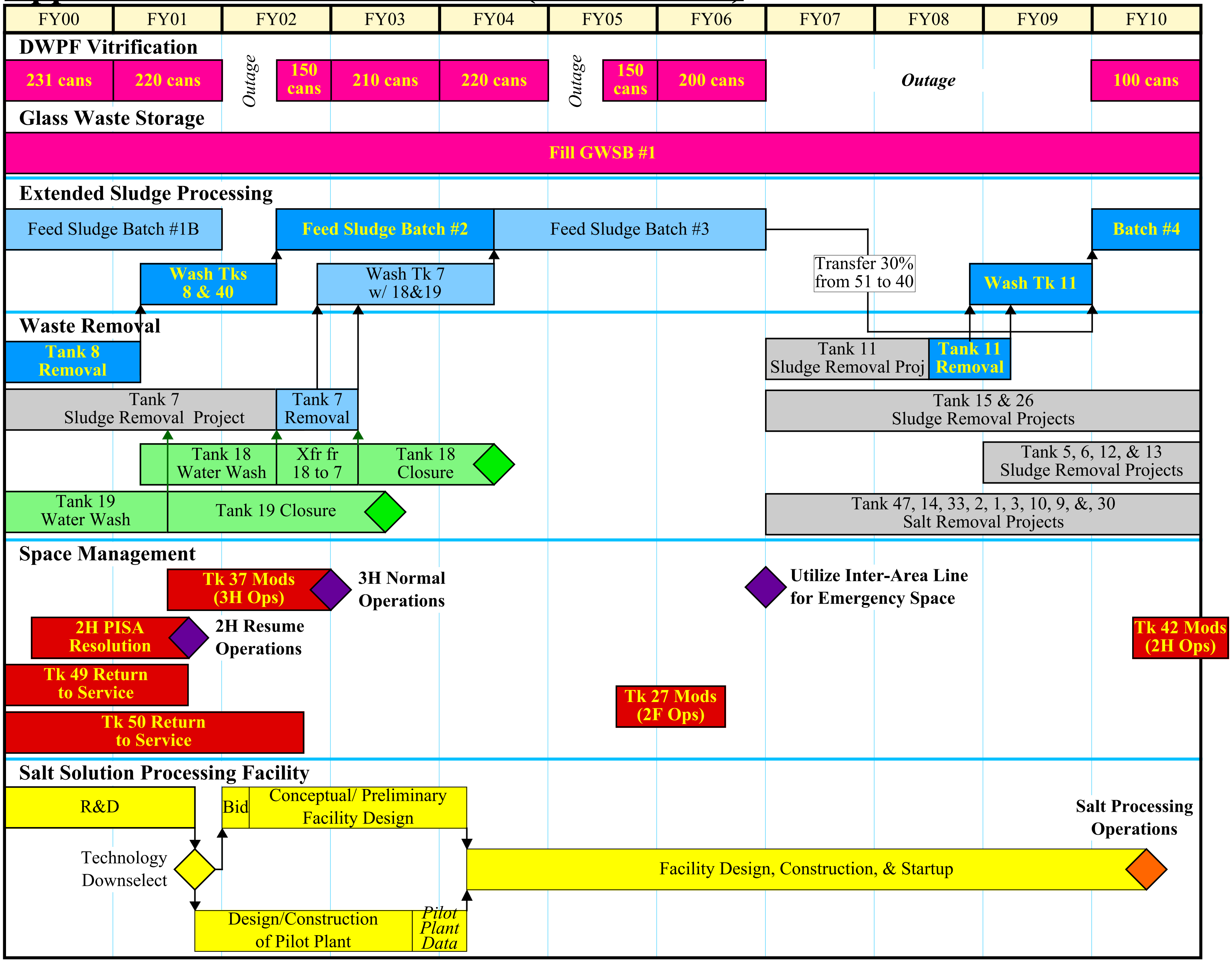
Appendix I.9 — Tank Inventory (Stretch Case)



Appendix I.10 - Tank Closures (Stretch Case)



Appendix I.11 - Level 1 Schedule (Stretch Case)



Appendix J
Super Stretch
Case

Appendix J – Super Stretch Case

Appendix J provides the detailed production planning information for the Super Stretch Case. During the contract extension, additional scope was identified that would significantly improve the HLW program performance. The execution of these items would have to be funded by implementing additional savings or by obtaining additional funding from Congress. The additional scope is not currently authorized for execution. It would have to be change-controlled into the contract prior to execution. This additional scope was included in the third strategy -- the Super Stretch Case -- which:

1. Provides excellent risk reduction by expediting waste removal from "high risk" tanks,
2. Meets all regulatory commitments,
3. Starts salt processing activities by mid 2010, and
4. Processes an average of 250 canisters per year after salt processing becomes operational.

Key Milestone	Rev 12 Super Stretch Case
Total Number of Canisters Produced	5,871
DWPF Sludge Production (in average canisters per year)	
• FY01	255
• FY02	150
• FY03	240
• FY04	240
• FY05	150
• FY06	115
• FY07	200
• FY08	200
• FY09	200
• FY10	150
• FY11 to End of Program	250
Key Risk Reduction Dates	
Date when all "high risk" tanks are emptied	FY14
Date when all "non-compliant" tanks are emptied	FY15
Date when all "non-compliant" tanks are closed	FY18
Date Salt Processing Becomes Operational	FY10
Date by which salt processing is completed	FY22
Date by which sludge processing is completed	FY23
Regulatory Commitments	
Are all STP commitments met?	Yes
Are all FFA regulatory commitments met?	Yes
Estimated Life-Cycle Costs	
• Costs in escalated dollars ($ in billions)	$17.6
• Costs in constant 1999 dollars ($ in billions)	$12.3
Canister Storage Locations	
• Make additional 450 GWSB #1 locations usable	FY03-05
• Begin work on additional Canister Storage locations – 2 Privatized Modules	Module #1 FY04 Module #2 FY07
• Place the two Privatized Modules into Radioactive Operations	Module #1 FY07 Module #2 FY10
Waste Removal	
• Tank 7 ready for sludge removal	7/02
• Tank 11 ready for sludge removal	4/05
• Tank 26 ready for sludge removal	9/07

Appendix J – Super Stretch Case

Key Milestone	Rev 12 Super Stretch Case
Tank Closures	
• Complete closure of Tank 19	4/03
• Complete closure of Tank 18	4/04
• Complete closure of 5th Tank	FY08
• Complete closure of 6th Tank	FY09
• Complete closure of 7th Tank	FY10
• Complete closure of 24th Tank	FY19
Key Space Management Activities	
• Reuse Tank 49 for waste storage	7/01
• Reuse Tank 50 for waste storage	9/02
• Tank 37 modification completed for 3H Evaporator Drop Tank	9/02
Repository Activities	
• Start shipping canisters to the Federal Repository	FY10
• Complete shipping canisters to Federal Repository	FY39
Facility Deactivation Complete	FY40

This appendix provides the following data: Funding Requirements, Waste Removal and Tank Closure Schedule, Material Balance, Salt Processing Batch makeup, Sludge Batch makeup, Canister Storage requirements, Near Term Saltstone Operations, Usable Tank Space estimates, an Inventory of the amound of waste in Types I, II, III, & IV tanks, a chart of Non-Compliant Tank Closures with respect to the FFA, and a Level 1 Schedule.

Appendix J.1 - Funding (Super Stretch)

Budget Authority in Escalated Dollars

Project Title	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09
HL-01 H Tank Farm											
H Tank Farm Operations	85,371	89,019	95,078	93,420	100,337	106,546	108,122	110,347	113,327	113,266	115,576
LI: Replacement Evaporator	12,835	3,567	-	-	-	-	-	-	-	-	-
HL-01 Total	**98,205**	**92,586**	**95,078**	**93,420**	**100,337**	**106,546**	**108,122**	**110,347**	**113,327**	**113,266**	**115,576**
HL-02 F Tank Farm	**58,928**	**60,993**	**59,966**	**63,928**	**68,328**	**70,471**	**71,464**	**74,184**	**76,187**	**73,509**	**75,493**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	1,108	3,824	3,169	3,311	3,552	3,673	3,786	3,931	4,037	4,058	4,168
WR: Tank Closure	124	350	16	3,113	4,745	1,653	-	-	16,187	10,660	8,547
HL-03 Total	**1,232**	**4,174**	**3,185**	**6,424**	**8,297**	**5,326**	**3,786**	**3,931**	**20,224**	**14,718**	**12,714**
HL-04 Feed Preparations & Sludge Operations	**53,328**	**52,037**	**50,722**	**56,097**	**62,734**	**66,549**	**70,173**	**69,739**	**71,622**	**72,071**	**74,017**
HL-05 Vitrification											
Vitrification Ops	127,626	116,698	111,727	126,400	132,185	133,344	141,166	146,986	145,944	150,235	155,255
Failed Equip. Storage Vaults	-	-	1,143	-	-	-	-	-	-	-	-
HL-05 Total	**127,626**	**116,698**	**112,870**	**126,400**	**132,185**	**133,344**	**141,166**	**146,986**	**145,944**	**150,235**	**155,255**
HL-06 Glass Waste Storage	**436**	**603**	**684**	**712**	**2,056**	**2,078**	**1,472**	**839**	**10,824**	**21,366**	**30,190**
HL-13 Salt Disposition											
Salt Disposition Ops	15,620	10,175	17,543	4,982	-	-	-	-	-	-	-
LI: Salt Alternative	-	-	-	29,465	84,345	135,123	150,278	150,768	150,895	143,752	98,761
HL-13 Total	**15,620**	**10,175**	**17,543**	**34,447**	**84,345**	**135,123**	**150,278**	**150,768**	**150,895**	**143,752**	**98,761**
HL-09 LI: Tk Fm Services Upgrade I	**1,632**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-10 LI: Storm Water Upgrades	**2,508**	**3,533**	**138.3381**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-11 LI: Tk Fm Services Upgrade II	**838**	**2,141**	**10,455**	**6,303**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-12 LI: Waste Removal											
LI: WR from Tanks	24,739	21,796	23,046	28,690	11,082	25,192	28,897	38,905	53,401	63,677	78,814
LI: Vit Upgrades	12	653	616	-	-	-	7,063	7,276	14,945	15,255	15,667
LI: Pipe, Evaps & Infrastructure	-	-	-	993	5,995	15,870	12,536	-	-	-	-
HL-12 Total	**24,751**	**22,449**	**23,662**	**29,683**	**17,077**	**41,063**	**48,496**	**46,181**	**68,346**	**78,932**	**94,481**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HLW TOTAL	**385,103**	**365,388**	**374,304**	**417,413**	**475,359**	**560,499**	**594,957**	**602,976**	**657,369**	**667,849**	**656,488**
HLW w/o Salt Total	**369,483**	**355,213**	**356,760**	**382,966**	**391,013**	**425,375**	**444,678**	**452,208**	**506,474**	**524,097**	**557,727**
Solid Waste Facilities											
ETF	16,510	15,098	16,115	17,302	18,705	20,455	22,088	23,838	20,579	23,997	20,586
Saltstone	1,595	857	1,099	2,055	4,454	2,317	2,229	2,314	2,377	7,353	15,734
SW TOTAL	**18,105**	**15,955**	**17,214**	**19,356**	**23,159**	**22,772**	**24,317**	**26,152**	**22,956**	**31,351**	**36,321**
Life Cycle Cost	**403,208**	**381,344**	**391,518**	**436,769**	**498,517**	**583,271**	**619,274**	**629,128**	**680,325**	**699,200**	**692,809**

Appendix J.1 - Funding (Super Stretch)

Budget Authority in Escalated Dollars

Project Title	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
HL-01 H Tank Farm											
H Tank Farm Operations	117,928	121,112	123,570	126,074	129,478	126,503	123,278	126,607	130,025	128,298	130,120
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**117,928**	**121,112**	**123,570**	**126,074**	**129,478**	**126,503**	**123,278**	**126,607**	**130,025**	**128,298**	**130,120**
HL-02 F Tank Farm	**77,532**	**79,625**	**80,153**	**82,317**	**81,429**	**80,992**	**72,926**	**73,379**	**73,803**	**75,796**	**66,347**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	13,688	25,356	23,264	16,229	16,667	14,672	15,068	15,475	5,297	5,440	5,587
WR: Tank Closure	8,752	14,794	14,007	23,435	72,883	85,460	41,373	11,292	21,838	46,199	42,255
HL-03 Total	**22,440**	**40,151**	**37,271**	**39,664**	**89,551**	**100,132**	**56,441**	**26,767**	**27,135**	**51,639**	**47,842**
HL-04 Feed Preparations & Sludge Operations	**76,015**	**68,871**	**70,731**	**72,640**	**74,602**	**76,616**	**78,685**	**80,809**	**82,991**	**85,232**	**87,533**
HL-05 Vitrification											
Vitrification Ops	160,620	160,312	168,042	175,531	172,995	182,082	189,295	193,042	193,907	202,545	212,556
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**160,620**	**160,312**	**168,042**	**175,531**	**172,995**	**182,082**	**189,295**	**193,042**	**193,907**	**202,545**	**212,556**
HL-06 Glass Waste Storage	**20,619**	**12,832**	**13,262**	**13,707**	**14,167**	**14,643**	**15,135**	**15,643**	**16,168**	**16,712**	**17,273**
HL-13 Salt Disposition											
Salt Disposition Ops	45,821	79,791	84,288	86,322	80,006	82,458	83,648	97,864	101,945	104,750	108,222
LI: Salt Alternative	57,843	-	-	-	-	45,370	62,127	47,853	-	-	-
HL-13 Total	**103,664**	**79,791**	**84,288**	**86,322**	**80,006**	**127,829**	**145,775**	**145,718**	**101,945**	**104,750**	**108,222**
HL-09 LI: Tk Fm Services Upgrade I	-	-	-	-	-	-	-	-	-	-	-
HL-10 LI: Storm Water Upgrades	-	-	-	-	-	-	-	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	-	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	64,453	74,538	54,046	88,400	98,000	76,048	71,014	74,593	60,492	42,483	13,642
LI: Vit Upgrades	28,158	18,590	12,728	19,608	20,137	20,681	14,160	14,542	-	-	-
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	**92,611**	**93,128**	**66,774**	**108,008**	**118,137**	**96,729**	**85,174**	**89,135**	**60,492**	**42,483**	**13,642**
FA-24 Facility Decontamination/Decommissioning	-	-	-	-	-	**43,183**	**36,285**	-	-	-	-
HLW TOTAL	**671,429**	**655,822**	**644,091**	**704,263**	**760,365**	**848,708**	**802,995**	**751,100**	**686,467**	**707,454**	**683,535**
HLW w/o Salt Total	**567,765**	**576,031**	**559,803**	**617,941**	**680,359**	**720,879**	**657,219**	**605,382**	**584,522**	**602,704**	**575,313**
Solid Waste Facilities											
ETF	21,843	21,875	25,438	32,919	25,062	25,243	30,249	25,667	32,191	27,072	28,746
Saltstone	24,306	35,875	53,592	42,606	39,905	55,953	56,416	52,257	61,883	62,422	69,203
SW TOTAL	**46,150**	**57,751**	**79,030**	**75,525**	**64,967**	**81,196**	**86,664**	**77,924**	**94,074**	**89,494**	**97,949**
Life Cycle Cost	**717,579**	**713,573**	**723,121**	**779,788**	**825,332**	**929,904**	**889,659**	**829,024**	**780,541**	**796,948**	**781,483**

Appendix J.1 - Funding (Super Stretch)

Budget Authority in Escalated Dollars

Project Title	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
HL-01 H Tank Farm											
H Tank Farm Operations	133,634	135,511	135,614	54,075	-	-	-	-	-	-	-
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**133,634**	**135,511**	**135,614**	**54,075**	-	-	-	-	-	-	-
HL-02 F Tank Farm	**49,588**	**28,416**	-	-	-	-	-	-	-	-	-
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	-	-	-	-
WR: Tank Closure	62,258	54,170	132,850	106,648	911	-	-	-	-	-	-
HL-03 Total	**62,258**	**54,170**	**132,850**	**106,648**	**911**	-	-	-	-	-	-
HL-04 Feed Preparations & Sludge Operations	**89,896**	**46,162**	**23,704**	-	-	-	-	-	-	-	-
HL-05 Vitrification											
Vitrification Ops	200,547	203,167	32,471	-	-	-	-	-	-	-	-
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**200,547**	**203,167**	**32,471**	-	-	-	-	-	-	-	-
HL-06 Glass Waste Storage	**17,854**	**10,799**	**11,152**	**11,517**	**3,065**	**3,148**	**3,233**	**3,320**	**2,984**	**3,064**	**3,147**
HL-13 Salt Disposition											
Salt Disposition Ops	110,447	107,014	11,141	-	-	-	-	-	-	-	-
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	-	-
HL-13 Total	**110,447**	**107,014**	**11,141**	-	-	-	-	-	-	-	-
HL-09 LI: Tk Fm Services Upgrade I	-	-	-	-	-	-	-	-	-	-	-
HL-10 LI: Storm Water Upgrades	-	-	-	-	-	-	-	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	-	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	18,977	22,402	39,086	6,622	-	-	-	-	-	-	-
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	-	-
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	**18,977**	**22,402**	**39,086**	**6,622**	-	-	-	-	-	-	-
FA-24 Facility Decontamination/Decommissioning	-	-	**196,488**	**230,330**	**89,515**	**2,302**	-	-	-	-	-
HLW TOTAL	**683,200**	**607,640**	**582,505**	**409,190**	**93,492**	**5,450**	**3,233**	**3,320**	**2,984**	**3,064**	**3,147**
HLW w/o Salt Total	**572,753**	**500,626**	**571,364**	**409,190**	**93,492**	**5,450**	**3,233**	**3,320**	**2,984**	**3,064**	**3,147**
Solid Waste Facilities											
ETF	40,738	31,015	30,116	-	-	-	-	-	-	-	-
Saltstone	46,219	29,058	3,741	-	-	-	-	-	-	-	-
SW TOTAL	**86,958**	**60,074**	**33,857**	-	-	-	-	-	-	-	-
Life Cycle Cost	**770,158**	**667,714**	**616,363**	**409,190**	**93,492**	**5,450**	**3,233**	**3,320**	**2,984**	**3,064**	**3,147**

Appendix J.1 - Funding (Super Stretch)

Budget Authority in Escalated Dollars

Project Title	FY32	FY33	FY34	FY35	FY36	FY37	FY38	FY39	FY40	Cumulative FY99-End
HL-01 H Tank Farm										
H Tank Farm Operations	-	-	-	-	-	-	-	-	-	2,972,235
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	16,402
HL-01 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2,988,637**
HL-02 F Tank Farm	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,675,753**
HL-03 Waste Removal & Tank Closures										
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	-	-	195,359
WR: Tank Closure	-	-	-	-	-	-	-	-	-	784,520
HL-03 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**979,878**
HL-04 Feed Preparations & Sludge Operations	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,713,575**
HL-05 Vitrification										
Vitrification Ops	-	-	-	-	-	-	-	-	-	3,934,679
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	1,143
HL-05 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3,935,821**
HL-06 Glass Waste Storage	**3,232**	**3,319**	**3,409**	**3,501**	**3,595**	**3,692**	**3,792**	**3,895**		**343,140**
HL-13 Salt Disposition										
Salt Disposition Ops	-	-	-	-	-	-	-	-	-	1,232,038
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	1,156,583
HL-13 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2,388,621**
HL-09 LI: Tk Fm Services Upgrade I	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,632**
HL-10 LI: Storm Water Upgrades	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**6,179**
HL-11 LI: Tk Fm Services Upgrade II	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**19,737**
HL-12 LI: Waste Removal										
LI: WR from Tanks	-	-	-	-	-	-	-	-	-	1,203,034
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	210,090
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	35,394
HL-12 Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,448,519**
FA-24 Facility Decontamination/Decommissioning	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**18,112**	**-**	**616,216**
HLW TOTAL	**3,232**	**3,319**	**3,409**	**3,501**	**3,595**	**3,692**	**3,792**	**22,007**	**-**	**16,117,708**
HLW w/o Salt Total	**3,232**	**3,319**	**3,409**	**3,501**	**3,595**	**3,692**	**3,792**	**22,007**	**-**	**13,729,087**
Solid Waste Facilities										
ETF	-	-	-	-	-	-	-	-	-	613,448
Saltstone	-	-	-	-	-	-	-	-	-	675,822
SW TOTAL	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,289,270**
Life Cycle Cost	**3,232**	**3,319**	**3,409**	**3,501**	**3,595**	**3,692**	**3,792**	**22,007**	**-**	**17,406,978**

Appendix J.1 - Funding (Super Stretch)

Budget Authority in Constant FY99 Year Dollars

Project Title	FY99	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09
HL-01 H Tank Farm											
H Tank Farm Operations	85,371	85,926	88,585	84,752	88,634	91,644	90,555	89,989	89,989	87,577	87,013
LI: Replacement Evaporator	12,835	3,443	-	-	-	-	-	-	-	-	-
HL-01 Total	**98,205**	**89,369**	**88,585**	**84,752**	**88,634**	**91,644**	**90,555**	**89,989**	**89,989**	**87,577**	**87,013**
HL-02 F Tank Farm	**58,928**	**58,873**	**55,871**	**57,996**	**60,359**	**60,615**	**59,853**	**60,497**	**60,497**	**56,836**	**56,836**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	1,108	3,691	2,953	3,004	3,138	3,159	3,171	3,206	3,206	3,138	3,138
WR: Tank Closure	124	338	15	2,824	4,191	1,422	-	-	12,853	8,242	6,434
HL-03 Total	**1,232**	**4,029**	**2,967**	**5,828**	**7,329**	**4,581**	**3,171**	**3,206**	**16,059**	**11,380**	**9,572**
HL-04 Feed Preparations & Sludge Operations	**53,328**	**50,229**	**47,258**	**50,892**	**55,417**	**57,241**	**58,771**	**56,873**	**56,873**	**55,724**	**55,724**
HL-05 Vitrification											
Vitrification Ops	127,626	112,643	104,097	114,672	116,767	114,695	118,230	119,869	115,889	116,161	116,886
Failed Equip. Storage Vaults	-	-	1,065	-	-	-	-	-	-	-	-
HL-05 Total	**127,626**	**112,643**	**105,162**	**114,672**	**116,767**	**114,695**	**118,230**	**119,869**	**115,889**	**116,161**	**116,886**
HL-06 Glass Waste Storage	**436**	**582**	**637**	**646**	**1,816**	**1,787**	**1,233**	**684**	**8,595**	**16,520**	**22,729**
HL-13 Salt Disposition											
Salt Disposition Ops	15,620	9,822	16,345	4,520	-	-	-	-	-	-	-
LI: Salt Alternative	-	-	-	26,731	74,508	116,225	125,862	122,953	119,821	111,148	74,354
HL-13 Total	**15,620**	**9,822**	**16,345**	**31,251**	**74,508**	**116,225**	**125,862**	**122,953**	**119,821**	**111,148**	**74,354**
HL-09 LI: Tk Fm Services Upgrade I	**1,632**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-10 LI: Storm Water Upgrades	**2,508**	**3,410**	**128.8910**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-11 LI: Tk Fm Services Upgrade II	**838**	**2,066**	**9,741**	**5,718**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-12 LI: Waste Removal											
LI: WR from Tanks	24,739	21,039	21,472	26,028	9,789	21,669	24,202	31,728	42,404	49,234	59,336
LI: Vit Upgrades	12	630	574	-	-	-	5,915	5,934	11,867	11,795	11,795
LI: Pipe, Evaps & Infrastructure	-	-	-	901	5,296	13,651	10,499	-	-	-	-
HL-12 Total	**24,751**	**21,669**	**22,046**	**26,929**	**15,085**	**35,320**	**40,616**	**37,661**	**54,272**	**61,030**	**71,131**
FA-24 Facility Decontamination/Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**385,103**	**352,692**	**348,742**	**378,683**	**419,915**	**482,107**	**498,292**	**491,732**	**521,996**	**516,376**	**494,247**
HLW w/o Salt Total	**369,483**	**342,870**	**332,397**	**347,432**	**345,407**	**365,882**	**372,430**	**368,779**	**402,175**	**405,227**	**419,893**
Solid Waste Facilities											
ETF	16,510	14,574	15,015	15,696	16,523	17,594	18,500	19,440	16,341	18,555	15,499
Saltstone	1,595	827	1,024	1,864	3,935	1,993	1,867	1,887	1,887	5,686	11,846
SW TOTAL	**18,105**	**15,401**	**16,039**	**17,560**	**20,458**	**19,587**	**20,366**	**21,327**	**18,228**	**24,240**	**27,344**
Life Cycle Cost	**403,208**	**368,093**	**364,781**	**396,244**	**440,372**	**501,694**	**518,658**	**513,059**	**540,225**	**540,616**	**521,591**

Appendix J.1 - Funding (Super Stretch)

Budget Authority in Constant FY99 Year Dollars

Project Title	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
HL-01 H Tank Farm											
H Tank Farm Operations	86,449	86,449	85,886	85,322	85,322	81,170	77,021	77,021	77,021	74,000	73,078
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**86,449**	**86,449**	**85,886**	**85,322**	**85,322**	**81,170**	**77,021**	**77,021**	**77,021**	**74,000**	**73,078**
HL-02 F Tank Farm	**56,836**	**56,836**	**55,709**	**55,709**	**53,659**	**51,968**	**45,563**	**44,640**	**43,718**	**43,718**	**37,262**
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	10,034	18,099	16,169	10,983	10,983	9,414	9,414	9,414	3,138	3,138	3,138
WR: Tank Closure	6,416	10,560	9,735	15,860	48,028	54,835	25,849	6,869	12,936	26,647	23,731
HL-03 Total	**16,450**	**28,659**	**25,905**	**26,843**	**59,011**	**64,249**	**35,263**	**16,283**	**16,074**	**29,784**	**26,869**
HL-04 Feed Preparations & Sludge Operations	**55,724**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**	**49,160**
HL-05 Vitrification											
Vitrification Ops	117,746	114,431	116,795	118,792	113,998	116,832	118,267	117,437	114,862	116,825	119,376
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**117,746**	**114,431**	**116,795**	**118,792**	**113,998**	**116,832**	**118,267**	**117,437**	**114,862**	**116,825**	**119,376**
HL-06 Glass Waste Storage	**15,115**	**9,160**	**9,218**	**9,277**	**9,336**	**9,396**	**9,456**	**9,516**	**9,577**	**9,639**	**9,701**
HL-13 Salt Disposition											
Salt Disposition Ops	33,590	56,955	58,583	58,419	52,721	52,909	52,261	59,536	60,388	60,418	60,780
LI: Salt Alternative	42,403	-	-	-	-	29,112	38,816	29,112	-	-	-
HL-13 Total	**75,993**	**56,955**	**58,583**	**58,419**	**52,721**	**82,021**	**91,077**	**88,647**	**60,388**	**60,418**	**60,780**
HL-09 LI: Tk Fm Services Upgrade I	-	-	-	-	-	-	-	-	-	-	-
HL-10 LI: Storm Water Upgrades	-	-	-	-	-	-	-	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	-	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	47,249	53,205	37,564	59,826	64,579	48,796	44,368	45,379	35,833	24,504	7,661
LI: Vit Upgrades	20,642	13,270	8,847	13,270	13,270	13,270	8,847	8,847	-	-	-
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	**67,891**	**66,475**	**46,410**	**73,095**	**77,849**	**62,065**	**53,214**	**54,225**	**35,833**	**24,504**	**7,661**
FA-24 Facility Decontamination/Decommissioning	-	-	-	-	-	**27,708**	**22,670**	-	-	-	-
HLW TOTAL	**492,206**	**468,125**	**447,665**	**476,617**	**501,057**	**544,568**	**501,691**	**456,931**	**406,633**	**408,048**	**383,886**
HLW w/o Salt Total	**416,213**	**411,170**	**389,082**	**418,198**	**448,335**	**462,548**	**410,614**	**368,284**	**346,245**	**347,630**	**323,107**
Solid Waste Facilities											
ETF	16,013	15,614	17,680	22,278	16,515	16,197	18,899	15,614	19,069	15,614	16,144
Saltstone	17,818	25,608	37,248	28,834	26,296	35,902	35,247	31,791	36,657	36,004	38,866
SW TOTAL	**33,831**	**41,222**	**54,928**	**51,112**	**42,811**	**52,099**	**54,146**	**47,405**	**55,725**	**51,619**	**55,010**
Life Cycle Cost	**526,037**	**509,348**	**502,593**	**527,730**	**543,868**	**596,667**	**555,837**	**504,336**	**462,358**	**459,666**	**438,896**

Appendix J.1 - Funding (Super Stretch)

Budget Authority in Constant FY99 Year Dollars

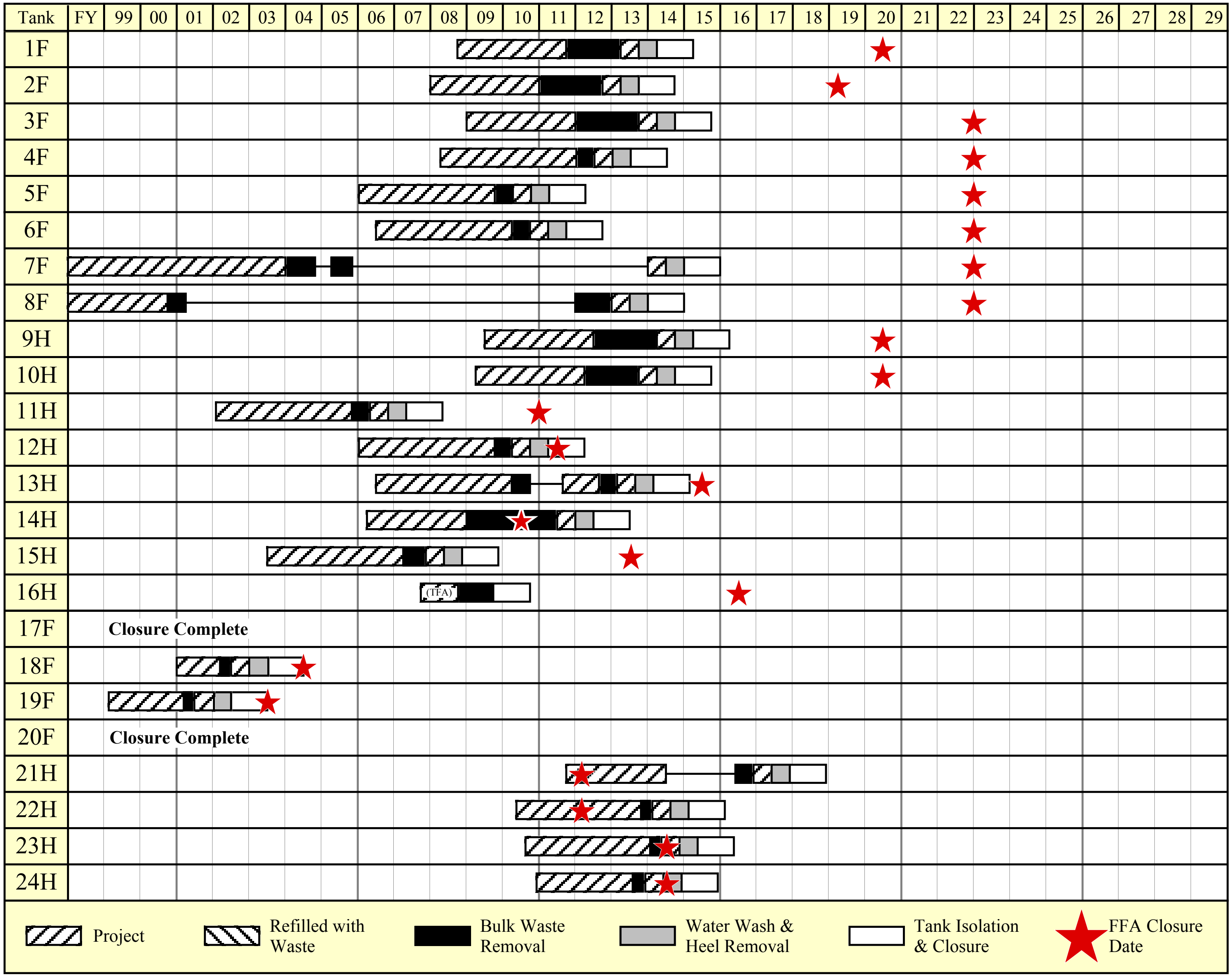
Project Title	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
HL-01 H Tank Farm											
H Tank Farm Operations	73,078	72,156	70,313	27,299	-	-	-	-	-	-	-
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**73,078**	**72,156**	**70,313**	**27,299**	-	-	-	-	-	-	-
HL-02 F Tank Farm	**27,117**	**15,131**	-	-	-	-	-	-	-	-	-
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	-	-	-	-
WR: Tank Closure	34,046	28,844	68,880	53,841	448	-	-	-	-	-	-
HL-03 Total	**34,046**	**28,844**	**68,880**	**53,841**	**448**	-	-	-	-	-	-
HL-04 Feed Preparations & Sludge Operations	**49,160**	**24,580**	**12,290**	-	-	-	-	-	-	-	-
HL-05 Vitrification											
Vitrification Ops	109,670	108,182	16,835	-	-	-	-	-	-	-	-
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**109,670**	**108,182**	**16,835**	-	-	-	-	-	-	-	-
HL-06 Glass Waste Storage	**9,763**	**5,750**	**5,782**	**5,814**	**1,507**	**1,507**	**1,507**	**1,507**	**1,318**	**1,318**	**1,318**
HL-13 Salt Disposition											
Salt Disposition Ops	60,399	56,982	5,776	-	-	-	-	-	-	-	-
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	-	-
HL-13 Total	**60,399**	**56,982**	**5,776**	-	-	-	-	-	-	-	-
HL-09 LI: Tk Fm Services Upgrade I	-	-	-	-	-	-	-	-	-	-	-
HL-10 LI: Storm Water Upgrades	-	-	-	-	-	-	-	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	-	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	10,378	11,928	20,265	3,343	-	-	-	-	-	-	-
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	-	-
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	**10,378**	**11,928**	**20,265**	**3,343**	-	-	-	-	-	-	-
FA-24 Facility Decontamination/Decommissioning	-	-	**101,875**	**116,281**	**44,003**	**1,102**	-	-	-	-	-
HLW TOTAL	**373,611**	**323,555**	**302,016**	**206,579**	**45,958**	**2,609**	**1,507**	**1,507**	**1,318**	**1,318**	**1,318**
HLW w/o Salt Total	**313,212**	**266,572**	**296,240**	**206,579**	**45,958**	**2,609**	**1,507**	**1,507**	**1,318**	**1,318**	**1,318**
Solid Waste Facilities											
ETF	22,278	16,515	15,614	-	-	-	-	-	-	-	-
Saltstone	25,275	15,473	1,940	-	-	-	-	-	-	-	-
SW TOTAL	**47,553**	**31,988**	**17,554**	-	-	-	-	-	-	-	-
Life Cycle Cost	**421,164**	**355,542**	**319,571**	**206,579**	**45,958**	**2,609**	**1,507**	**1,507**	**1,318**	**1,318**	**1,318**

Appendix J.1 - Funding (Super Stretch)

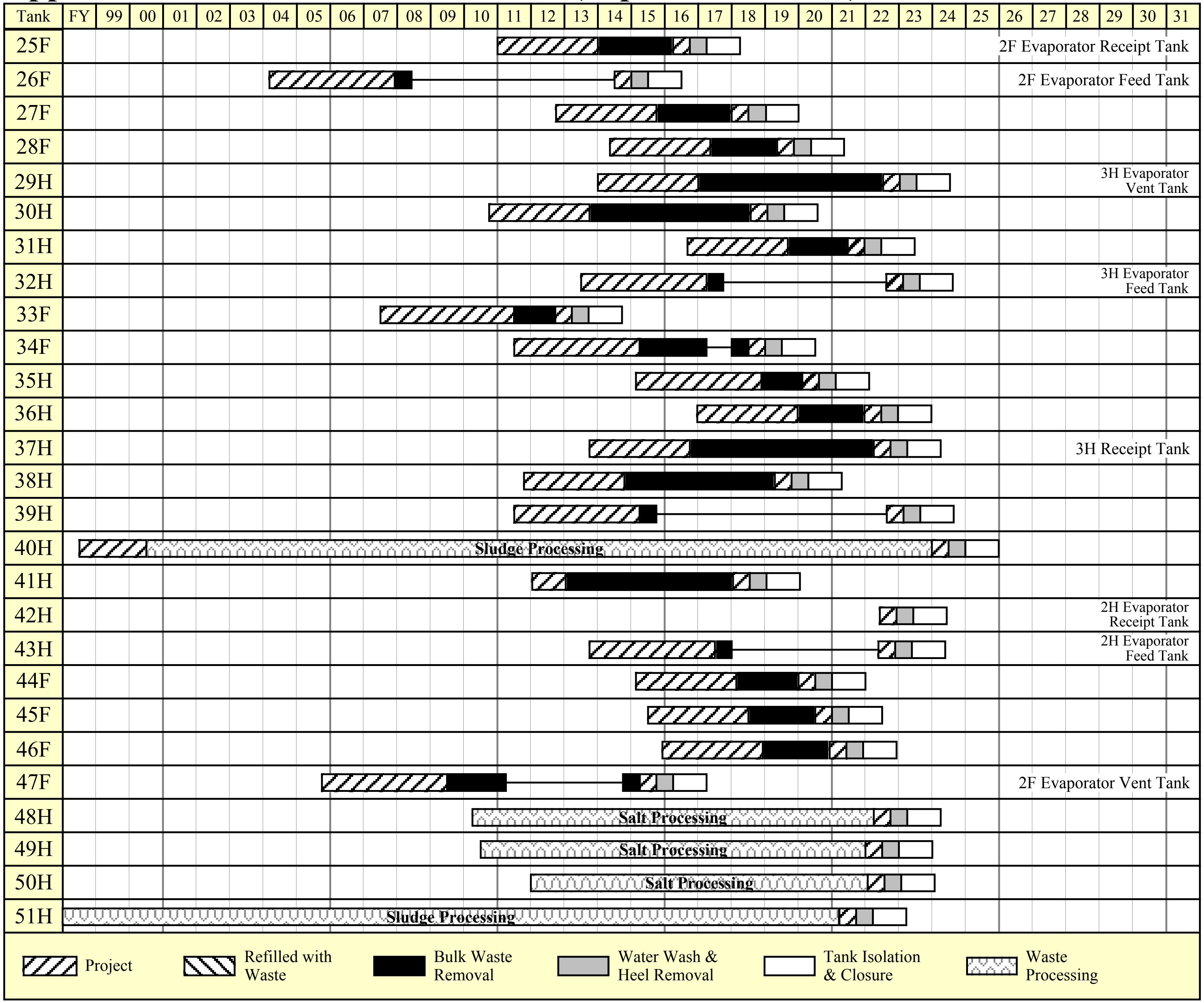
Budget Authority in Constant FY99 Year Dollars

Project Title	FY32	FY33	FY34	FY35	FY36	FY37	FY38	FY39	FY40	Cumulative FY99-End
HL-01 H Tank Farm										
H Tank Farm Operations	-	-	-	-	-	-	-	-	-	2,101,622
LI: Replacement Evaporator	-	-	-	-	-	-	-	-	-	16,278
HL-01 Total	-	-	-	-	-	-	-	-	-	**2,117,900**
HL-02 F Tank Farm	-	-	-	-	-	-	-	-	-	**1,235,028**
HL-03 Waste Removal & Tank Closures										
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	-	-	136,834
WR: Tank Closure	-	-	-	-	-	-	-	-	-	463,969
HL-03 Total	-	-	-	-	-	-	-	-	-	**600,803**
HL-04 Feed Preparations & Sludge Operations	-	-	-	-	-	-	-	-	-	**1,231,689**
HL-05 Vitrification										
Vitrification Ops	-	-	-	-	-	-	-	-	-	2,797,582
Failed Equip. Storage Vaults	-	-	-	-	-	-	-	-	-	1,065
HL-05 Total	-	-	-	-	-	-	-	-	-	**2,798,647**
HL-06 Glass Waste Storage	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	-	**212,696**
HL-13 Salt Disposition										
Salt Disposition Ops	-	-	-	-	-	-	-	-	-	776,023
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	911,044
HL-13 Total	-	-	-	-	-	-	-	-	-	**1,687,067**
HL-09 LI: Tk Fm Services Upgrade I	-	-	-	-	-	-	-	-	-	**1,632**
HL-10 LI: Storm Water Upgrades	-	-	-	-	-	-	-	-	-	**6,047**
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	-	-	**18,364**
HL-12 LI: Waste Removal										
LI: WR from Tanks	-	-	-	-	-	-	-	-	-	846,517
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	148,783
LI: Pipe, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	30,347
HL-12 Total	-	-	-	-	-	-	-	-	-	**1,025,646**
FA-24 Facility Decontamination/Decommissioning	-	-	-	-	-	-	-	**6,132**	-	**319,772**
HLW TOTAL	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	**7,450**	-	**11,255,289**
HLW w/o Salt Total	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	**7,450**	-	**9,568,222**
Solid Waste Facilities										
ETF	-	-	-	-	-	-	-	-	-	428,292
Saltstone	-	-	-	-	-	-	-	-	-	427,369
SW TOTAL	-	-	-	-	-	-	-	-	-	**855,661**
Life Cycle Cost	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	**1,318**	**7,450**	-	**12,110,950**

Appendix J.2 Waste Removal Schedule (SuperStretch Case)



Appendix J.2 Waste Removal Schedule (SuperStretch Case)



Appendix J.3 - Material Balance (Super Stretch Case)

End of Month/Year	Influents (gallons) F Canyon LHW	F Canyon HHW	F-Can Total	H Canyon LHW	H Canyon HHW	H-Can Total	DWPF Recycle	Other	Inhibited Water	Jet Dilution	Total In	Effluents (gallons) Space Recovery from Evaporation 2F Evaps	2H Evaps	3H Evaps	Total	Salt Solution to Processing	Sludge to ESP/DWPF	Tot-Out	Net-Out
Oct 2000	0	32,924	32,924	1,650	12,285	13,935	144,715	50,026	62,222	12,440		105,434	-	113,303	218,737	-	19,656	Actuals	(see Note 2)
Nov 2000	0	16,883	16,883	0	17,800	17,800	119,758	11,356	83,278	56,760		1,089	-	(16,111)	(15,022)	-	21,762	Actuals	(see Note 2)
Dec 2000	0	49,491	49,491	1,439	21,376	22,815	115,928	31,692	0	14,560		(20,849)	-	(9,442)	(30,291)	-	15,795	Actuals	(see Note 2)
Jan 2001	28,500	20,625	49,125	3,828	11,025	14,853	109,386	16,875	113,410	13,207	316,856	72,376	-	34,507	106,883	-	10,038	116,921	(199,935)
Feb 2001	30,000	28,500	58,500	5,104	14,700	19,804	145,848	22,500	260,091	36,630	543,373	101,602	-	39,677	141,280	-	13,384	154,664	(388,709)
Mar 2001	28,000	25,500	53,500	5,104	15,220	20,324	131,463	22,500	-	54,625	282,412	125,909	-	-	125,909	-	13,384	139,293	(143,119)
Apr 2001	30,000	27,500	57,500	15,104	15,220	30,324	85,410	22,500	30,000	42,580	268,314	170,338	-	180,890	351,228	-	13,384	364,612	96,298
May 2001	25,000	28,500	53,500	25,104	15,220	40,324	125,667	22,500	10,000	39,745	291,736	166,684	-	-	166,684	-	13,384	180,068	(111,668)
Jun 2001	18,000	25,500	43,500	5,104	15,220	20,324	110,281	22,500	460,000	47,113	703,719	167,098	-	164,206	331,304	-	13,384	344,688	(359,031)
Jul 2001	15,000	27,500	42,500	5,104	15,220	20,324	145,848	22,500	-	25,749	256,921	85,603	-	-	85,603	-	13,384	98,987	(157,934)
Aug 2001	15,000	28,500	43,500	5,104	15,220	20,324	145,848	22,500	360,000	59,060	651,232	60,594	60,313	101,769	222,676	-	13,384	236,060	(415,171)
Sep 2001	18,000	25,500	43,500	5,104	15,220	20,324	131,812	22,500	-	58,869	277,005	86,686	199,393	-	286,079	-	13,384	299,463	22,458
FY01	207,500	237,625	445,125	74,660	132,265	206,925	1,131,563	196,875	1,233,501	377,578	3,591,568	1,036,890	259,706	521,049	1,817,646	-	117,110	1,934,756	(1,656,811)
Oct 2001	15,000	27,500	42,500	25,104	15,220	40,324	-	22,500	250,000	42,451	397,775	33,008	154,177	83,770	270,955	-	-	270,955	(126,820)
Nov 2001	15,000	28,500	43,500	5,104	15,220	20,324	-	22,500	-	41,657	127,981	86,730	154,864	-	241,594		-	241,594	113,613
Dec 2001	18,000	25,500	43,500	5,104	15,220	20,324	-	22,500	-	43,768	130,092	70,308	87,734	94,712	252,754		-	252,754	122,662
Jan 2002	24,000	5,000	29,000	13,052	15,220	28,272	27,232	22,500	297,297	85,529	489,830	55,350	171,486	-	226,836		3,100	229,936	(259,895)
Feb 2002	24,000	6,000	30,000	13,052	15,220	28,272	108,928	22,500	-	86,267	275,967	12,506	342,971	66,350	421,828	-	12,400	434,228	158,261
Mar 2002	27,000	3,000	30,000	13,052	14,700	27,752	108,928	22,500	-	38,936	228,116	81,949	182,189	-	264,138	-	12,400	276,538	48,422
Apr 2002	24,000	3,000	27,000	13,052	14,700	27,752	108,928	22,500	-	113,493	299,673	148,184	264,830	26,067	439,081	-	12,400	451,481	151,808
May 2002	23,000	6,000	29,000	13,052	14,700	27,752	108,928	22,500	182,520	40,759	411,459	84,564	306,453	-	391,017	400,000	12,400	803,417	391,958
Jun 2002	26,000	3,000	29,000	13,052	14,700	27,752	108,928	22,500	656,670	35,279	880,129	70,651	231,146	29,754	331,551	400,000	12,400	743,951	(136,178)
Jul 2002	8,000	18,000	26,000	13,052	14,700	27,752	108,928	10,000	-	44,952	217,632	77,713	158,978	29,970	266,662	40,381	12,400	319,443	101,810
Aug 2002	8,000	18,000	26,000	13,052	14,700	27,752	108,928	10,000	-	68,740	241,420	66,004	267,733	37,099	370,835		12,400	383,235	141,815
Sep 2002	8,000	3,000	11,000	13,052	14,700	27,752	108,928	10,000	-	66,093	223,773	-	131,688	-	131,688	-	12,400	144,088	(79,685)
FY02	220,000	146,500	366,500	152,780	179,000	331,780	898,656	232,500	1,386,487	707,924	3,923,847	786,967	2,454,249	367,722	3,608,939	840,381	102,300	4,551,620	627,771
Oct 2002	8,000	3,000	11,000	33,052	14,700	47,752	114,936	10,000	-	104,623	288,311	-	264,031	117,697	381,727	-	12,400	394,127	105,817
Nov 2002	8,000	3,000	11,000	33,052	14,700	47,752	114,936	10,000	-	62,596	246,284	-	191,692	173,405	365,097	-	12,400	377,497	131,213
Dec 2002	8,000	3,000	11,000	13,052	14,700	27,752	114,936	10,000	-	117,484	281,172	-	139,525	99,495	239,020	-	12,400	251,420	(29,752)
Jan 2003	8,000	3,000	11,000	5,104	14,700	19,804	114,936	10,000	-	77,223	232,963	78,005	180,726	151,205	409,936	-	12,400	422,336	189,372
Feb 2003	8,000	3,000	11,000	5,104	14,700	19,804	114,936	10,000	-	96,487	252,227	178,144	145,793	123,015	446,952	-	12,400	459,352	207,126
Mar 2003	8,000	3,000	11,000	5,104	14,700	19,804	114,936	10,000	-	33,602	189,342	103,811	191,929	68,140	363,881	-	12,400	376,281	186,938
Apr 2003	8,000	3,000	11,000	7,404	14,700	22,104	114,936	10,000	-	78,647	236,687	221,124	194,011	210,647	625,782	-	12,400	638,182	401,495
May 2003	8,000	3,000	11,000	7,404	14,700	22,104	114,936	10,000	-	96,054	254,094	92,929	140,473	114,929	348,331	-	12,400	360,731	106,637
Jun 2003	8,000	3,000	11,000	7,404	14,700	22,104	114,936	10,000	106,000	70,550	334,590	85,159	183,960	140,367	409,486	-	12,400	421,886	87,296
Jul 2003	8,000	3,000	11,000	6,732	13,132	19,864	114,936	10,000	450,000	39,061	644,861	189,371	145,819	91,283	426,474	-	12,400	438,874	(205,987)
Aug 2003	8,000	3,000	11,000	6,732	13,132	19,864	114,936	10,000	-	83,605	239,405	149,371	135,871	107,965	393,207	-	12,400	405,607	166,203
Sep 2003	8,000	3,000	11,000	6,732	13,132	19,864	114,936	10,000	450,000	54,261	660,061	285,824	228,270	89,372	603,466	-	12,400	615,866	(44,196)
FY03	96,000	36,000	132,000	136,876	171,696	308,572	1,379,232	120,000	1,006,000	914,193	3,859,997	1,383,738	2,142,100	1,487,520	5,013,359	-	148,800	5,162,159	1,302,162
Oct 2003	8,000	3,000	11,000	26,732	13,132	39,864	114,936	10,000	400,000	59,257	635,057	162,430	127,007	215,096	504,533	-	12,400	516,933	(118,125)
Nov 2003	8,000	3,000	11,000	6,732	13,132	19,864	114,936	10,000	-	71,924	227,724	107,982	110,937	222,984	441,904	-	12,400	454,304	226,580
Dec 2003	8,000	3,000	11,000	6,732	13,132	19,864	114,936	10,000	340,000	58,751	554,551	205,563	131,119	86,627	423,309	-	12,400	435,709	(118,842)
Jan 2004	8,000	3,000	11,000	6,732	13,132	19,864	114,936	10,000	-	57,777	213,577	194,640	222,176	79,894	496,710	-	12,400	509,110	295,533
Feb 2004	8,000	3,000	11,000	6,732	13,132	19,864	114,936	10,000	-	91,030	246,830	150,700	215,797	60,654	427,151	-	12,400	439,551	192,720
Mar 2004	8,000	3,000	11,000	6,732	13,132	19,864	114,936	10,000	298,816	43,666	498,282	119,936	168,844	-	288,780	-	12,400	301,180	(197,102)
Apr 2004	8,000	3,000	11,000	6,732	13,832	20,564	114,936	10,000	357,669	32,779	546,948	124,735	133,458	-	258,193	-	12,400	270,593	(276,355)
May 2004	8,000	3,000	11,000	26,732	13,832	40,564	114,936	10,000	200,000	92,331	468,831	65,164	133,485	-	198,648	-	12,400	211,048	(257,783)
Jun 2004	8,000	3,000	11,000	6,732	13,832	20,564	114,936	10,000	-	24,051	180,551	64,167	174,566	-	238,732	-	12,400	251,132	70,581
Jul 2004	8,000	3,000	11,000	6,732	13,832	20,564	114,936	10,000	-	26,226	182,726	43,212	141,143	-	184,355	-	12,400	196,755	14,029
Aug 2004	8,000	3,000	11,000	6,732	13,832	20,564	114,936	10,000	-	75,623	232,123	32,941	134,007	-	166,948	-	12,400	179,348	(52,775)
Sep 2004	8,000	3,000	11,000	6,732	13,832	20,564	114,936	10,000	-	35,944	192,444	95,634	123,654	-	219,289	-	12,400	231,689	39,245
FY04	96,000	36,000	132,000	120,784	161,784	282,568	1,379,232	120,000	1,596,485	669,359	4,179,644	1,367,104	1,816,193	665,255	3,848,552	-	148,800	3,997,352	(182,294)

Tank 50 emptied to Saltstone

Appendix J.3 - Material Balance (Super Stretch Case)

End of Month/Year	Influents (gallons)											Effluents (gallons)							Net-Out
	F Canyon			H Canyon			DWPF Recycle	Other	Inhibited Water	Jet Dilution	**Total In**	Space Recovery from Evaporation				Salt Solution to Processing	Sludge to ESP/DWPF	**Tot-Out**	
	LHW	HHW	**F-Can Total**	LHW	HHW	**H-Can Total**						2F Evaps	2H Evaps	3H Evaps	**Total**				
FY05	96,000	61,200	**157,200**	100,388	163,788	**264,176**	844,152	120,000	480,000	808,591	**2,674,119**	824,937	1,689,525	1,232,522	**3,746,983**	-	74,400	**3,821,383**	**1,147,267**
FY06	96,000	40,800	**136,800**	125,200	265,200	**390,400**	606,576	70,000	600,000	522,335	**2,326,111**	457,131	1,218,608	1,652,892	**3,328,630**	-	50,161	**3,378,791**	**1,052,683**
FY07	96,000	36,000	**132,000**	131,200	403,200	**534,400**	1,173,216	-	900,000	663,535	**3,403,151**	559,593	984,968	1,033,192	**2,577,753**	-	128,520	**2,706,268**	**(696,882)**
FY08	96,000	36,000	**132,000**	47,600	375,300	**422,900**	1,173,216	-	1,385,000	592,668	**3,705,784**	528,317	857,614	1,605,738	**2,991,672**	-	125,842	**3,117,512**	**(588,274)**
FY09	120,000	120,000	**240,000**	-	120,000	**120,000**	1,173,216	-	276,553	375,472	**2,185,241**	565,445	954,833	225,763	**1,746,043**	-	315,840	**2,061,883**	**(123,358)**
FY10	120,000	120,000	**240,000**	-	120,000	**120,000**	1,348,800	-	3,722,873	610,398	**6,042,071**	-	1,492,146	884,812	**2,376,957**	3,000,000	315,840	**5,692,797**	**(349,269)**
FY11	120,000	-	**120,000**	-	-	-	2,194,032	-	4,046,005	870,100	**7,230,137**	-	1,193,065	2,617,829	**3,810,891**	6,000,000	253,820	**10,064,712**	**2,834,575**
FY12	80,000	-	**80,000**	-	-	-	2,194,032	-	3,891,748	606,271	**6,772,051**	-	2,208,273	120,278	**2,328,551**	6,000,000	168,000	**8,496,552**	**1,724,501**
FY13	-	-	-	-	-	-	2,194,032	-	8,362,510	1,011,148	**11,567,692**	-	2,285,394	2,227,247	**4,512,640**	5,872,990	168,000	**10,553,630**	**(1,014,064)**
FY14	-	-	-	-	-	-	2,194,032	-	3,714,774	759,632	**6,668,438**	-	2,266,477	639,927	**2,906,404**	6,000,000	157,660	**9,064,064**	**2,395,626**
FY15	-	-	-	-	-	-	2,194,032	-	3,077,313	841,674	**6,113,019**	-	2,257,175	341,199	**2,598,374**	6,000,000	159,360	**8,757,735**	**2,644,716**
FY16	-	-	-	-	-	-	2,194,032	-	4,523,266	645,597	**7,362,895**	-	3,229,225	2,625,150	**5,854,376**	5,967,440	159,360	**11,981,176**	**4,618,282**
FY17	-	-	-	-	-	-	2,194,032	-	2,366,990	637,276	**5,198,299**	-	2,365,812	-	**2,365,812**	5,938,037	187,860	**8,491,709**	**3,293,411**
FY18	-	-	-	-	-	-	2,194,032	-	3,734,653	480,504	**6,409,188**	-	502,724	-	**502,724**	5,948,227	195,360	**6,646,312**	**237,125**
FY19	-	-	-	-	-	-	2,194,032	-	3,787,009	866,750	**6,847,791**	-	4,061,304	2,171,215	**6,232,519**	5,980,573	190,320	**12,403,411**	**5,555,621**
FY20	-	-	-	-	-	-	2,194,032	-	4,466,201	802,043	**7,462,276**	-	2,408,461	1,730,451	**4,138,910**	6,000,000	175,200	**10,314,111**	**2,851,835**
FY21	-	-	-	-	-	-	2,194,032	-	5,352,575	671,685	**8,218,293**	-	2,298,705	415,141	**2,713,846**	5,999,200	131,134	**8,844,179**	**625,886**
FY22	-	-	-	-	-	-	2,148,323	-	2,465,802	547,313	**5,161,438**	-	3,137,424	-	**3,137,424**	6,794,221	160,704	**10,092,349**	**4,930,911**
FY23	-	-	-	-	-	-	777,053	-	607,990	306,920	**1,691,963**	-	906,418	-	**906,418**	6,834,221	160,704	**7,901,343**	**6,209,380**

Notes:

1) Discussion of the components of the Influents and Effluents is contained in Section 8.1.3 “HLW System Material Balance”

Appendix J.4 — Salt Solution Processing (Super Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A	B	C	D	E	F	G	H	I	J	K	L	M	N
Salt Batch	Feed Tank	Date to Begin Blending	Source Tank	Feed Volume (kgal)	Feed Type	Start Feed to Salt Processing	TPB Used (kgal)	Sludge Batch	PHA Waste Loading (wt%)	Decontaminated Salt Solution to Saltstone (kgal)	ETF to Saltstone (kgal)	Grout Produced (kgal)	Vault #s
SPT001	48	12/24/09	Heel	-		4/1/10	59.0	5	17.6%	1,653	180	3,245	4
			21	104,000	ls								
			50	200,000	cs								
			47	900,000	ds								
SPT002	49	5/9/10	Heel	250,000		6/20/10	62.2	5	17.5%	1,696		3,001	4
			14	452,533	ds								
			21	125,000	ls								
			47	400,000	ds								
SPT003	48	6/20/10	Heel	2,160		9/12/10	61.6	5	17.6%	1,575		2,788	4
			50	250,000	cs								
			33	450,000	cs								
			47	500,000	ds								
SPT004	49	9/12/10	Heel	16,634		12/6/10	56.5	5	17.9%	1,685	180	3,301	1
			47	623,000	ds								
			21	75,000	ls								
			33	306,500	cs								
			50	200,000	cs								
SPT005	48	12/6/10	Heel	160		2/20/11	58.8	5	17.6%	1,596		2,826	2
			50	200,000	cs								
			33	400,000	cs								
			47	450,000	ds								
			42	95,000	cs								
			21	75,000	ls								
SPT006	49	2/20/11	Heel	19,314		5/12/11	58.7	5	17.4%	1,580		2,797	2
			2	998,000	ds			6	15.0%				
			50	110,000	cs								
			21	95,000	ls								
SPT007	48	5/12/11	Heel	18,960		7/29/11	67.4	6	15.2%	1,611		2,852	2
			2	812,977	ds								
			50	160,000	cs								
			8	230,542	cs								

Appendix J.4 — Salt Solution Processing (Super Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT008	49	7/29/11	Heel	20,434		10/24/11	68.1	6	15.3%	1,610	180	3,169	2
			33	367,419	cs								
			21	70,000	ls								
			26	730,000	cs								
			50	20,000	cs								
SPT009	50	9/1/11	Heel	14,040		1/19/12	64.4	6	15.0%	1,698		3,005	3
			1	1,100,000	ds								
			30	90,000	cs								
			21	18,000	ls								
SPT010	48	10/24/11	Heel	20,620		4/14/12	71.2	6	15.6%	1,629		2,883	3
			1	570,082	ds								
			30	200,000	cs								
			8	373,934	cs								
			21	50,000	ls								
SPT011	49	1/19/12	Heel	5,350		7/11/12	58.8	6	15.0%	1,575		2,787	3
			3	850,000	ds								
			26	315,000	cs								
			21	50,000	ls								
SPT012	50	4/14/12	Heel	20,360		9/28/12	55.7	6	14.8%	1,613	180	3,173	3
			3	964,473	ds								
			26	218,600	cs								
			21	18,000	ls								
SPT013	48	7/11/12	Heel	12,397		12/13/12	64.3	6	15.5%	1,498		2,651	5
			10	708,727	ds								
			30	200,000	cs								
			21	190,000	ls								
SPT014	49	9/28/12	Heel	18,950		3/4/13	57.3	6	14.8%	1,674		2,963	5
			9	1,050,000	ds								
			30	103,000	cs								
			21	50,000	ls								

Appendix J.4 — Salt Solution Processing (Super Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A	B	C	D	E	F	G	H	I	J	K	L	M	N
Salt Batch	Feed Tank	Date to Begin Blending	Source Tank	Feed Volume (kgal)	Feed Type	Start Feed to Salt Processing	TPB Used (kgal)	Sludge Batch	PHA Waste Loading (wt%)	Decontaminated Salt Solution to Saltstone (kgal)	ETF to Saltstone (kgal)	Grout Produced (kgal)	Vault #s
SPT015	50	12/13/12	Heel	19,476		5/21/13	63.9	6	15.3%	1,565		2,771	5
			9	858,273	ds								
			26	250,000	cs								
			21	50,000	ls								
SPT016	48	3/4/13	Heel	-		8/11/13	41.1	6	13.7%	1,638		2,900	5
			41	995,997	ds								
			26	200,000	cs								
SPT017	49	5/21/13	Heel	20,069		10/15/13	46.3	6	14.1%	1,677	180	3,286	6
			41	965,058	ds								
			26	237,395	cs								
SPT018	50	8/11/13	Heel	-		12/23/13	52.8	6	14.5%	1,692		2,994	6
			41	850,000	ds			7	11.8%				
			30	220,000	cs								
			21	150,000	ls								
SPT019	48	10/15/13	Heel	-		3/25/14	55.3	7	12.1%	1,653		2,926	6
			41	781,000	ds								
			30	239,965	cs								
			21	200,000	ls								
SPT020	49	12/23/13	Heel	20,620		6/26/14	18.6	7	9.2%	1,658		2,934	7
			41	814,600	ds								
			30	387,000	ds								
SPT021	50	3/25/14	Heel	18,800		8/20/14	48.4	7	11.7%	1,730		3,062	7
			30	391,129	cs								
			25	710,000	ds								
			35	100,000	cs								
SPT022	48	6/26/14	Heel	19,804		11/15/14	48.1	7	11.7%	1,671	180	3,276	7
			25	870,000	ds								
			38	129,892	cs								
			42	202,816	cs								
SPT023	49	8/20/14	Heel	20,284		2/8/15	37.4	7	11.1%	1,642		2,907	7
			25	1,129,990	ds								
			42	72,256	cs								

Appendix J.4 — Salt Solution Processing (Super Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A	B	C	D	E	F	G	H	I	J	K	L	M	N
Salt Batch	Feed Tank	Date to Begin Blending	Source Tank	Feed Volume (kgal)	Feed Type	Start Feed to Salt Processing	TPB Used (kgal)	Sludge Batch	PHA Waste Loading (wt%)	Decontaminated Salt Solution to Saltstone (kgal)	ETF to Saltstone (kgal)	Grout Produced (kgal)	Vault #s
SPT024	50	11/15/14	Heel	17,974		4/23/15	47.3	7	11.7%	1,643		2,908	8
			25	935,692	ds								
			42	268,776	cs								
SPT025	48	2/8/15	Heel	20,620		7/16/15	43.0	7	11.3%	1,659		2,937	8
			38	875,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			21	65,000	ls								
SPT026	49	4/23/15	Heel	20,620		10/5/15	42.8	7	11.4%	1,659	180	3,255	8
			38	875,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			21	65,000	ls								
SPT027	50	7/16/15	Heel	20,620		12/25/15	41.1	7	11.4%	1,643		2,908	9
			38	875,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			21	65,000	ls								
SPT028	48	10/5/15	Heel	20,620		3/11/16	40.7	7	11.4%	1,633		2,890	9
			38	875,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			21	65,000	ls								

Appendix J.4 — Salt Solution Processing (Super Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A	B	C	D	E	F	G	H	I	J	K	L	M	N
Salt Batch	Feed Tank	Date to Begin Blending	Source Tank	Feed Volume (kgal)	Feed Type	Start Feed to Salt Processing	TPB Used (kgal)	Sludge Batch	PHA Waste Loading (wt%)	Decontaminated Salt Solution to Saltstone (kgal)	ETF to Saltstone (kgal)	Grout Produced (kgal)	Vault #s
SPT029	49	12/25/15	Heel	12,220		5/27/16	39.8	7	11.2%	1,653		2,925	9
			38	415,604	ds								
			27	475,000	ds								
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			23	65,000	ls								
SPT030	50	3/11/16	Heel	12,220		8/12/16	38.7	7	11.1%	1,625		2,876	9
			27	870,000	ds			8	17.3%				
			34	100,000	cs								
			35	75,000	cs								
			30	75,000	cs								
			23	65,000	ls								
SPT031	48	5/27/16	Heel	3,820		10/26/16	38.0	8	17.2%	1,646	180	3,233	10
			34	100,000	cs								
			27	900,000	ds								
			35	75,000	cs								
			30	75,000	cs								
			23	65,000	ls								
SPT032	49	8/12/16	Heel	20,048		12/13/16	38.5	8	17.2%	1,670		2,956	10
			34	100,000	cs								
			27	900,000	ds								
			35	75,000	cs								
			30	75,000	cs								
			41	65,000	ls								
SPT033	50	10/26/16	Heel	-		1/31/17	42.9	8	17.7%	1,673		2,961	10
			27	594,140	cs								
			29	295,000	ds								
			34	128,674	ds								
			35	75,000	cs								
			41	65,000	ls								
			30	63,936	cs								

Appendix J.4 — Salt Solution Processing (Super Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT034	48	12/13/16	Heel	-		3/24/17	46.5	8	18.0%	1,638		2,900	10
			37	1,221,750	ds								
SPT035	49	1/31/17	Heel	-		5/17/17	40.4	8	18.0%	1,519		2,689	11
			29	900,000	ds								
			35	150,000	cs								
			23	106,720	ls								
SPT036	50	3/24/17	Heel	20,620		7/4/17	36.4	8	17.1%	1,697		3,004	11
			29	445,000	ds								
			34	628,142	ds								
			37	48,870	ds								
			35	79,911	cs								
SPT037	48	5/17/17	Heel	20,620		8/20/17	43.5	8	17.7%	1,726		3,055	11
			29	930,000	ds								
			30	50,000	cs								
			35	125,000	cs								
			42	96,923	cs								
SPT038	49	7/4/17	Heel	-		10/12/17	32.8	8	16.6%	1,727	180	3,375	12
			29	839,980	ds								
			42	360,000	cs								
SPT039	50	8/20/17	Heel	20,620		11/27/17	46.6	8	18.0%	1,604		2,840	12
			28	850,000	ds								
			42	270,000	cs								
			35	60,000	cs								
SPT040	48	10/12/17	Heel	20,620		1/19/18	43.7	8	18.0%	1,566		2,772	12
			28	850,000	ds								
			42	168,725	cs								
			38	100,000	ls								
			35	50,000	cs								
SPT041	49	11/27/17	Heel	-		3/11/18	43.0	8	18.0%	1,624		2,874	12
			28	965,000	ds								
			38	175,000	ls								
			35	60,000	cs								

Appendix J.4 — Salt Solution Processing (Super Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT042	50	1/19/18	Heel	-		5/1/18	48.0	8	18.2%	1,543		2,732	13
			28	340,000	ds								
			38	800,000	ls								
			35	60,000	cs								
SPT043	48	3/11/18	Heel	-		6/24/18	47.7	8	18.0%	1,672		2,959	13
			28	394,000	ds								
			43	805,000	cs								
SPT044	49	5/1/18	Heel	-		8/19/18	49.9	8	18.2%	1,647		2,915	13
			43	275,012	cs								
			44	865,000	ds								
			35	50,000	cs								
SPT045	50	6/24/18	Heel	-		10/14/18	46.9	8	18.0%	1,666	180	3,267	13
			44	1,170,000	ds								
			35	50,000	cs								
SPT046	48	8/19/18	Heel	-		12/7/18	46.4	8	18.0%	1,646		2,913	14
			44	1,155,000	ds								
			35	50,000	cs								
SPT047	49	10/14/18	Heel	-		1/30/19	50.3	8	18.0%	1,642		2,907	14
			44	138,665	ds								
			45	1,015,000	ds								
			35	50,000	cs								
SPT048	50	12/7/18	heel	18,800		3/29/19	49.6	8	18.0%	1,650		2,921	14
			45	1,098,000	ds			9	17.9%				
			35	50,000	cs								
			43	55,000	cs								
SPT049	48	1/30/19	heel	3,200		5/25/19	50.3	9	17.9%	1,637		2,898	14
			45	1,150,000	ds								
			29	50,000	cs								
SPT050	49	3/29/19	heel	1,812		7/21/19	45.9	9	18.2%	1,681		2,975	15
			45	508,018	ds								
			46	595,000	ds								
			29	100,000	cs								

Appendix J.4 — Salt Solution Processing (Super Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A	B	C	D	E	F	G	H	I	J	K	L	M	N
Salt Batch	Feed Tank	Date to Begin Blending	Source Tank	Feed Volume (kgal)	Feed Type	Start Feed to Salt Processing	TPB Used (kgal)	Sludge Batch	PHA Waste Loading (wt%)	Decontaminated Salt Solution to Saltstone (kgal)	ETF to Saltstone (kgal)	Grout Produced (kgal)	Vault #s
SPT051	50	5/25/19	heel	19,920		9/12/19	45.5	9	18.2%	1,740		3,080	15
			46	1,050,000	ds								
			29	150,000	cs								
SPT052	48	7/21/19	heel	1,200		11/4/19	44.8	9	18.3%	1,716	180	3,356	15
			46	1,050,000	ds								
			29	150,000	cs								
SPT053	49	9/12/19	heel	2,950		12/26/19	35.9	9	19.4%	1,723		3,050	16
			46	1,116,857	ds								
			29	102,056	cs								
SPT054	50	11/4/19	heel	17,920		2/6/20	45.4	9	19.0%	1,735		3,070	16
			31	1,075,000	ds								
			29	129,520	cs								
SPT055	48	12/26/19	heel	-		3/28/20	50.7	9	18.7%	1,753		3,103	16
			31	1,060,000	ds								
			29	161,750	cs								
SPT056	49	2/6/20	heel	20,620		5/23/20	47.5	9	18.7%	1,742		3,083	16
			31	1,060,000	ds								
			29	141,923	cs								
SPT057	50	3/28/20	heel	20,620		7/16/20	47.1	9	18.7%	1,715		3,036	17
			31	443,361	ds								
			36	685,000	ds								
			29	73,562	cs								
SPT058	48	5/23/20	heel	20,620		9/7/20	46.8	9	18.7%	1,702		3,013	17
			36	1,160,000	ds								
			29	41,923	cs								
SPT059	49	7/16/20	heel	20,620		10/29/20	47.0	9	18.7%	1,712	180	3,349	17
			36	1,160,000	ds								
			29	41,923	cs								
SPT060	50	9/7/20	heel	20,620		12/21/20	44.7	9	18.7%	1,715		3,036	18
			36	817,240	ds			10	18.7%				
			29	44,683	cs								
			37	340,000	ds								

Appendix J.4 — Salt Solution Processing (Super Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A Salt Batch	B Feed Tank	C Date to Begin Blending	D Source Tank	E Feed Volume (kgal)	F Feed Type	G Start Feed to Salt Processing	H TPB Used (kgal)	I Sludge Batch	J PHA Waste Loading (wt%)	K Decontaminated Salt Solution to Saltstone (kgal)	L ETF to Saltstone (kgal)	M Grout Produced (kgal)	N Vault #s
SPT061	48	10/29/20	heel	20,620		2/10/21	48.6	10	18.5%	1,722		3,047	18
			37	1,100,000	ds								
			29	101,923	cs								
SPT062	49	12/21/20	heel	20,620		4/6/21	16.5	10	17.6%	1,681		2,975	18
			37	681,000	ds								
			42	520,851	cs								
SPT063	50	2/10/21	heel	20,620		5/3/21	41.6	10	18.5%	1,699		3,007	18
			37	1,134,270	ds								
			29	67,653	cs								
SPT064	48	4/6/21	heel	20,620		6/21/21	35.5	10	19.6%	1,780		3,151	19
			43	1,000,000	cs								
			29	150,000	cs								
			IW	54,000									
SPT065	49	5/3/21	heel	20,620		8/1/21	136.4	10	15.9%	1,963		3,475	19
			32	948,909	cs								
			IW	263,135									
SPT066	50	6/21/21	heel	20,620		1/5/22	156.5	10	15.4%	2,065	180	3,974	19
			39	980,000	cs								
			IW	230,000									
SPT067	48	8/1/21	heel	20,620		7/8/22	22.5	10	15.4%	284		503	19
			39	137,546	cs								
			IW	3,190									

Appendix J.4 — Salt Solution Processing (Super Stretch Case)

	Waste Removal					Salt Processing		DWPF		Saltstone			
A	B	C	D	E	F	G	H	I	J	K	L	M	N
Salt Batch	Feed Tank	Date to Begin Blending	Source Tank	Feed Volume (kgal)	Feed Type	Start Feed to Salt Processing	TPB Used (kgal)	Sludge Batch	PHA Waste Loading (wt%)	Decontaminated Salt Solution to Saltstone (kgal)	ETF to Saltstone (kgal)	Grout Produced (kgal)	Vault #s

Notes:

A) Each Salt Batch consists of a tank of blended dissolved salt solution to comprise a consistent feed stock. Each batch is individually tested and confirmed to meet processing qualification specifications.

B) Tank that is filled with a blended solution of feed stock ready for salt processing. The feed tanks for salt processing include Tanks 48, 49, and 50. Because of limited tank space at the time of initial salt processing, only Tanks 48 and 49 are available to feed.

C) Date when the first supernate solution is transferred into the salt processing feed tank.

D) The primary source of the supernate solution. The "heel" is the volume that is left over from the previous batch. "IW" refers to inhibited water.

E) The volume that is transferred from the source tank.

F) "cs" - Concentrated supernate. Does not originate from a solid salt cake.
"ls" - Light supernate. Generally supernate with a specific gravity of less than 1.2. Usually applied to DWPF recycle water.
"ds" - Dissolved salt solution. Originates from a salt cake dissolution process.

G) Date when the first salt solution is fed to the Salt Processing Facility.

H) Tetra-phenyl borate solution required to precipate the cesium to below Salt Stone waste acceptance criteria limits.

I) Sludge Batch number which is coupled with the salt processing batch.

J) Canister waste loading of precipitate hydrolysis aqueous (PHA).

K) Liquid volume of decontaminated salt solution from the Salt Processing Facility sent to Saltstone. Volume is shown for first salt batch in a fiscal year. This forecast volume would actually be received over the entire year at a rate of ~15 kgal per year.

L) Liquid volume of ETF concentrate sent to Saltstone.

M) Volume of grout that occupies vault storage space.

N) Corresponding Saltstone vault ID numbers. With a permanent roof, each cell measures 98.5 x 98.5 x 25 feet = 242,500 cu-ft. Existing Vault #1 has 6 cells, of which 3.5 are filled. Vault #4 has 12 cells, of which 1 is filled. New vaults will have 6 cells each. Vault # fill sequence to be 4, 1, 2, 3, 5, 6, 7, ... etc.

Appendix J.5 – Sludge Processing (Super Stretch Case)

	Waste Removal		ESP Pretreatment							DWPF Vitrification						
A Sludge Batch	B Source Tanks	C Sludge Content (kg)	D Feed Prep Start Date	E Feed Prep Total Dur. (months)	F Total ESP Water Vol. (kgal)	G Na (wt% dry)	H Hg (wt% dry)	I Total Solids (wt%)	J Pretreated Volume (kgal)	K Feed Volume (kgal)	L Start Feed	M Canister Yield	N Feed Duration (years)	O Finish Feed	P Feed Tank	Q Sludge Loading (wt %)
1A	51	298,000			na	8.80		16.4	491	491	3/1/96	492	2.75	8/30/98	51	25.0
										-140	(Tk 51 heel @ 40 ")					
										351						
1B	42	420,861			na	7.77	0.30	16.5	460	460	10/1/98	738	3.00	9/30/01	51	25.0
	total	420,861										(Includes use of 80 cans of Tank 51 heel)				
2	8	182,451			1,977	8.75	0.30	16.0	456	456	1/1/02	471	2.19	3/10/04	40	28.0
	40	179,098								-140	(Assumes DWPF outage in 1stQ FY02)					
	total	361,549								316						
3	7(70%)	288,957	11/16/02	16	3,156	8.70	0.10	16.0	540	540	3/10/04	395	2.54	9/24/06	51	29.0
	18(70%)	14,777														
	19(70%)	1,956														
	total	305,690														
4	7(30%)	123,839	9/6/05	13	1,199	9.44	1.60	16.0	451	451	10/1/06	406	2.03	10/10/08	40	30.5
	11	124,380														
	18(30%)	6,333														
	19(30%)	838														
	total	255,390														
5	15	165,818	5/19/07	17	2,285	11.51	1.50	16.0	567	567	10/10/08	469	2.47	3/30/11	51	29.4
	26	154,896									(Assume coupled salt and sludge feed starts in April 2010)					
	total	320,714														
6	5	57,630	11/5/09	17	2,815	8.70	2.20	16.0	727	727	3/30/11	598	2.39	8/19/13	40	31.6
	6	38,708														
	12	189,715														
	13(30%)	125,280														
	total	411,333														
7	13(70%)	292,320	3/27/12	17	2,862	9.08	1.90	16.0	743	743	8/19/13	652	2.61	3/28/16	51	29.8
	4	65,477														
	33	62,401														
	total	420,198														
8	21	6,393	12/4/14	16	2,034	8.76	1.30	16.0	677	677	3/28/16	584	2.34	7/29/18	40	27.8
	22	13,265														
	23	59,110														
	34	77,119														
	39	89,474														
	47	137,763														
	total	383,124														
9	32	214,886	4/5/17	16	1,846	10.06	4.90	16.0	472	472	7/29/18	387	1.55	2/14/20	51	28.8
	43	51,940														
		266,826														

Appendix J.5 – Sludge Processing (Super Stretch Case)

	Waste Removal		ESP Pretreatment							DWPF Vitrification						
A Sludge Batch	B Source Tanks	C Sludge Content (kg)	D Feed Prep Start Date	E Feed Prep Total Dur. (months)	F Total ESP Water Vol. (kgal)	G Na (wt% dry)	H Hg (wt% dry)	I Total Solids (wt%)	J Pretreated Volume (kgal)	K Feed Volume (kgal)	L Start Feed	M Canister Yield	N Feed Duration (years)	O Finish Feed	P Feed Tank	Q Sludge Loading (wt %)
10	ESP Heels (Tks 40,42,51)	158,377	11/21/18	15	1,877	8.24	4.90	16.0	913	913	2/14/20	679	2.72	11/1/22	40	31.6
	35	138,956														
	Other Insoluble Solids	219,000														
	total	516,333														
Totals		3,662,018			20,051	Total Estimated Washwater						5,871	Total Estimated Cans			

Notes:

General) Above based on the following yearly canister production values: FY01 255 cans/yr, FY02 150 cans/yr, FY03 240 cans/yr, FY04 240 cans/yr, FY05 150 cans/yr, FY06 115 cans/yr, FY07-FY09 200 cans/yr, FY10 150 cans/yr, FY11-End 250 cans/yr.

A) Each Sludge Batch must be individually tested and confirmed to meet waste qualification spedifications

B) Sludge in these tanks will comprise the batch. Note: 100% of the sludge from Tanks 7, 18&19 will be moved to ESP to support Sludge Batch 3. However, 30% of this sludge will be combined with Tank 11 sludge to make Sludge Batch 4.

C) Amount of sludge from each source tank in the batch obtained from WCS data base

D) Feed Prep start date is the date that sludge is first moved into the the ESP feed tank (40 or 51) to begin preparation of the sludge batch (i.e. obtain proper alkali composition of the sludge slurry for feed to DWPF)

E) Total planned duration of transfers, washing, sampling, test glass production, and associated decants for the preparation of a sludge batch for feed to DWPF

F) Total estimated volume of sludge transfer water and wash water decants to obtain target soluble Na concentration for feed to DWPF

G) Amount of total Na in washed sludge (dry basis)

H) Amount of total Hg in washed sludge (dry basis)

I) Total solids (soluble and insoluble) in washed sludge

J) Volume of sludge at given wt% total solids before heel effects (Batch 1B is actual. Batch 2 is projected from detailed analysis. Batch 3 and beyond are based on ratio of batch sludge kg values converted to gallons and adjusted from an estimated 25 wt% solids to 16 wt% solids)

K) Volume of sludge available for feed after adding or subtracting pump heel

L) Start feed date based on depletion of previous batch down to pump heel

M) Estimated number of canisters produced given the pretreatment as shown. Numbers are actual for Batch 1A and estimated for remaining batches. Coupled Salt and Sludge Feed assumed to start with Batch 5.

N) Column O divided by the planned canister production during the period in which the batch is vitrified. See production note under General Section above.

O) Column N plus column P. Finish Feed means when the last transfer of feed is sent from the Feed Tank. The last canister for the batch will be poured later. The DWPF has approximately 25 canisters of feed in process. Therefore 25 more canisters will be produced from the batch after the last feed is sent to DWPF.

P) Batch feed tank

Q) Weight % of glass comprised of sludge oxides.

Appendix J.6 - Canister Storage (Super Stretch Case)

End of FY	SRS Cans Produced		SRS Cans in GWSB #1 (2,159 max)			SRS Cans in Modular Storage (2 buildings @ 585)			SRS Cans Shipped to Repository		Net Cans Stored At SRS
	Yearly	Cum.	Added	Shipped	Cum.	Added	Shipped	Cum.	Each Year	Cumulative	
1996	64	64	64		64						64
1997	169	233	169		233						233
1998	250	483	250		483						483
1999	236	719	236		719						719
2000	231	950	231		950						950
2001	255	1,205	255		1,205						1,205
2002	150	1,355	150		1,355						1,355
2003	240	1,595	240		1,595						1,595
2004	240	1,835	240		1,835						1,835
2005	150	1,985	150		1,985	0		0			1,985
2006	115	2,100	115		2,100	0		0			2,100
2007	200	2,300	59		2,159	141		141			2,300
2008	200	2,500			2,159	200		341			2,500
2009	200	2,700			2,159	200		541			2,700
2010	150	2,850		(105)	2,054	150		691	105	105	2,745
2011	250	3,100		(205)	1,849	250		941	205	310	2,790
2012	250	3,350	25	(205)	1,669	225		1,166	205	515	2,835
2013	250	3,600	250	(205)	1,714	0		1,166	205	720	2,880
2014	250	3,850	250	(205)	1,759	0		1,166	205	925	2,925
2015	250	4,100	250	(205)	1,804	0		1,166	205	1,130	2,970
2016	250	4,350	250	(205)	1,849	0		1,166	205	1,335	3,015
2017	250	4,600	250	(205)	1,894	0	0	1,166	205	1,540	3,060
2018	250	4,850	250	(205)	1,939	0	0	1,166	205	1,745	3,105
2019	250	5,100	250	(205)	1,984	0	0	1,166	205	1,950	3,150
2020	250	5,350	250	(205)	2,029	0	0	1,166	205	2,155	3,195
2021	250	5,600	250	(205)	2,074	0	0	1,166	205	2,360	3,240
2022	250	5,850	250	(205)	2,119	0	0	1,166	205	2,565	3,285
2023	21	5,871	21	0	2,140	0	(205)	961	205	2,770	3,101
2024	0	5,871		0	2,140	0	(205)	756	205	2,975	2,896
2025	0	5,871		0	2,140	0	(205)	551	205	3,180	2,691
2026	0	5,871		0	2,140	0	(205)	346	205	3,385	2,486
2027	0	5,871		0	2,140	0	(205)	141	205	3,590	2,281
2028	0	5,871		(64)	2,076	0	(141)	0	205	3,795	2,076
2029	0	5,871		(205)	1,871	0	0	0	205	4,000	1,871
2030	0	5,871		(205)	1,666	0	0	0	205	4,205	1,666
2031	0	5,871		(205)	1,461	0	0	0	205	4,410	1,461
2032	0	5,871		(205)	1,256	0	0	0	205	4,615	1,256

Appendix J.6 - Canister Storage (Super Stretch Case)

End of FY	SRS Cans Produced		SRS Cans in GWSB #1 (2,159 max)			SRS Cans in Modular Storage (2 buildings @ 585)			SRS Cans Shipped to Repository		Net Cans Stored At SRS
	Yearly	Cum.	Added	Shipped	Cum.	Added	Shipped	Cum.	Each Year	Cumulative	
2033	0	5,871		(205)	1,051	0	0	0	205	4,820	1,051
2034	0	5,871		(205)	846	0	0	0	205	5,025	846
2035	0	5,871		(205)	641	0	0	0	205	5,230	641
2036	0	5,871		(205)	436	0	0	0	205	5,435	436
2037	0	5,871		(205)	231	0	0	0	205	5,640	231
2038	0	5,871		(205)	26	0	0	0	205	5,845	26
2039	0	5,871		(26)	0	0	0	0	26	5,871	0
2040	0	5,871			0			0	0	5,871	

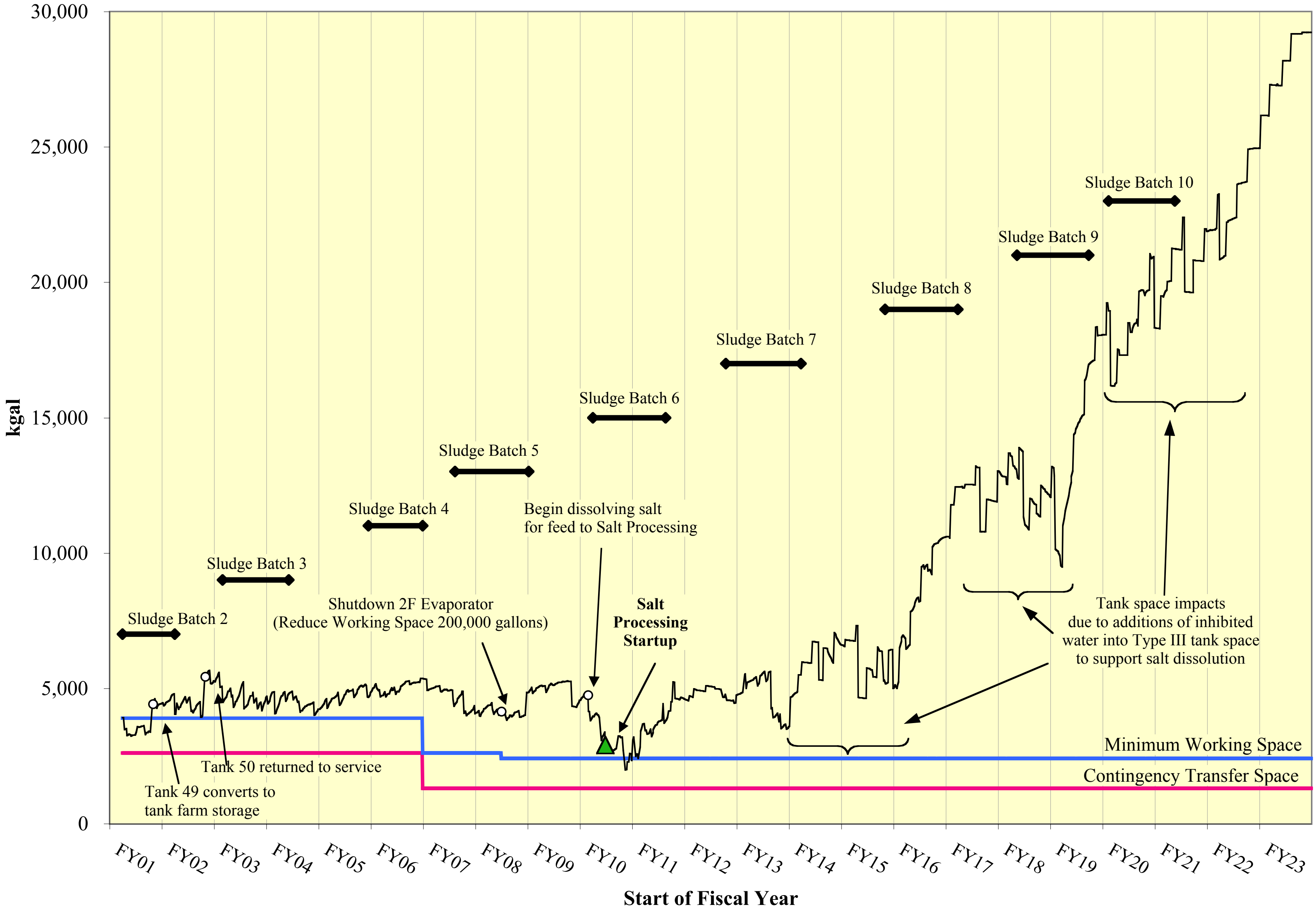
Notes:

1) GWSB #1 filling began in May 1996. Of its 2,286 canister storage locations, 5 positions store non-radioactive test canisters and 122 are unuseable with no viable repair technique. This yields a capacity of 2,159 usable storage locations, including 450 presently unusable location that require modification per an existing plan before they will be useable.
2) GWSB#1 is expected to reach maximum capacity in FY07.
3) Additional glass waste storage locations will be built as privatized modularized buildings, which will be $^{1}/_{4}$ of the size of GWSB #1. The first building, GWSB #2A, will be needed in FY07 and the second building, GWSB #2B, will be needed in FY10. Unless additional canisters are required to complete the program or shipments are delayed to the Federal Repository, these two modularized buildings should meet the programs needs.
4) This Plan assumes that canisters can be transported to the Federal Repository starting in FY10 at a rate of 105 canisters in FY10 and 205 canisters/yr thereafter, until the end of the program.
5) A canister load-out facility will be required to move the canisters from the GWSBs to a railcar. Assume one year for design (FY07) and three years for construction (FY08-10).
6) GWSB #1 will be emptied and available for D&D in FY39.
7) GWSBs #2A and 2B will be emptied and available for D&D in FY26 and FY29 respectively.
8) This Plan does not include possible can-in-canister disposition of excess plutonium.
9) The Plan does not include additional locations in GWSB #2A and 2B for spent fuels materials. These materials could be added and included in these buildings, but would result in the overall need to build one additional privatized modularized building. As information becomes available on the needed locations for Spent Fuel material it will be added into the privatized proposal.

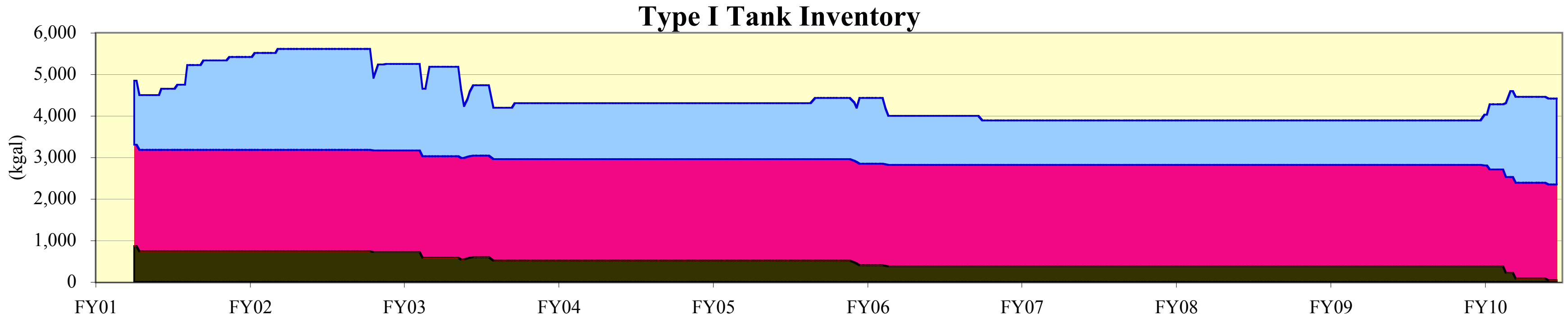
Appendix J.7 — Near Term Saltstone Operations (Super Stretch Case)

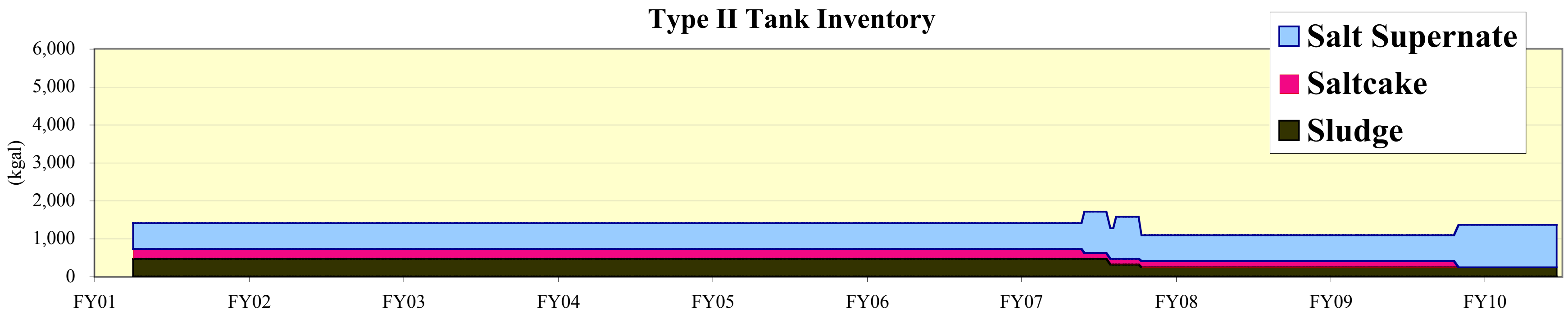
FY	Beginning of year Tk 50 Inventory (Kgal)	ETF Conc (Kgal)	Material Fed to Saltstone (Kgal)	End of year Tk 50 Inven. (Kgal)	Grout Produced (Kgal)	Cum Vault Cells Filled	Active Vault #	Notes:
FY01	(as of 3/1/01) 482	355 (Includes 250 kgal moved from Tank 49)	0	837	0	3.50	---	3.5 cells already filled at the start of FY01. (3.0 cells in Vault 1 and 0.5 cells in Vault 4) Saltstone Facility in partial lay-up (not operating).
FY02	837	180	(1,017)	0	1,800	4.49	4	Saltstone Facility operates to de-inventory Tank 50. Tank 50 mods required for return to waste storage in FY02
FY03	0	180	(180)	0	319	4.67	4	Saltstone Facility operates as required to support ETF.
FY04	0	180	(180)	0	319	4.84	4	Saltstone Facility operates as required to support ETF.
FY05	0	180	(180)	0	319	5.02	4	Saltstone Facility operates as required to support ETF.
FY06	0	180	(180)	0	319	5.19	4	Saltstone Facility operates as required to support ETF.
FY07	0	180	(180)	0	319	5.37	4	Saltstone Facility operates as required to support ETF.
FY08	0	180	(180)	0	319	5.55	4	Saltstone Facility operates as required to support ETF.
FY09	0	180	(180)	0	319	5.72	4	Saltstone Facility operates as required to support ETF.

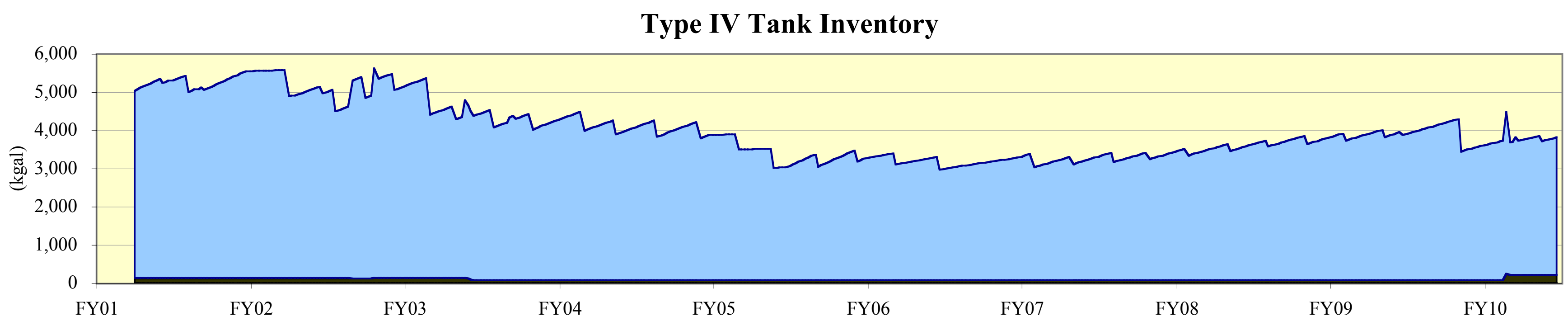
Appendix J.8 Useable Tank Space (Super Stretch Case)



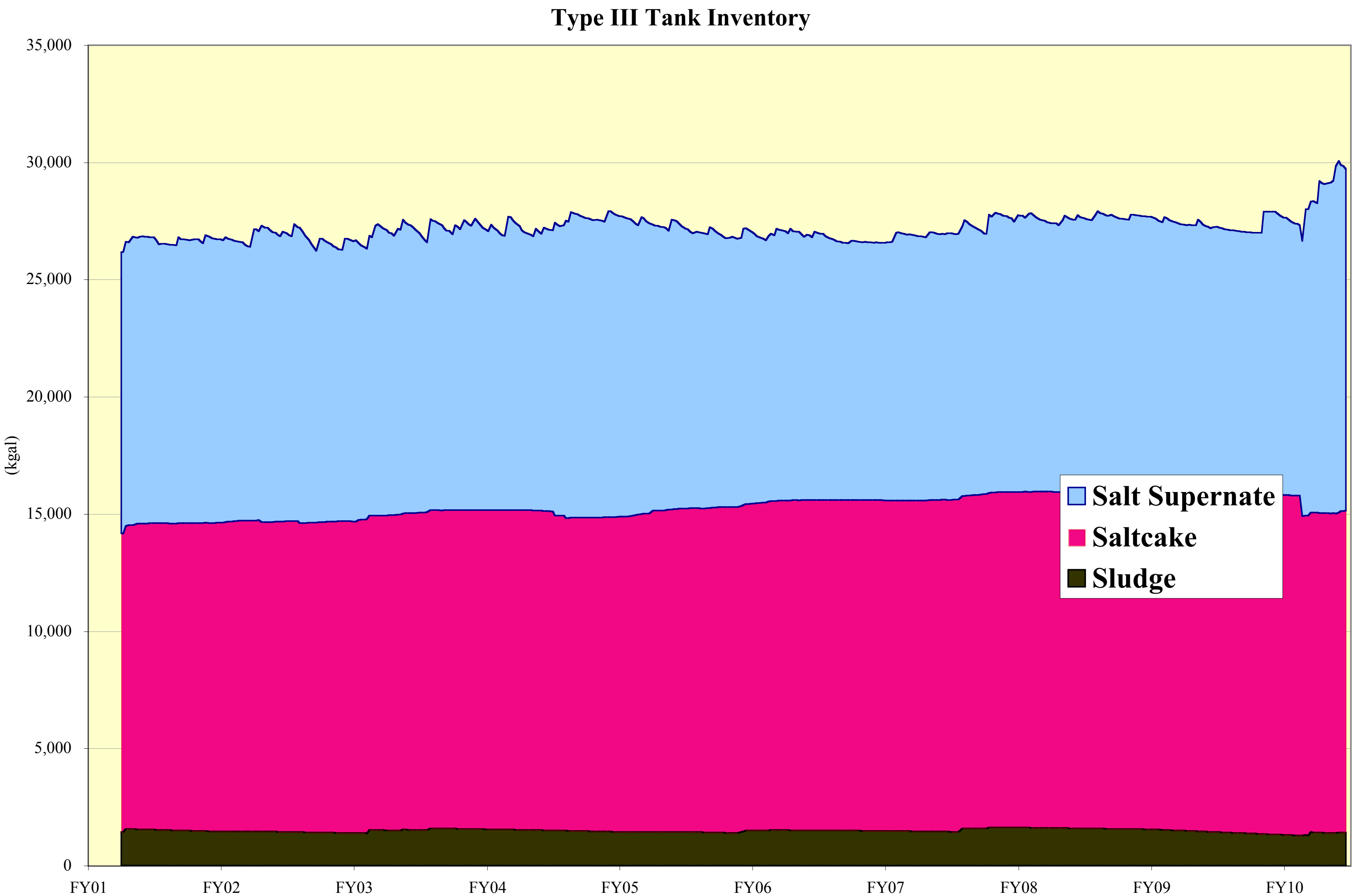
Appendix J.9 — Tank Inventory (Super Stretch Case)



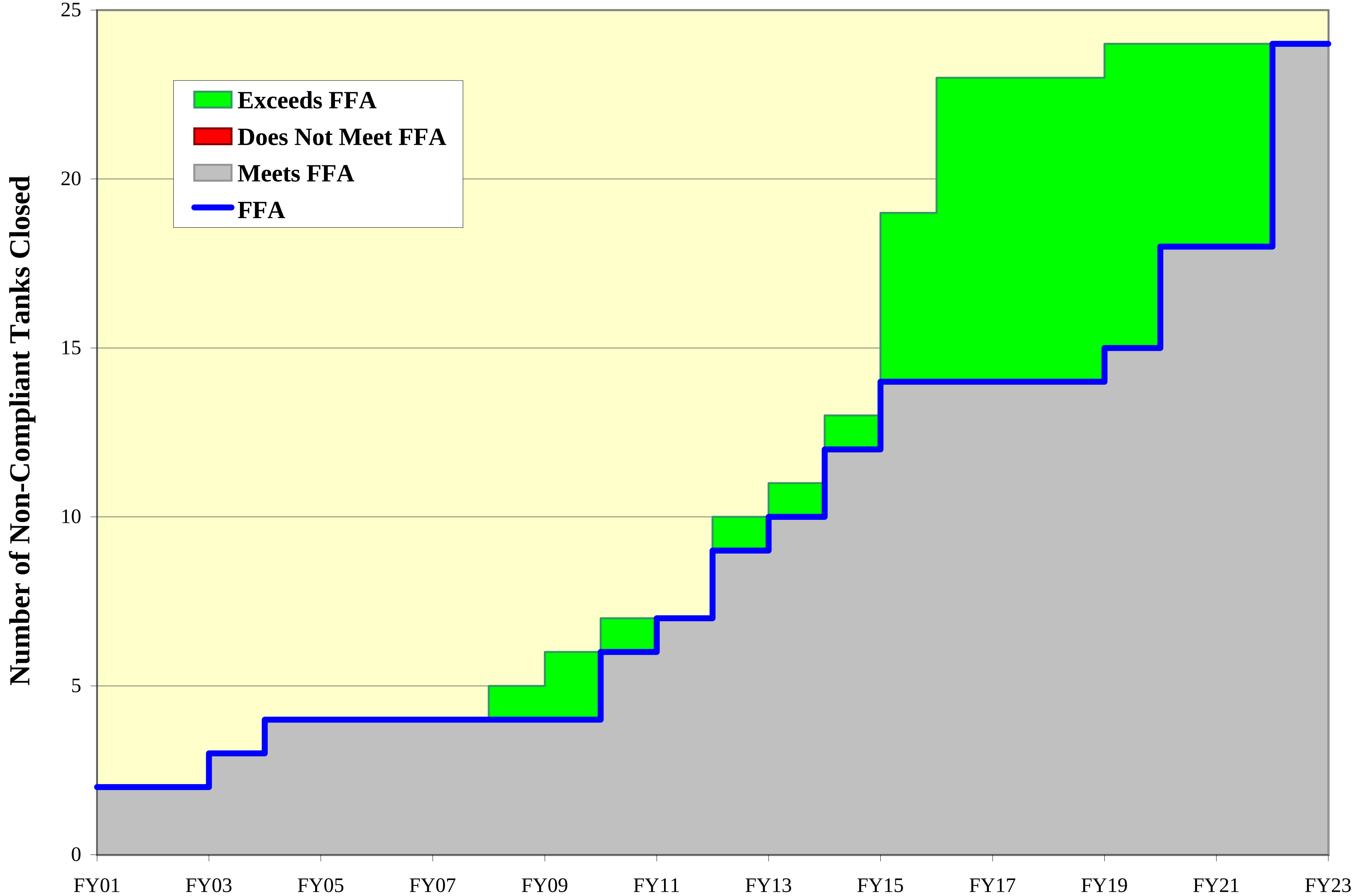




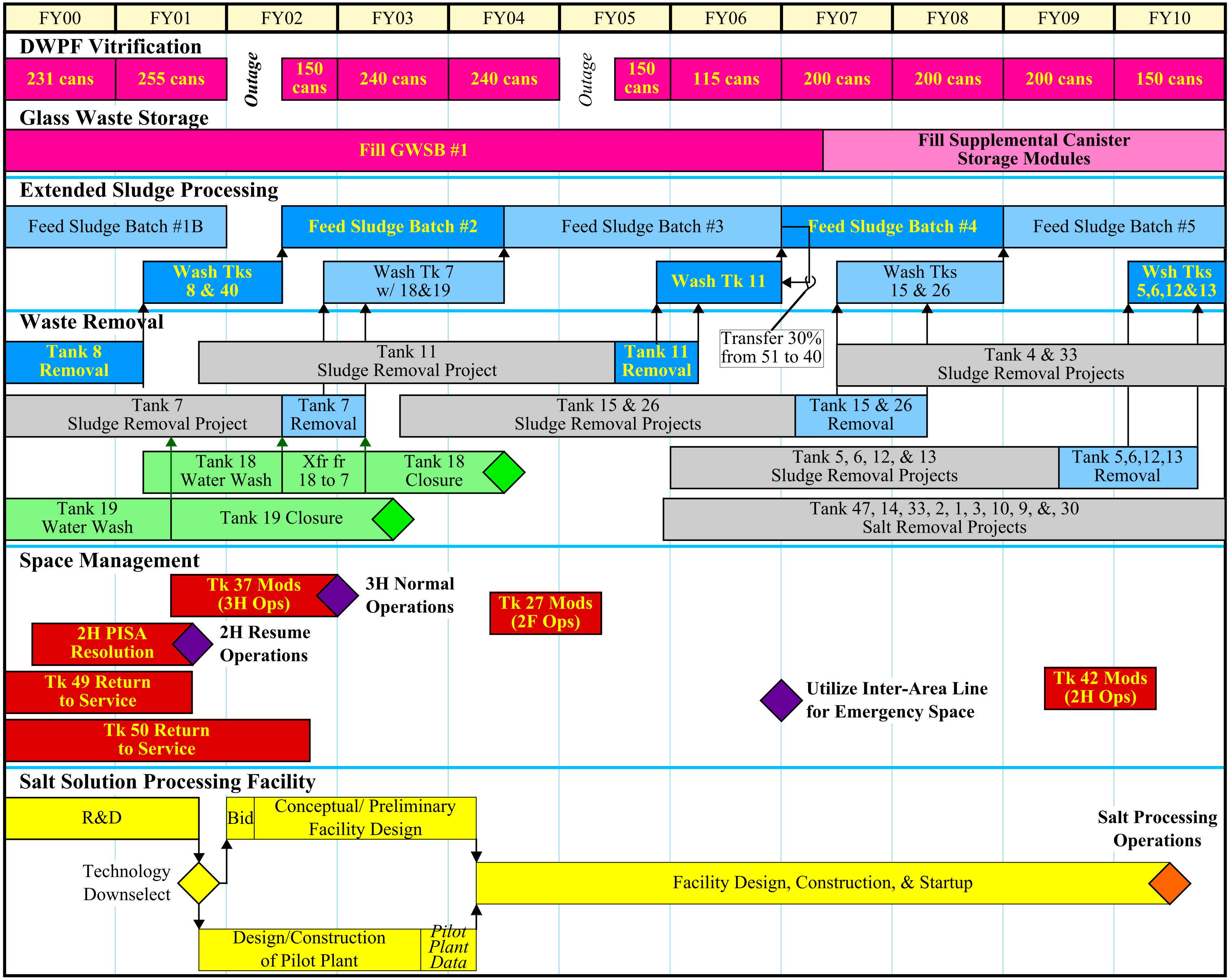
Appendix J.9 — Tank Inventory (Super Stretch Case)



Appendix J.10 - Tank Closures (Super Stretch Case)



Appendix J.11 - Level 1 Schedule (SuperStretch Case)



Appendix K – Execution Strategy

Appendix K provides the detailed production planning information for the Execution strategy. The Execution strategy is a short term strategy which includes information only for the contract period FY01 – FY06. This strategy is success oriented in the early years of the contract which will best position the program for future success if funding can be made available to move to the Super Stretch Case. The reader should not expect that the performance of the HLW System will be able to fully achieve this case, however, it describes the best short term execution strategy that can be envisioned at this time. This information should be used by the employees in the HLW System facilities as a benchmark for expected performance and a reference to the work scope that is authorized for implementation under the contract.

Key Scope Milestone	Execution Strategy
Total Number of Canisters Produced FY01 – FY06	1,150
DWPF Sludge Production (in average canisters per year)	
• FY01	255
• FY02	150
• FY03	240
• FY04	240
• FY05	150
• FY06	115
Canister Storage Locations	
• Make additional 450 GWSB #1 locations usable	FY04
• Begin work on additional Canister Storage locations – 1 Privatized Module	FY04
• Place Privatized Module into Radioactive Operations	FY07
Waste Removal	
• Tank 7 ready for sludge removal	7/02
Tank Closures	
• Complete closure of Tank 19	3/02
• Complete closure of Tank 18	3/04
Key Space Management Activities	
• Reuse Tank 49 for waste storage	9/01
• Reuse Tank 50 for waste storage	9/02
• Tank 37 modification completed for 3H Evaporator Drop Tank	9/02

This appendix provides the following data: Material Balances, Sludge Batch makeup, Canister Storage requirements, Near Term Saltstone Operations, Usable Tank Space estimates and a Level 1 Schedule.

Appendix K.1 - Material Balance (Execution Strategy)

End of Month/Year	Influents (gallons) F Canyon LHW	F Canyon HHW	F-Can Total	H Canyon LHW	H Canyon HHW	H-Can Total	DWPF Recycle	Other	Inhibited Water	Jet Dilution	Total In	Effluents (gallons) Space Recovery from Evaporation 2F Evaps	2H Evaps	3H Evaps	Total	Salt Solution to Processing	Sludge to ESP/DWPF	Tot-Out	Net-Out
Oct 2000	0	32,924	**32,924**	1,650	12,285	**13,935**	144,715	50,026	62,222	12,440		105,434	-	113,303	**218,737**	-	19,656	**Actuals**	**(see Note 2)**
Nov 2000	0	16,883	**16,883**	0	17,800	**17,800**	119,758	11,356	83,278	56,760		1,089	-	(16,111)	**(15,022)**	-	21,762	**Actuals**	**(see Note 2)**
Dec 2000	0	49,491	**49,491**	1,439	21,376	**22,815**	115,928	31,692	0	14,560		(20,849)	-	(9,442)	**(30,291)**	-	15,795	**Actuals**	**(see Note 2)**
Jan 2001	28,500	20,625	**49,125**	3,828	11,025	**14,853**	109,386	16,875	113,410	13,207	**316,856**	72,376	-	34,507	**106,883**	-	10,038	**116,921**	**(199,935)**
Feb 2001	30,000	28,500	**58,500**	5,104	14,700	**19,804**	145,848	22,500	260,091	36,630	**543,373**	101,602	-	39,677	**141,280**	-	13,384	**154,664**	**(388,709)**
Mar 2001	28,000	25,500	**53,500**	5,104	15,220	**20,324**	131,463	22,500	-	54,625	**282,412**	125,909	-	-	**125,909**	-	13,384	**139,293**	**(143,119)**
Apr 2001	30,000	27,500	**57,500**	15,104	15,220	**30,324**	85,410	22,500	30,000	42,580	**268,314**	170,338	-	180,890	**351,228**	-	13,384	**364,612**	**96,298**
May 2001	25,000	28,500	**53,500**	25,104	15,220	**40,324**	125,667	22,500	10,000	39,745	**291,736**	166,684	-	-	**166,684**	-	13,384	**180,068**	**(111,668)**
Jun 2001	18,000	25,500	**43,500**	5,104	15,220	**20,324**	110,281	22,500	460,000	47,113	**703,719**	167,098	-	164,206	**331,304**	-	13,384	**344,688**	**(359,031)**
Jul 2001	15,000	27,500	**42,500**	5,104	15,220	**20,324**	145,848	22,500	-	25,749	**256,921**	85,603	-	-	**85,603**	-	13,384	**98,987**	**(157,934)**
Aug 2001	15,000	28,500	**43,500**	5,104	15,220	**20,324**	145,848	22,500	360,000	59,060	**651,232**	60,594	60,313	101,769	**222,676**	-	13,384	**236,060**	**(415,171)**
Sep 2001	18,000	25,500	**43,500**	5,104	15,220	**20,324**	131,812	22,500	-	58,869	**277,005**	86,686	199,393	-	**286,079**	-	13,384	**299,463**	**22,458**
FY01	207,500	237,625	**445,125**	74,660	132,265	**206,925**	1,131,563	196,875	1,233,501	377,578	**3,591,568**	1,036,890	259,706	521,049	**1,817,646**	-	117,110	**1,934,756**	**(1,656,811)**
Oct 2001	15,000	27,500	**42,500**	25,104	15,220	**40,324**	-	22,500	250,000	42,451	**397,775**	33,008	154,177	83,770	**270,955**	-	-	**270,955**	**(126,820)**
Nov 2001	15,000	28,500	**43,500**	5,104	15,220	**20,324**	-	22,500	-	41,657	**127,981**	86,730	154,864	-	**241,594**		-	**241,594**	**113,613**
Dec 2001	18,000	25,500	**43,500**	5,104	15,220	**20,324**	-	22,500	-	43,768	**130,092**	70,308	87,734	94,712	**252,754**		-	**252,754**	**122,662**
Jan 2002	24,000	5,000	**29,000**	13,052	15,220	**28,272**	27,232	22,500	297,297	85,529	**489,830**	55,350	171,486	-	**226,836**		3,100	**229,936**	**(259,895)**
Feb 2002	24,000	6,000	**30,000**	13,052	15,220	**28,272**	108,928	22,500	-	86,267	**275,967**	12,506	342,971	66,350	**421,828**		12,400	**434,228**	**158,261**
Mar 2002	27,000	3,000	**30,000**	13,052	14,700	**27,752**	108,928	22,500	-	38,936	**228,116**	81,949	182,189	-	**264,138**		12,400	**276,538**	**48,422**
Apr 2002	24,000	3,000	**27,000**	13,052	14,700	**27,752**	108,928	22,500	-	113,493	**299,673**	148,184	264,830	26,067	**439,081**	-	12,400	**451,481**	**151,808**
May 2002	23,000	6,000	**29,000**	13,052	14,700	**27,752**	108,928	22,500	182,520	40,759	**411,459**	84,564	306,453	-	**391,017**	400,000	12,400	**803,417**	**391,958**
Jun 2002	26,000	3,000	**29,000**	13,052	14,700	**27,752**	108,928	22,500	656,670	35,279	**880,129**	70,651	231,146	29,754	**331,551**	400,000	12,400	**743,951**	**(136,178)**
Jul 2002	8,000	18,000	**26,000**	13,052	14,700	**27,752**	108,928	10,000	-	44,952	**217,632**	77,713	158,978	29,970	**266,662**	40,381	12,400	**319,443**	**101,810**
Aug 2002	8,000	18,000	**26,000**	13,052	14,700	**27,752**	108,928	10,000	-	68,740	**241,420**	66,004	267,733	37,099	**370,835**	-	12,400	**383,235**	**141,815**
Sep 2002	8,000	3,000	**11,000**	13,052	14,700	**27,752**	108,928	10,000	-	66,093	**223,773**	-	131,688	-	**131,688**	-	12,400	**144,088**	**(79,685)**
FY02	220,000	146,500	**366,500**	152,780	179,000	**331,780**	898,656	232,500	1,386,487	707,924	**3,923,847**	786,967	2,454,249	367,722	**3,608,939**	840,381	102,300	**4,551,620**	**627,771**
Oct 2002	8,000	3,000	**11,000**	33,052	14,700	**47,752**	114,936	10,000	-	104,623	**288,311**	-	264,031	117,697	**381,727**	-	12,400	**394,127**	**105,817**
Nov 2002	8,000	3,000	**11,000**	33,052	14,700	**47,752**	114,936	10,000	-	62,596	**246,284**	-	191,692	173,405	**365,097**	-	12,400	**377,497**	**131,213**
Dec 2002	8,000	3,000	**11,000**	13,052	14,700	**27,752**	114,936	10,000	-	117,484	**281,172**	-	139,525	99,495	**239,020**	-	12,400	**251,420**	**(29,752)**
Jan 2003	8,000	3,000	**11,000**	5,104	14,700	**19,804**	114,936	10,000	-	77,223	**232,963**	78,005	180,726	151,205	**409,936**	-	12,400	**422,336**	**189,372**
Feb 2003	8,000	3,000	**11,000**	5,104	14,700	**19,804**	114,936	10,000	-	96,487	**252,227**	178,144	145,793	123,015	**446,952**	-	12,400	**459,352**	**207,126**
Mar 2003	8,000	3,000	**11,000**	5,104	14,700	**19,804**	114,936	10,000	-	33,602	**189,342**	103,811	191,929	68,140	**363,881**	-	12,400	**376,281**	**186,938**
Apr 2003	8,000	3,000	**11,000**	7,404	14,700	**22,104**	114,936	10,000	-	78,647	**236,687**	221,124	194,011	210,647	**625,782**	-	12,400	**638,182**	**401,495**
May 2003	8,000	3,000	**11,000**	7,404	14,700	**22,104**	114,936	10,000	-	96,054	**254,094**	92,929	140,473	114,929	**348,331**	-	12,400	**360,731**	**106,637**
Jun 2003	8,000	3,000	**11,000**	7,404	14,700	**22,104**	114,936	10,000	106,000	70,550	**334,590**	85,159	183,960	140,367	**409,486**	-	12,400	**421,886**	**87,296**
Jul 2003	8,000	3,000	**11,000**	6,732	13,132	**19,864**	114,936	10,000	450,000	39,061	**644,861**	189,371	145,819	91,283	**426,474**	-	12,400	**438,874**	**(205,987)**
Aug 2003	8,000	3,000	**11,000**	6,732	13,132	**19,864**	114,936	10,000	-	83,605	**239,405**	149,371	135,871	107,965	**393,207**	-	12,400	**405,607**	**166,203**
Sep 2003	8,000	3,000	**11,000**	6,732	13,132	**19,864**	114,936	10,000	450,000	54,261	**660,061**	285,824	228,270	89,372	**603,466**	-	12,400	**615,866**	**(44,196)**
FY03	96,000	36,000	**132,000**	136,876	171,696	**308,572**	1,379,232	120,000	1,006,000	914,193	**3,859,997**	1,383,738	2,142,100	1,487,520	**5,013,359**	-	148,800	**5,162,159**	**1,302,162**
Oct 2003	8,000	3,000	**11,000**	26,732	13,132	**39,864**	114,936	10,000	400,000	59,257	**635,057**	162,430	127,007	215,096	**504,533**	-	12,400	**516,933**	**(118,125)**
Nov 2003	8,000	3,000	**11,000**	6,732	13,132	**19,864**	114,936	10,000	-	71,924	**227,724**	107,982	110,937	222,984	**441,904**	-	12,400	**454,304**	**226,580**
Dec 2003	8,000	3,000	**11,000**	6,732	13,132	**19,864**	114,936	10,000	340,000	58,751	**554,551**	205,563	131,119	86,627	**423,309**	-	12,400	**435,709**	**(118,842)**
Jan 2004	8,000	3,000	**11,000**	6,732	13,132	**19,864**	114,936	10,000	-	57,777	**213,577**	194,640	222,176	79,894	**496,710**	-	12,400	**509,110**	**295,533**
Feb 2004	8,000	3,000	**11,000**	6,732	13,132	**19,864**	114,936	10,000	-	91,030	**246,830**	150,700	215,797	60,654	**427,151**	-	12,400	**439,551**	**192,720**
Mar 2004	8,000	3,000	**11,000**	6,732	13,132	**19,864**	114,936	10,000	298,816	43,666	**498,282**	119,936	168,844	-	**288,780**	-	12,400	**301,180**	**(197,102)**
Apr 2004	8,000	3,000	**11,000**	6,732	13,832	**20,564**	114,936	10,000	357,669	32,779	**546,948**	124,735	133,458	-	**258,193**	-	12,400	**270,593**	**(276,355)**
May 2004	8,000	3,000	**11,000**	26,732	13,832	**40,564**	114,936	10,000	200,000	92,331	**468,831**	65,164	133,485	-	**198,648**	-	12,400	**211,048**	**(257,783)**
Jun 2004	8,000	3,000	**11,000**	6,732	13,832	**20,564**	114,936	10,000	-	24,051	**180,551**	64,167	174,566	-	**238,732**	-	12,400	**251,132**	**70,581**
Jul 2004	8,000	3,000	**11,000**	6,732	13,832	**20,564**	114,936	10,000	-	26,226	**182,726**	43,212	141,143	-	**184,355**	-	12,400	**196,755**	**14,029**
Aug 2004	8,000	3,000	**11,000**	6,732	13,832	**20,564**	114,936	10,000	-	75,623	**232,123**	32,941	134,007	-	**166,948**	-	12,400	**179,348**	**(52,775)**
Sep 2004	8,000	3,000	**11,000**	6,732	13,832	**20,564**	114,936	10,000	-	35,944	**192,444**	95,634	123,654	-	**219,289**	-	12,400	**231,689**	**39,245**
FY04	96,000	36,000	**132,000**	120,784	161,784	**282,568**	1,379,232	120,000	1,596,485	669,359	**4,179,644**	1,367,104	1,816,193	665,255	**3,848,552**	-	148,800	**3,997,352**	**(182,294)**

Tank 50 emptied to Saltstone

Appendix K.1 - Material Balance (Execution Strategy)

End of Month/Year	Influents (gallons) F Canyon LHW	F Canyon HHW	F Canyon F-Can Total	H Canyon LHW	H Canyon HHW	H Canyon H-Can Total	DWPF Recycle	Other	Inhibited Water	Jet Dilution	Total In	Effluents (gallons) Space Recovery from Evaporation 2F Evaps	2H Evaps	3H Evaps	Total	Salt Solution to Processing	Sludge to ESP/DWPF	Tot-Out	Net-Out
Oct 2004	8,000	3,000	**11,000**	26,732	13,832	**40,564**	-	10,000	-	55,502	**117,066**	47,356	205,100	-	**252,456**	-	-	**252,456**	**135,390**
Nov 2004	8,000	15,000	**23,000**	6,732	13,832	**20,564**	-	10,000	-	63,789	**117,353**	95,161	114,306	203,458	**412,925**	-	-	**412,925**	**295,572**
Dec 2004	8,000	7,000	**15,000**	6,732	13,832	**20,564**	-	10,000	-	42,188	**87,752**	74,035	120,703	199,821	**394,559**	-	-	**394,559**	**306,807**
Jan 2005	8,000	3,550	**11,550**	6,732	13,832	**20,564**	-	10,000	-	66,698	**108,812**	53,834	198,777	-	**252,611**	-	-	**252,611**	**143,800**
Feb 2005	8,000	3,550	**11,550**	6,732	13,832	**20,564**	-	10,000	-	70,396	**112,510**	96,791	140,180	58,836	**295,807**	-	-	**295,807**	**183,297**
Mar 2005	8,000	3,550	**11,550**	6,732	13,832	**20,564**	-	10,000	-	50,896	**93,010**	73,051	132,038	153,883	**358,972**	-	-	**358,972**	**265,962**
Apr 2005	8,000	3,550	**11,550**	6,732	13,832	**20,564**	140,692	10,000	-	23,994	**206,800**	56,889	163,253	119,492	**339,634**	-	12,400	**352,034**	**145,234**
May 2005	8,000	3,550	**11,550**	6,732	13,832	**20,564**	140,692	10,000	-	139,221	**322,027**	-	166,451	-	**166,451**	-	12,400	**178,851**	**(143,175)**
Jun 2005	8,000	3,550	**11,550**	6,732	13,832	**20,564**	140,692	10,000	-	76,676	**259,482**	108,493	90,618	176,124	**375,234**	-	12,400	**387,634**	**128,153**
Jul 2005	8,000	3,550	**11,550**	6,600	13,100	**19,700**	140,692	10,000	-	28,748	**210,690**	54,553	151,460	126,110	**332,123**	-	12,400	**344,523**	**133,833**
Aug 2005	8,000	3,550	**11,550**	6,600	13,100	**19,700**	140,692	10,000	-	133,164	**315,106**	14,463	118,868	59,539	**192,870**	-	12,400	**205,270**	**(109,836)**
Sep 2005	8,000	7,800	**15,800**	6,600	13,100	**19,700**	140,692	10,000	-	57,319	**243,511**	150,311	87,771	135,259	**373,341**	-	12,400	**385,741**	**142,230**
FY05	96,000	61,200	**157,200**	100,388	163,788	**264,176**	844,152	120,000	-	808,591	**2,194,119**	824,937	1,689,525	1,232,522	**3,746,983**	-	74,400	**3,821,383**	**1,627,267**
Oct 2005	8,000	7,800	**15,800**	26,600	13,100	**39,700**	50,548	10,000	-	44,126	**160,174**	172,184	142,902	99,478	**414,563**	-	4,129	**418,692**	**258,518**
Nov 2005	8,000	3,000	**11,000**	26,600	13,100	**39,700**	50,548	10,000	-	49,459	**160,707**	153,395	111,392	88,747	**353,534**	-	4,129	**357,663**	**196,957**
Dec 2005	8,000	3,000	**11,000**	6,600	13,100	**19,700**	50,548	10,000	-	79,789	**171,037**	66,951	83,022	58,353	**208,326**	-	4,129	**212,455**	**41,418**
Jan 2006	8,000	3,000	**11,000**	6,600	13,100	**19,700**	50,548	10,000	-	46,258	**137,506**	-	134,926	118,629	**253,554**	-	4,129	**257,683**	**120,178**
Feb 2006	8,000	3,000	**11,000**	6,600	13,100	**19,700**	50,548	10,000	-	31,282	**122,530**	-	133,290	64,650	**197,940**	-	4,129	**202,069**	**79,538**
Mar 2006	8,000	3,000	**11,000**	6,600	13,100	**19,700**	50,548	10,000	-	54,570	**145,818**	-	120,901	85,811	**206,712**	-	4,129	**210,841**	**65,023**
Apr 2006	8,000	3,000	**11,000**	7,600	31,100	**38,700**	50,548	10,000	-	36,423	**146,671**	-	127,042	72,388	**199,430**	-	4,129	**203,559**	**56,888**
May 2006	8,000	3,000	**11,000**	7,600	31,100	**38,700**	50,548	-	-	38,236	**138,484**	-	97,572	56,534	**154,106**	-	4,129	**158,235**	**19,751**
Jun 2006	8,000	3,000	**11,000**	7,600	31,100	**38,700**	50,548	-	-	35,811	**136,059**	-	73,445	43,442	**116,887**	-	4,129	**121,016**	**(15,043)**
Jul 2006	8,000	3,000	**11,000**	7,600	31,100	**38,700**	50,548	-	-	43,767	**144,015**	-	65,293	35,704	**100,997**	-	4,129	**105,126**	**(38,889)**
Aug 2006	8,000	3,000	**11,000**	7,600	31,100	**38,700**	50,548	-	-	40,172	**140,420**	-	73,795	31,892	**105,688**	-	4,129	**109,817**	**(30,604)**
Sep 2006	8,000	3,000	**11,000**	7,600	31,100	**38,700**	50,548	-	-	40,992	**141,240**	-	55,028	30,165	**85,193**	-	2,065	**87,258**	**(53,982)**
FY06	96,000	40,800	**136,800**	125,200	265,200	**390,400**	606,576	70,000	-	540,885	**1,744,661**	392,530	1,218,608	785,793	**2,396,930**	-	47,484	**2,444,414**	**699,753**

Notes:

1) Discussion of the components of the Influents and Effluents is contained in Section 8.1.3 “HLW System Material Balance”
2) Actual values for October through December 2000 are obtained from the “HLW Morning Reports”

Appendix K.2 – Sludge Processing (Execution Strategy)

	Waste Removal		ESP Pretreatment							DWPF Vitrification						
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Sludge Batch	Source Tanks	Sludge Content (kg)	Feed Prep Start Date	Feed Prep Total Dur. (months)	Total ESP Water Vol. (kgal)	Na (wt% dry)	Hg (wt% dry)	Total Solids (wt%)	Pretreated Volume (kgal)	Feed Volume (kgal)	Start Feed	Canister Yield	Feed Duration (years)	Finish Feed	Feed Tank	Sludge Loading (wt %)
1A	51	298,000			na	8.80		16.4	491	491	3/1/96	492	2.75	8/30/98	51	25.0
										-140	(Tk 51 heel @ 40 ")					
										351						
1B	42	420,861			na	7.77	0.30	16.5	460	460	10/1/98	738	3.00	9/30/01	51	25.0
	total	420,861										(Includes use of 80 cans of Tank 51 heel)				
2	8	182,451			1,977	8.75	0.30	16.0	456	456	1/1/02	471	2.19	3/10/04	40	28.0
	40	179,098								-140	(Assumes DWPF outage in 1stQ FY02)					
	total	361,549								316						
3	7(70%)	288,957	11/16/02	16	3,156	8.70	0.10	16.0	540	540	3/10/04	395	2.54	9/24/06	51	29.0
	18(70%)	14,777														
	19(70%)	1,956														
	total	305,690														
Totals		1,088,100			5,133	Total Estimated Washwater						2,096	Total Estimated Cans			

Notes:

General) Above based on the following yearly canister production values: FY01 255 cans/yr, FY02 150 cans/yr, FY03 240 cans/yr, FY04 240 cans/yr, FY05 150 cans/yr, FY06 115 cans/yr.

A) Each Sludge Batch must be individually tested and confirmed to meet waste qualification spedicfications

B) Sludge in these tanks will comprise the batch. Note: 100% of the sludge from Tanks 7, 18&19 will be moved to ESP to support Sludge Batch 3. However, 30% of this sludge will be combined with Tank 11 sludge to make Sludge Batch 4.

C) Amount of sludge from each source tank in the batch obtained from WCS data base

D) Feed Prep start date is the date that sludge is first moved into the the ESP feed tank (40 or 51) to begin preparation of the sludge batch (i.e. obtain proper alkali composition of the sludge slurry for feed to DWPF)

E) Total planned duration of transfers, washing, sampling, test glass production, and associated decants for the preparation of a sludge batch for feed to DWPF

F) Total estimated volume of sludge transfer water and wash water decants to obtain target soluble Na concentration for feed to DWPF

G) Amount of total Na in washed sludge (dry basis)

H) Amount of total Hg in washed sludge (dry basis)

I) Total solids (soluble and insoluble) in washed sludge

J) Volume of sludge at given wt% total solids before heel effects (Batch 1B is actual. Batch 2 is projected from detailed analysis. Batch 3 and beyond are based on ratio of batch sludge kg values converted to gallons and adjusted from an estimated 25 wt% solids to 16 wt% solids)

K) Volume of sludge available for feed after adding or subtracting pump heel

L) Start feed date based on depletion of previous batch down to pump heel

M) Estimated number of canisters produced given the pretreatment as shown. Numbers are actual for Batch 1A and estimated for remaining batches. Coupled Salt and Sludge Feed assumed to start with Batch 5.

N) Column O divided by the planned canister production during the period in which the batch is vitrified. See production note under General Section above.

O) Column N plus column P. Finish Feed means when the last transfer of feed is sent from the Feed Tank. The last canister for the batch will be poured later. The DWPF has approximately 25 canisters of feed in process. Therefore 25 more canisters will be produced from the batch after the last feed is sent to DWPF.

P) Batch feed tank

Q) Weight % of glass comprised of sludge oxides.

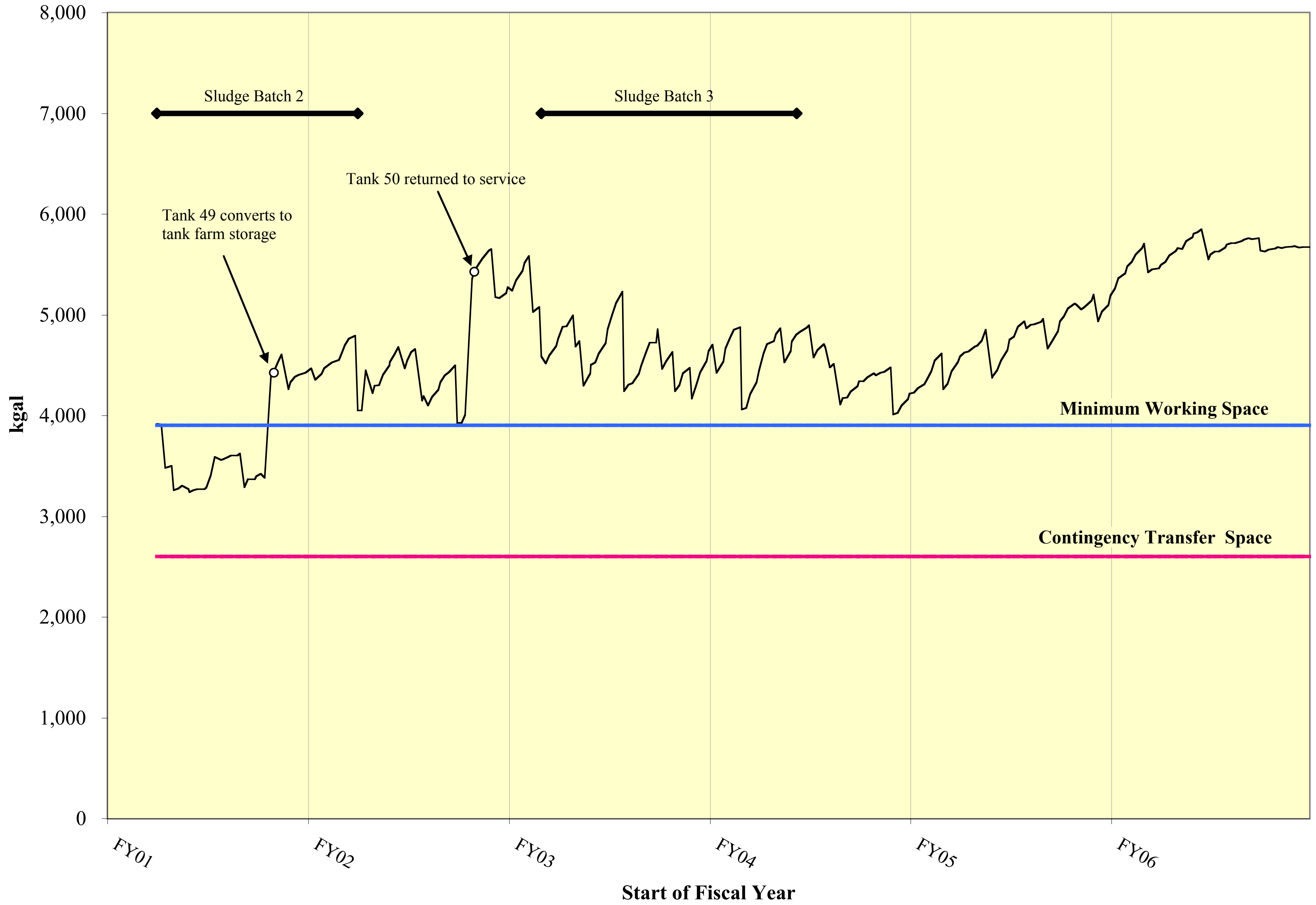
Appendix K.3 - Canister Storage (Execution Strategy)

End of FY	SRS Cans Produced		SRS Cans in GWSB #1 (2,159 max)			SRS Cans in Modular Storage (1 building @ 585)			SRS Cans Shipped to Repository		Net Cans Stored At SRS
	Yearly	Cum.	Added	Shipped	Cum.	Added	Shipped	Cum.	Each Year	Cumulative	
1996	64	64	64		64						64
1997	169	233	169		233						233
1998	250	483	250		483						483
1999	236	719	236		719						719
2000	231	950	231		950						950
2001	255	1,205	255		1,205						1,205
2002	150	1,355	150		1,355						1,355
2003	240	1,595	240		1,595						1,595
2004	240	1,835	240		1,835						1,835
2005	150	1,985	150		1,985	0		0			1,985
2006	115	2,100	115		2,100	0		0			2,100

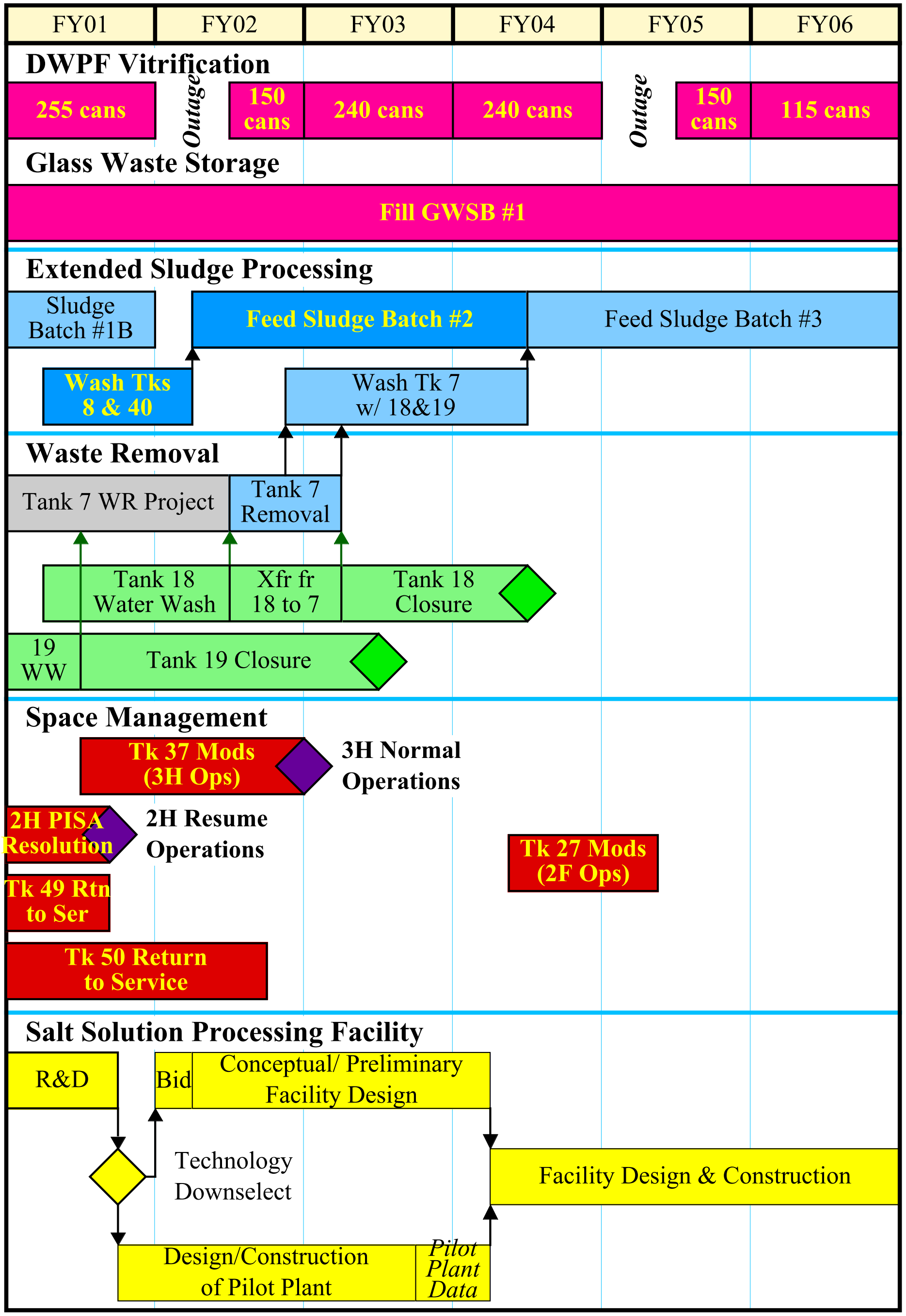
Notes:

1) GWSB #1 filling began in May 1996. Of its 2,286 canister storage locations, 5 positions store non-radioactive test canisters and 122 are unuseable with no viable repair technique. This yields a capacity of 2,159 usable storage locations, including 450 presently unusable location that require modification per an existing plan before they will be useable.
2) GWSB #1 is expected to reach maximum capacity in FY07.
3) Additional glass waste storage locations will be built as privatized modularized buildings, which will be $^{1}/_{4}$ of the size of GWSB #1. The first building, GWSB #2A, will be needed in FY07.

Appendix K.4 Useable Tank Space (Execution Strategy)



Appendix K.5 — Level 1 Schedule (Execution Strategy)



Distribution List

DOE–HQ
Fisher, K.W. (Kurt), EM-42
Picha, K.G. (Kenneth), EM-35
DOE–SR
Aleman, S.M. (Suzanne), 703-H
Anderson, C.E. (Charlie), 704-S
Baez, A.N. (Alejendro), 703-A
Barber`, D.A. (Don), 703-H
Blanco, S.M. (Soni) (15), 704-S
Everatt, C.A. (Carl), 704-S
Glenn, Jr, M.S. (Sam), 703-F
Gnann, H.B. (Howard), 704-S
Gonyaw, D.J. (Debbie), 704-S
Gutmann, T.S. (Tom), 704-S
Hansen, C.A. (Charles), 703-F
Ling, L.T. (Larry), 703-H
McCullough, Jr, J.W. (Jim), 704-3N
Pearson, W.D. (Bill) (21), 704-S
Spader, W.F. (Bill), 704-3N
Stubbs, W.L. (Bill), 704-S
Yarborough, R.M. (Rob), 704-S
DNFSB
Davis, R.T. (Todd), 719-14A
Ogg, D.G. (Dan) (3), 719-14A
WSRC–Sr.Staff
Becker, D.L. (Dan), 703-A
Buggy, J.J. (Joe), 703-A
Grefenstette, P.D. (Paul), 703-A
Jones, C.B. (Clay), 703-A
Pedde, R.A. (Bob), 703-A
HLWD–Staff
Campbell, P.D. (Dean), 705-A
Conner, Jr, H.T. (Harold), 703-H
Cwalina, A.M. (Andy), 703-H
Hay, J.B. (Joanne), 703-H
Padezanin, III, T. (Ted), 703-H
Piccolo, S.F. (Steve), 703-H
HLW–Pgm Mgmt
Caldwell, T.B. (Tommy), 703-H
Cathey, S.S. (Susan), 703-H
Chew, D.P. (David), 703-H
Dean, K.B. (Kelly), 703-H
Mahoney, M.J. (Mark) (120), 703-H
Wilson, W.A. (Walter), 703-H
Wise, F.E. (Frank), 703-H
HLW–Controller
Harris, T.A. (Tony), 704-67S
Herrmann, Jr, H.O. (Harry), 703-H
Kennedy, P.S. (Pam), 703-H
Ross, T.D. (Tim), 742-9G
HLW–WD
Barnes, J.L. (Jeff), 704-S
Reynolds, T.R. (Tammy), 210-S
Westergreen, J.D. (Jeff), 704-S
HLW–CST
Borders, M.N. (Mike), 704-56H
Buxton, M.D. (Marybeth), 742-14G
Clark, Jr, W.C. (Wyatt), 241-100F
Coleman, D.H. (David), 241-100F
Davis, Jr, W.T. (Will), 707-H
Davis, N.R. (Neil), 703-H
Dickert, V.G. (Ginger), 703-H
Gilles, M.L. (Michael), 704-56H
Green, M.J. (Michael), 742-14G
Herbert, J.E. (Jim), 241-108F
Johnson, M.D. (Mike), 703-H
Lampley, C.G. (Charles), 241-100F
Long, B.E. (Bruce), 241-197H
Runnels, R.A. (Rick), 707-H
Sherburne, D.C. (David), 241-100F
Stevens, P.H. (Pete), 703-H
Whittenburg, A.L. (Anatia), 704-56H
HLW–SWP
Adams, R.A. (Bob), 704-3N
Hinds, Jr, R.N. (Bob), 704-3N
Morin, J.P. (Jerry), 703-H
HLW–Maint
Handfinger, H.M. (Harvey), 704-71S
Hauer, K.A. (Kim), 704-71S
Hill, P.J. (Peter), 704-56H
Lawson, Jr, L.G. (Gordon), 704-71S
Lucas, T.J. (Ted), 210-S
Mohammadi, M.N. (Rod), 704-71S
Wilkerson, S.W. (Steve), 704-71S
Wilson, R.W. (Robert), 704-71S
HLW–Train & Proc
Chandler, T.E. (Tim), 766-H
Thompson, D.G. (Dennis), 766-H
HLW–QA
Kuhn, R.J. (Ron), 703-H
HLWE
Allen, V.P. (Trish), 703-H
Bates, W.F. (Bill), 707-H
Blocker, R.H. (Roz), 703-H
Broaden, D.A. (Dave), 703-H
Campbell, R.M. (Ron), 703-H
Carter, J.T. (Joe), 704-3N
Cauthen, G.L. (Gary), 707-H
Chapman, N.F. (Noel), 704-3N
Cloninger, J.M. (Mack), 704-S
d'Entremont, P.D. (Paul), 703-H
Dewes, J.N. (John), 703-H
Edwards, Jr, R.E. (Richard), 704-25S
Elder, H.H. (Hank), 704-196N
Fowler, R.C. (Rick), 704-196N
Freed, E.J. (Eric), 707-2H
Gillam, J.M. (Jeff), 703-H
Hayes, Jr, C.R. (Chuck), 703-H
Hester, Jr, J.R. (Bob), 703-H
Jacobs, R.A (Roy), 704-3N
Jones, D.W. (Dan), 703-H
Jones, J.F. (Janet), 742-13G
Kerley, W.D. (Bill), 704-S
Kidd, M.S. (Mike), 742-13G
Lewis, B.L. (Brenda), 703-H
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