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Savannah River Site High Level Waste System Plan

Waste Immobilization

An Integrated System at the Savannah River Site

REVISION 13

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High Level Waste System Plan
Revision 13 (U)

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Executive Summary

Introduction

The High Level Waste (HLW) System Plan documents the operating strategy of the HLW System at the Savannah River Site (SRS) to receive, store, treat and dispose of approximately 38 million gallons of liquid, high-level radioactive waste. This waste is stored, on an interim basis, in 49 underground tanks. To date, twelve revisions of the *Plan* have been issued, each giving an updated status of the HLW operating strategy at the time of issue. Broadly speaking, the 38 million gallons of HLW waste can be characterized as being either *salt* waste (soluble in the liquid) or *sludge* waste (insoluble). Immobilization of the sludge portion of the waste has been operating since 1996 (the HLW System has already removed and vitrified approximately 1,200 canisters of an estimated total 6,000 canisters of sludge). The operating strategy for salt disposition is evolving; the current integrated salt strategy includes low curie salt processing, actinide removal and processing via caustic-side solvent extraction (CSSX).

This thirteenth revision (Revision 13) of the HLW System Plan —

- Discusses the salt processing strategy in detail and models three cases showing the sensitivity of varying startup dates and processing rates for salt processing
- Updates the status of key commitments of System Plan Revision 12 Base and Stretch Cases (these two cases represent the minimum performance and the Contract Performance Baseline in the fiscal year FY01-06 Site Contract)
- Updates the status of key issues, assumptions and vulnerabilities in the HLW System
- Summarizes major scope changes, such as the planned receipt of Am-Cm solution into the Tank Farm from F-Canyon.

The three salt processing cases modeled are:

		Case 1	Case 2	Case 3
Gallons Low Curie/Actinide		0	1.5 Mgal	3.0 Mgal
Small Scale Salt Processing:	Startup	FY12	FY10	FY08
	Flow rate*	10%	15%	20%
Additional Salt Capacity:	Startup	FY16	FY15	FY13
	Flow rate*	100%	80%	50%

*The design flow rate is 6 million gallons per year.

Although, the HLW System operating strategy considers many factors, the following items are of major concern in evaluating the above cases:

- Meeting regulatory commitments to remove this waste
- Maintaining a continuous flow of waste to the processing facilities
- Space management (i.e., available tank storage capacity)
- Tank age and condition
- Removing non-compliant tanks from service
- Waste Removal completion date (i.e., when waste is removed from all tanks)
- Funding.

The results of these cases are discussed in depth, with tables and with comparisons to Revision 12 Base and Stretch Cases, in Appendices I, J, K, L and M. In summary, relative to the other two cases, Case 3, with its accelerated initiation of salt processing, provides —

- faster reduction of waste inventory
- accelerated risk reduction (earlier removal of waste from high risk tanks)
- ability to meet Federal Facility Agreement (FFA) commitments
- increased tank farm flexibility (ability to handle emergent issues).

Site Background

The 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 38 million gallons of liquid, high-level radioactive waste stored on an interim basis in 49 underground waste storage tanks as of the beginning of January 2002. Continued, long-term storage of these liquid, high-level wastes in underground tanks poses an environmental risk (twelve of the SRS tanks have a waste leakage history). Therefore, the High Level Waste Division (HLWD) 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 2001, over 1,200 canisters of waste have been vitrified. The canisters vitrified to date have contained sludge waste.

Salt Processing Status

A final DOE technology selection for HLW salt solution processing was completed and a Salt Processing Environmental Impact Statement (EIS) Record of Decision (ROD) was issued in October 2001. The ROD designated Caustic Side Solvent Extraction (CSSX) as the preferred alternative to be used to separate cesium from HLW salt. In parallel, DOE is evaluating the implementation of other salt processing alternatives for specific waste portions that would not need to be processed in the CSSX facility. The evaluation of alternatives and potential operations would be undertaken to maintain operational capacity and flexibility in the HLW system and meet commitments for closure of high-level waste tanks. The Final Salt Processing Supplemental Environmental Impact Statement (SEIS) acknowledges the possibility of offsite treatment or disposal for certain waste streams.

This revision of the Plan reflects the above change in the DOE and Westinghouse Savannah River Company (WSRC) strategy to not rely on a single Salt Waste Processing Facility (SWPF). Instead a graded approach to salt processing is assumed.

The new integrated Salt Disposition Strategy is to:

- Treat low curie salt waste and dispose at Saltstone
- Create an Actinide Removal Process (ARP) to enable disposal of additional low curie/high actinide salt waste & potentially provide actinide removal for the high curie demonstration CSSX facility
- Dispose of high curie salt waste by removing cesium in a small scale demonstration CSSX processing facility
- Tailor follow-on high curie salt waste processing capability depending on the success of early low curie salt disposal.

Salt Disposition Strategy Case Comparison

Three different salt disposition strategy cases are described in the Plan. The three different cases were modeled to bound varying levels of success associated with the startup and processing rates for salt processing. Modeling results of these three cases will provide the basis for assessing potential HLW system impacts as further decisions are made on the sizing and timing of the SWPF and as results are obtained from initial alternative salt disposition efforts (e.g. low curie processing). The three Salt Disposition strategies provided by DOE ensure that HLW in the 49 waste tanks is processed by the 2028 Site Treatment Plan (STP) regulatory commitment date. A detailed description of the three cases is provided in Section 1.

Other than for specific Salt Disposition assumption differences highlighted below, each of the three cases modeled used the same set of approved HLW System Plan Revision 13 assumptions. The Revision 13 assumptions documented in HLW-PMD-2002-0004, which were approved by both WSRC and DOE Savannah River (DOE-SR), include details on such items as the processing rates for HLW evaporators, designated uses of waste tanks and the forecast volumes of influents from the canyons and Defense Waste Processing Facility (DWPF) to HLW.

HLW performed a Tank Farm sensitivity analysis surrounding the FY10 startup date of the SWPF. The analysis evaluated the benefits of initiating alternative salt processing early and the effect of varying startup dates for a salt process facility. The Tank Farm salt processing sensitivity analysis showed that accelerated success with salt processing, by means of the SWPF or by alternative methods, provides the following benefits:

- Faster reduction of total Tank Farm waste inventory
- Improvement in risk reduction for waste removal from high risk tanks
- Ability to meet Federal Facility Agreement (FFA) commitments for closure of tanks by year through 2022
- Increased Type III tank space providing higher levels of flexibility and contingency for handling emergent technical and physical processing impacts.

The analysis also showed that a delay in the startup of a salt processing facility results in more challenges (higher risk) to accomplish the HLW mission of stabilizing waste to reduce risk, closing tanks and supporting other SRS missions. The table below summarizes key comparison data for these cases as compared to the Base, Stretch and Super Stretch Cases in the last revision of the HLW System Plan.

Comparison of Cases	Rev 12 Base	Rev 12 Stretch	Rev 12 Super Stretch	Rev 13 Case 1	Rev 13 Case 2	Rev 13 Case 3
Total Number of Canisters Produced*	5,914	5,914	5,871	6,041*	6,041*	6,120*
DWPF Canister Production Rate:						
• FY01 to FY06	850	1,150	1,150	1,150	1,150	1,150
• FY07 to FY12	857	560	1,250	550	610	1,270
• FY13 to End of Sludge Processing	200/yr	230/yr	250/yr	230/yr	230/yr	230/yr
• Salt-only Cans at End of Program	0	0	0	0	0	79
Date when all High Risk Tanks (Type I & II) are Emptied	FY16	FY16	FY14	FY18	FY15	FY13
Date when all Non-Compliant Tanks are Emptied	FY19	FY17	FY15	FY18	FY18	FY15
Date when all Non-Compliant Tanks are Closed	FY21	FY20	FY18	FY20	FY20	FY17
Low Curie Salt and Actinide Processing to Saltstone	n/a	n/a	n/a	Un-successful	1.5 Mgal saltcake by end of FY05	3.0 Mgal saltcake by end of FY07
Date Small Scale SWPF becomes Operational	FY10	FY10	FY10	FY12	FY10	FY08
Date Additional Salt Waste Capacity Operational	n/a	n/a	n/a	FY16	FY15	FY13
Date by which Salt Processing is Completed	2024	2022	2022	2027	2027	2028
Date by which Sludge Processing is Completed	2029	2027	2023	2027	2027	2024
Are the Site Treatment Plan Regulatory Commitments met?	No	Yes	Yes	Yes	Yes	Yes
Are the Federal Facility Agreement Regulatory Commitments met?	No	No	Yes**	No	No	Yes**
Life Cycle Costs (FY02-FY40):						
• In escalated dollars ($ in billions)	$19.6	$18.0	$16.2	$20.7	$20.4	$19.3
• In constant dollars (FY01$ in billions)	$12.8	$12.0	$11.2	$13.3	$13.2	$12.8

* Additional canisters are based on updated sludge information
** Yearly closure commitments (total number of tanks/yr) are met

Accelerated Immobilization of Waste Minimizes the Environmental Risks of Continuing to Store HLW in High Risk Tanks

In Case 1, waste is removed from all Type I and II *high risk* tanks by FY18. In Case 3, this waste is removed five 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 5.7 million gallons of waste and 143 million curies of radioactivity.

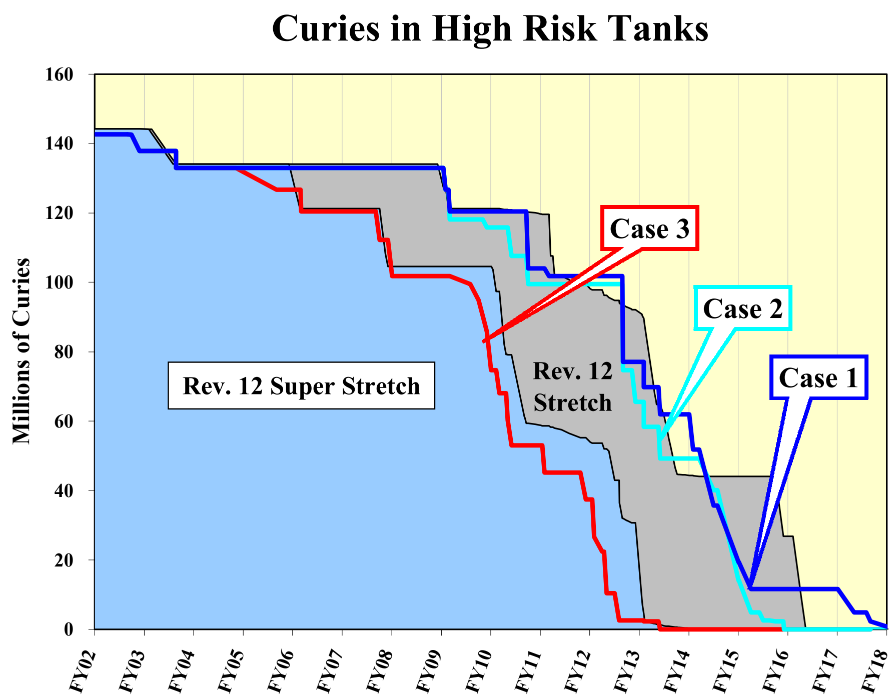


Figure 1

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 sixteen 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, eleven of these tanks have leaked waste from the primary tank into the secondary containment (annulus pan). In one case, some waste (estimated to be tens of gallons) leaked from the secondary containment into the environment. In FY01, after receiving transfers of low source term waste, some small, previously undiscovered leak sites were found in Tanks 5 and 6. Approximately 90 gallons of low curie content waste was detected in the secondary containment (annulus pan) of Tank 6. A smaller amount of waste was detected in the annulus pan of Tank 5. An extensive exterior wall inspection identified several leak sites in each of the tanks, and the liquid level in both tanks was removed to a level below the known leak sites. All leaked waste was successfully contained in the annulus pans, as designed. No waste was released to the environment. SRS maintains an aggressive program to monitor waste tank integrity. However, these recent findings for Tanks 5 and 6 underscore the need to complete waste removal in the shortest amount of time.

Not all *old style tanks* are considered high risk. For example, Type-IV Tanks 21-24 have experienced no leaks and continue to be used for low activity waste storage.

Only Case 3 Fully Meets All Regulatory Commitments

- There are two primary regulatory drivers for waste removal: the STP and the Federal Facility Agreement (FFA).
- The STP requires that the processing of all high-level waste (both existing and future) be completed by FY28. All three cases in the Plan meet the STP requirements.
- The FFA requires that the 22 *non-compliant tanks* be emptied and closed on an approved tank-by-tank schedule. Non-compliant tanks are those that do not have full secondary containment. They include Tanks 1-24 (two of which are operationally closed). While the three cases complete the closure of the 22 non-compliant tanks prior to 2022, only Case 3 fully meets the requirements on a tank-by-tank schedule. In Cases 1 and 2, there are years in which the number of closed tanks falls behind the number required by the cumulative FFA schedule. The number of tanks behind schedule ranges between 1-2 tanks in these years.

High Level Waste Program: A Proven Success

The HLW System at SRS has been successful over the last several years as HLW 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)
- FY01 227 canisters filled (Base goal was 163, Stretch goal was 220)

First HLW Tank Closures in the DOE Complex

SRS met the challenge of emptying and operationally 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 the tanks to be closed from operating Tank Farm processes
- Fill the tanks with a cement-like grout to complete operational closure.

HLW Tank Waste Removal Successes

Bulk waste removal was successfully completed from two of the high risk tanks in FY01.

- The successful suspension and transfer of sludge from Tank 8 was completed in January 2001. The sludge in Tank 8 was transferred to Extended Sludge Processing and pre-treated to make it compatible for feed to the vitrification process. This sludge (which was in Tank 8 at the beginning of FY01) is now being fed to DWPF as part of Sludge Batch 2 in FY02.
- Sludge in Tank 19 was removed using innovative removal techniques that minimized the volume of water added to the tank. The residual material has been characterized and the tank is ready for closure.

The movements of waste from these two tanks were the first sludge transfers made in the Tank Farms since the 1980's. Their success demonstrates HLWD's ability to meet commitments to remove sludge from the high risk tanks and maintain feed for DWPF vitrification. Similar work is being performed on Tanks 18 and 7 for removal of sludge from these two tanks in 2002.

Maximizing Accomplishments while Focusing on Cost Reductions

The estimated costs for the HLW Program at SRS have been reduced significantly over the last several years. Prior cost reduction initiatives have accomplished more than a 35% reduction in overall lifecycle costs to accomplish the program. Overall, life cycle costs are heavily impacted by the number of years required to complete the HLW program, and these three cases extend the completion date of the program as compared to the Revision 12 Stretch and Super Stretch cases.

Independent Benchmarking Confirms HLW's 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 Revision 12 Base and Stretch Cases represent minimum and stretch performance under the FY01 – FY06 contract extension. However, it is expected that funding will only be provided to accomplish the scope in the Base Case. It will be critical to find additional cost savings to allow the execution of the Stretch Case scope. Therefore, although the cost reductions that have been implemented to date place the HLW Program in a cost competitive position, HLW will continue its drive for cost efficiencies. Some of the areas where continued cost improvements will be expected include accelerated waste removal, simplification of Authorization Basis controls, implementation of Tank Focus area improvements and waste removal technology improvements.

Continuous Improvement – Initiatives for Accelerating Risk Reduction

At the time of the Plan, the EM Initiative of Accelerated Site Cleanup is not yet finalized and initiatives are being proposed to expedite risk reduction and enhance tank closure activities. The proposals involve the acceleration of waste processing and closure. It must be noted that, at the time of publication of this Plan, the impact of this initiative on the Plan is not known. If necessary, an interim update of this Plan will be produced when the initiative is finalized and the impacts are known.

Expediting Sludge Processing

DWPF is pursuing initiatives to improve production capacity and waste loading. The proposal is based on the culmination of several years of research that supports the development of a specific frit (glass forming materials) for each batch of sludge feed at DWPF. The change to a specialized frit for each sludge batch allows the glass to melt quicker, thereby allowing DWPF to increase it's average canister production. The change to the newly formed frit will also make it possible to improve waste loading by placing more waste in each canister. To meet the increased production levels, the preparation of future sludge batches must also be accelerated.

Expediting Salt Processing

As discussed above, this revision of the HLW System Plan reflects a change in the DOE and WSRC strategy of totally relying on a single SWPF. Instead a graded approach to salt waste processing is assumed.

The new integrated Salt Disposition Strategy is to:

- Treat low curie salt waste and dispose at Saltstone
- Create an Actinide Removal Process (ARP) to enable disposal of additional low curie/high actinide salt waste & potentially provide actinide removal for the high curie demonstration SWPF facility
- Dispose of high curie salt waste by removing cesium and actinide in a small scale demonstration SWPF processing facility
- Tailor follow-on high curie salt waste processing capability depending on the success of early low curie salt disposal.

Streamlining Tank Closure Approach

Expediting waste processing allows a corresponding acceleration of tank closure activities. In addition, SRS has undertaken the task of enhancing the tank closure program by implementing technical and cost-effective improvements. Dialog with South Carolina Department of Health and Environmental Control (SCDHEC) continues on these enhancements that include the following:

- Refining the waste characterization approach
- Dispositioning waste removal equipment in tanks to be closed
- Refining grout make-up and method of delivery in the tank closure process.

Key Process Issues

Work is underway to address several key process issues that have significant impacts on HLWD's ability to implement the HLW System Plan. A more detailed explanation of these issues is contained in Sections 4 and 5.

Tank Farm Useable Storage Space

The amount of useable storage space in the Tank Farms has increased from 700 kgal in Revision 12 to 2,200 kgal at the time of the Plan. The increase over the last year is due to three main factors.

- Tank 49 was successfully returned to HLW service adding over a million gallons to the Type III useable space
- Innovative cooling initiatives were implemented at Tank 30 (the 3H Evaporator concentrate receipt tank) allowing the 3H Evaporator to perform better than the Revision 12 forecast.
- Chemistry issues associated with operation of the 2H Evaporator were successfully overcome and 2H was returned to operation in 2001
- An increased level of focus has been placed on evaporator operational readiness and downtime minimization through effective management of planned outages and preemptive evaporator flushes.

With the return of Tank 49 and improved evaporator performance, significant progress has been made in the past year to increase the amount of useable Type III tank space. This success has alleviated some of the tank space concerns discussed in Revision 12. However, without some salt disposition success (such as low curie or actinide), then Type III tank space will continue to be a major concern until the startup of the SWPF. If no salt processing is assumed, the evaporator receipt tanks could eventually fill with salt, thereby forcing the evaporators to stop operating, a condition called *saltbound*. Given the assumptions used to model the three cases, such a saltbound condition did not occur before the assumed startup date for SWPF.

The effective management of tank space is essential to meeting HLW process commitments. For this reason, the Tank Farm space management strategy is routinely evaluated and updated. During FY01, two space management reviews were chartered. The first review was by Tank Space Management Team 2 (SMT2 Team) which was chartered in April 2001 to consider new initiatives and approaches to safely and efficiently manage Tank Farm space. This team took into account updated conditions since the initial Tank Space Management Team 1 (SMT1 Team) completed its evaluation in August 1999. The second review, an independent review of the SRS Tank Farm space management program, was undertaken in July 2001 at the request of HLW. The purpose of the review was to provide an assessment of the Tank Farm space management and waste processing strategies and to recommend alternatives and strategies to provide additional waste storage capacity in the Tank Farm.

Based on review of current operating conditions and input from the Tank Farm space management reviews, the current group of space management initiatives required to provide adequate space until a salt processing facility becomes operational is listed below:

- Continue to evaporate liquid waste, including the backlog of liquid waste that is waiting to be fully concentrated.
- Continue to use Tanks 21-24 as interim storage for low curie content waste.
- Return Tank 50 to waste service for use in supporting low curie and actinide salt processing (manage the Effluent Treatment Facility (ETF) concentrate without using Tank 50 as a temporary storage location).
- Disposition existing organics in Tank 48 and return it to HLW storage service.
- Maintain DWPF Recycle Stream reduction initiatives.
- Retrofit additional tanks as evaporator concentrate receipt tanks
- Process Tank 26 sludge in an earlier sludge batch to provide additional space
- Implement the small volume gain initiatives to achieve small incremental storage volumes.
- If required, reduce the minimum contingency transfer space (presently set at 2,600 kgal for the F & H Tank Farms) to a level not to be less than 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 could impact HLWD's ability to successfully support planned processing commitments due to a lack of Tank Farm waste storage space.

Due to the uncertainties in key Tank Farm space assumptions, the space management strategy is 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 Defense Nuclear Facilities Safety Board recommendation DNFSB 2000-1 Prioritization for Stabilizing Nuclear Materials and the HLW processing activities must be accommodated in the space available.

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. The Nuclear Materials Management Division (NMMD) will continue to refine their waste stream forecasts based on processing experience gained over the next few years. To ensure clear and timely communications, routine interface meetings continue between HLWD and NMMD.

Salt Processing

As previously discussed, the DOE and WSRC changed their salt processing strategy from a single SWPF, to a graded approach to salt processing.

The ability to maintain the tank closure and STP schedule with less than a 100% capacity SWPF relies on the success of the low curie and actinide removal initiatives. The implementation of these two alternative salt disposition processes will require good communication and coordination with stakeholders. Final decisions on the sizing and timing of salt waste processing facilities have not been made.

Age of the HLW Facilities

Many HLW facilities were constructed from the early 1950s to the late 1970s, and the overall material condition of these facilities has deteriorated over time. On occasion, routine repairs to service systems in the Tank Farms have escalated into weeks of unplanned downtime. Even so, the Tank Farm must continue to operate as it contains approximately 38 million gallons of highly radioactive waste, much of it in a mobile form. Therefore, planned infrastructure improvements must continue to be funded to continue safe storage of waste. The Plan includes provision for normal maintenance, some long-term service piping upgrades in the Tank Farms, and specific long duration equipment replacement activities such as the DWPF melter. However, unforeseen equipment failures, such as a major tank leak or transfer line failure, could have a significant impact on the operation of the HLW System.

Introduction

Revision 13 of the HLW System Plan (Plan) documents the current operating strategy of the HLW System at SRS to receive, store, treat and dispose of high-level radioactive 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 dispositioned at a Federal Repository. As of January 1, 2002 over 1,200 vitrified waste canisters have been produced. Two waste tanks were closed by the end of FY98 and bulk waste removal was completed on two of the high risk tanks (Tank 8 and 19). The Tank Farms have a remaining estimated 38 million gallons of waste containing over 400 million curies of radioactivity to be disposed of over the next 20 to 30 years.

The Plan will be used to:

- Document the results of a salt processing sensitivity analysis surrounding an FY10 startup of a salt processing facility and including other initiatives such as alternate methods of low source term salt disposition. Three salt sensitivity cases are included in the Plan. Major assumptions and results are summarized in Section 1.
- Develop future budgets
- Adjust individual project baselines to match projected funding
- Project the Site's ability to support the approved Federal Facility Agreement (FFA) Waste Removal Plan and Schedule and the Site Treatment Plan requirements.
- Status major commitments made in the Revision 12 Base and Stretch Cases that represent minimum and stretch performance under the FY01 – FY06 contract extension. The status is reflected for the life of the existing contract (FY01-06). A summary of major scope changes such as the planned receipt of Am-Cm solution into the Tank Farm from F Canyon is also included.
- Document the current Tank Farm space management strategy to increase operational flexibility

Improvements Since Revision 12

One goal of the planning process is to continuously improve the Plan to better serve the needs of stakeholders. Revision 13 of the Plan incorporates the results from several improvements in the planning process implemented since Revision 12 was issued.

An intense effort was made to develop and obtain buy-in on an integrated FY02 transfer and evaporator health plan for the remainder of 2002. With the numerous issues (See Sections 4.8 and 4.9) associated with evaporator operations, it was imperative to obtain input and understanding of key players from F Tank Farm (FTF), H Tank Farm (HTF), and DWPF on the processing plans for the next year. The 2002 processing plan then became the building block for the Plan out-year planning. As part of this process, a set of assumptions was developed for use in the Plan. The Revision 13 assumptions, which were signed by both WSRC and DOE-SR, include details on such items as the processing rates for HLW evaporators, designated uses of waste tanks and the forecast volumes of influents from the canyons and DWPF to HLW. The end result of obtaining signed-off assumptions and an agreed to FY02 transfer and evaporator feed health plan is the facility managers, engineering, transfer team, schedulers and planners have a good understanding and knowledge of important bases, assumptions and issues associated with Revision 13 of the Plan.

The effective management of tank space is essential to HLW meeting the process commitments. For this reason, the Tank Farm space management strategy is routinely evaluated, expanded upon and updated. During FY01, two space management reviews were chartered. The SMT2 was chartered in April 2001 to consider new initiatives and approaches to safely and efficiently manage Tank Farm space. This team took into account updated conditions since SMT1 completed its evaluation in August 1999. In addition, at the request of HLW, an independent review of the SRS Tank Farm space management program was undertaken in July 2001. The purpose of the review was to provide an assessment of the Tank Farm space management and waste processing strategies and to recommend alternatives and strategies to provide additional waste storage capacity and improve the operating margin in the Tank Farm.

A HLW Tank Farm vulnerability assessment identified the major risks that may impact the system and identified mitigation strategies to address these risks. It also identified ways to accommodate contingencies and to reduce the overall vulnerabilities in accomplishing the HLW System Plan.

The successful suspension and transfer of the Tank 8 and Tank 19 sludge in 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 preparation of the sludge removal campaign in Tank 7 scheduled for later in 2002 and into future waste removal planning.

The primary tank farm modeling tool was rewritten to more realistically simulate tank farm activities and to add options that are consistent with waste management plans (such as the low curie salt program). SpaceMan II™ differs mainly from SpaceMan™ (used in Revisions 11 and 12 of the Plan) in that Tank Farm activities are computed on a mass, rather than volume basis. In addition, supernate is tracked depending on its location in the waste form. This allows supernate to possess separate characteristics during salt dissolution and sludge washing campaigns. Evaporator and salt formation models were enhanced, and a more meticulous method was incorporated for sludge washing. These improvements increased the number of modeling options. Also, additional output files were added to construct various reports, charts, and schedules that allow for improved analysis of modeling results.

It should also be noted that HLW personnel are continuing to support activities that could lead to new missions for SRS. Potential DOE-Material Disposition (MD) program activities include the Mixed Oxide (MOX) Fuel Facility for disposition of surplus plutonium. See Section 7 for further discussions on the impacts of potential new site missions on the HLW Program.

State of the HLW System

The status of each key HLW facility is summarized below.

H Tank Farm: The **2H Evaporator system** continued to be impacted through most of 2001 by the resolution of the Potential Inadequacy in Safety Analysis (PISA) which was declared in January 2000. A dedicated multidiscipline team was assembled to resolve the technical issues dealing with the 2H cleaning and restart efforts. This 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 achieved restart in October 2001, but due to unrelated technical and mechanical (feed pump) issues, routine operations was not achieved until December 2001. The 2H evaporator achieved ~221K gallons of space recovered and ~250K gallons of overheads production during December 2001. These production figures represented a higher than average monthly output for the 2H system prior to shutdown for the PISA. The 2H Evaporator will focus on evaporating DWPF recycle material and low level waste from H Canyon and 299-H 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 4.8)

The **3H Evaporator system** received DOE approval for operation in December 1999. The 3H system ran well until the early part of November 2000 before Tank 30 (the concentrate receipt tank) experienced cooling coil failures. Consequently, the 3H system could only run for short 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. In the short term, a temporary modification was implemented to add a *stop leak* solution to two of the Tank 30 coils. This innovative initiative allowed the 3H to significantly perform better than the Revision 12 forecast. In the long term, modifications to Tank 37 to allow its use as a concentrate receipt tank are on track for completion in FY02.

The *useable space* (**see Appendix B – Glossary, and Section 5.1.1** for a full definition of useable space) in HTF has been increased from approximately 462 kgal (as of March 1, 2001) to more than 2,100 kgal) as of January 1, 2002 due to the increased performance of the 3H evaporator (stop leak) and the 2H evaporator finally running at expected production figures. Also Tank 49 was returned to full time Tank Farm waste storage service (it was a former in-tank precipitation (ITP) product storage tank) which also contributed to this increase in HTF useable space. The improved operations of the 3H Evaporator versus the Revision 12 forecast will allow for better use of Tank 49 for storage of fully concentrated waste.

Several major transfers took place in H Tank Farm during 2001. These transfers were targeted to prepare Sludge Batch 2 for final qualification before feeding it to DWPF to support canister production.

F Tank Farm: Despite a number of technical issues and physical challenges during FY01, the 2F Evaporator system achieved increased attainment in FY01 versus what was forecast. This resulted in space gain of ~686 kgal for FY01. The useable space in FTF improved from 191 kgal in March 2001 to 534 kgal by March 2002. The useable space dipped to 34 kgal briefly in January 2002 because of a series of factors with operating the tank farms.

Waste Removal: Construction of waste removal equipment is complete on Tanks 8 and 19. Bulk waste removal is complete on Tank 8. Heel removal on Tank 19 was completed in FY01. Design activities continue and construction of waste removal equipment was initiated on Tank 18. Construction of waste removal equipment continues on Tank 7. 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 FY02 to FY06 period. 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.

Tank Closure: Tanks 17 and 20 operational closure is complete. The FFA Waste Removal Plan and schedule requires Tank 19 to be closed in FY03 and Tank 18 to be closed in FY04. However, DOE-SR has requested approval from the Environmental Protection Agency (EPA) and SCDHEC to delay Tank 19 closure until FY04 so that it can be closed concurrently with Tank 18.

The residual material in Tank 19 has been characterized and preliminary fate and transport modeling has been performed. A closure module is being finalized for submittal to SCDHEC for approval to allow Tank 19 isolation activities to proceed.

Salt Waste Processing: A final DOE technology selection for HLW salt solution processing was completed and a Salt Processing EIS ROD was issued in October 2001. The ROD designated Caustic Side Solvent Extraction (CSSX) as the preferred alternative to be used to separate cesium from HLW salt. In parallel, DOE is evaluating the implementation of other salt processing alternatives for specific waste portions that would not need to be processed in the CSSX facility. The evaluation of alternatives and potential operations would be undertaken to maintain operational capacity and flexibility in the HLW system and meet commitments for closure of high-level waste tanks. The Final Salt Processing SEIS acknowledges the possibility of offsite treatment or disposal for certain waste streams.

This revision of the HLW System Plan reflects the above change in the DOE and WSRC strategy to not rely on a single SWPF. Instead a graded approach to salt processing is assumed.

The new integrated Salt Disposition Strategy is to:

- Treat low curie salt waste and dispose at Saltstone
- Create an Actinide Removal Process (ARP) to enable disposal of additional low curie/high actinide salt waste & potentially provide actinide removal for the high curie demonstration SWPF facility
- Dispose of high curie salt waste by removing cesium and actinide in a small scale demonstration SWPF processing facility
- Tailor follow-on high curie salt waste processing capability depending on the success of early low curie salt disposal.

Successful implementation of the low curie salt and Actinide Removal Process initiatives will reduce the quantity of re-dissolved saltcake needing to be processed through the future SWPF and support the closure of old type high-level radioactive waste tanks.

Defense Waste Processing Facility (DWPF): At the time of the Plan (January 1, 2002), a total of 1,221 cans have been generated at DWPF. Sludge Batch 1A consisted of 495 canisters and Sludge Batch 1B (which ended processing in November 2001) consisted of 726 canisters. Vitrification of Sludge Batch 2 began in December 2001.

Glass Waste Storage Building (GWSB): At the time of the Plan (January 1, 2002), 1,221 glass canisters are stored in GWSB 1. This represents approximately 57% of the available 2,159-canister capacity at GWSB 1.

Effluent Treatment Facility (ETF): In FY01, the ETF treated over 16 million gallons of low-level wastewater, and transferred approximately 100 kgal of waste concentrate to Tank 50 for storage. ETP processed its missions without affecting site operations. For FY02 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 due to the lack of feed material. The 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 to support alternative salt disposition. Saltstone will continue to operate as required to support salt disposition activities and to process ETF concentrate.

1. Salt Processing Sensitivity Analysis

1.1 *Summary*

HLWD performed a sensitivity analysis surrounding the FY10 startup date of a salt processing facility. The analysis evaluated the benefits derived from initiating salt processing early (low curie salt and actinide removal) and the effect of varying the startup date of a salt waste process facility.

The Tank Farm salt processing sensitivity analysis showed that adequate Tank Farm space can be maintained to support the case specific processing commitments for the three cases reviewed based upon assumptions used for the HLW system modeling. As expected, higher levels of accelerated success with salt processing, by means of the SWPF or by alternative methods, provided the following benefits:

- Faster reduction of total Tank Farm waste inventory
- Improvement in risk reduction for waste removal from high risk tanks
- Ability to meet FFA commitments for closure of the non-compliant tanks by year through 2022
- Increased Type III tank space providing higher levels of flexibility and contingency for handling emergent technical and physical processing impacts

The analysis also showed, from a space management standpoint, the Tank Farm can handle a delay in the startup of the SWPF. However, there is greater risk of not fulfilling HLWD's mission to stabilize waste in order to reduce risk, close tanks and support other SRS missions.

1.2 *Introduction*

On March 23, 2001, the Defense Nuclear Facilities Safety Board (DNFSB) issued Recommendation 2001-1, High-Level Waste Management at SRS. The recommendation addresses the need to ensure that the margin of safety and amount of tank space in the SRS HLW system is sufficiently maintained to enable timely stabilization of nuclear materials at SRS. The Department of Energy's revised implementation plan dated, September 14, 2001, committed to a sensitivity analysis of the Tank Farm schedule. This analysis was to be an evaluation surrounding an FY10 startup of a salt processing facility and to include other initiatives such as alternate methods of low-source-term salt disposition.

The following section describes the salt disposition sensitivity strategies, the major salt processing assumptions, and the case results. This analysis also compares the Useable Type III Tank Space forecasts with Revision 12 of the Plan and identifies the risks associated with operation of the HLW system that could have a major impact. The salt disposition sensitivity strategies and assumptions were agreed to by DOE-SR and HLW per the HLW System Plan Assumption Sheets.

1.3 *Salt Disposition Sensitivity Strategies*

Under the integrated Salt Disposition Strategy, salt solution will be processed through three paths; low curie salt, Actinide Removal and the SWPF using Caustic Side Solvent Extraction (CSSX). The Low curie path will send the salt solution directly to Saltstone if it meets the Waste Acceptance Criteria (WAC) requirements. The Actinide Removal Process will send a decontaminated salt stream to Saltstone and a monosodium titanate (MST) actinide stream to the Defense Waste Processing Facility (DWPF). The SWPF will send a decontaminated salt stream to Saltstone, an MST actinide stream to DWPF, and an acidified cesium stream to DWPF. Depending on the case being analyzed, the amount of salt solution for each of these paths varies. The demonstration SWPF will have an initial capacity less than 20% of the full-scale facility (17.5 gpm). The full scale SWPF will process 17.5 gpm when operating. This ensures the facility sustains a 6,000 kgal per year (running average) feed to SWPF. Note that the current Request for Proposal (RFP) has the Design contractor providing a cost and schedule sensitivity study for a SWPF over the range of 1% to 20% of the full-scale facility.

Three different Salt Disposition strategies were modeled to bound varying levels of success associated with the startup and processing rates for salt processing. Modeling results of the three Salt Disposition strategies will provide the basis for assessing potential HLW system impacts as further decisions are made on the sizing and timing of the SWPF and as results are obtained from initial alternative salt disposition efforts (*e.g.* low curie processing). The three Salt Disposition strategies provided by DOE ensure that HLW in the 49 waste tanks is processed by the 2028 STP regulatory commitment date.

Other than for specific Salt Disposition assumption differences highlighted below, each of the three cases modeled used the same set of approved HLW System Plan Revision 13 assumptions. The Revision 13 assumptions, which were approved by both WSRC and DOE-SR, include details on such items as the processing rates for HLW evaporators, designated uses of waste tanks and the forecast volumes of influents from the canyons and DWPF to HLW. These assumptions are contained in HLW-PMD-2002-0004.

The major assumptions for the Salt Disposition production sensitivity strategies are contained in the following summary table.

Salt Sensitivity Case Assumption

Waste Disposition Strategies	**Case 1**	**Case 2**	**Case3**
Low Curie Salt and/or Actinide processing to Saltstone	Unsuccessful	1,500 kgal of saltcake processed using low curie by the end of FY05. (~5,500 kgal of salt solution.)	1,500 kgal of saltcake processed using low curie by the end of FY05. Additional 1,500 kgal of saltcake processed using low curie by the end of FY07. (Total of 3,000 kgal of saltcake or ~11,000 kgal of salt solution)
Tank 48 return to HLW Service	Available for use as SWPF feed tank in FY12	Complete by beginning of FY06	Complete by beginning of FY06
Small Scale Salt Waste Processing Facility Processing begins % of design flowrate*	FY12 10% design flowrate	FY10 15% design flowrate	FY08 20% design flowrate
Additional Salt Waste Processing Capacity Processing begins % of design flowrate*	FY16 100%	FY15 80%	FY13 50%
Canister Production Rate Cans in FY01–06 Feed Break Avg. cans/year for remainder of program	1,150 FY07-09 230	1,150 FY07-09 230	1,150 none 230 Not counting Salt-only cans at end of program.

* Current Design flowrate is 6,000 kgal/yr at 6.44 M of Na^+.

1.4 *Salt Sensitivity Assumption Category Description*

A further description of each of the Waste Disposition Strategies in the table above follows.

1.4.1 Low Curie Salt and Actinide Processing to Saltstone

The low curie salt waste will be segregated from the other salt waste by removing the interstitial salt solution from selected tanks. The remaining salt cake in those tanks will be dissolved. If it meets performance requirements it will be stabilized and disposed at Saltstone under a landfill disposal permit.

The low curie with high actinide salt waste will be segregated from the other salt waste by removing the interstitial salt solution from other tanks. The remaining salt cake in those tanks will be dissolved and then processed through an actinide removal step. The actinides would be sent to vitrification but the bulk of the volume would be stabilized and disposed at Saltstone.

The cases assume varying levels of success for these alternative salt disposition methods. Case 1 assumes that hard saltcake is dissolved but that Saltstone WAC requirements are not met and therefore, no alternative salt disposition is accomplished. Cases 2 and 3 assume that 1,500 kgal and 3,000 kgal of hard saltcake are successfully dispositioned through alternative processing by FY05 and FY07, respectively.

1.4.2 Tank 48 Returned to HLW Service

Scoping studies are underway to evaluate methods to process the existing material in Tank 48 to remove organics to allow its use for the storage of other HLW. The return of Tank 48 to storage service is assumed to be by FY06 for Cases 2 and 3. For Case 1, Tank 48 cannot be assumed for storage of waste until it is used as a SWPF feed tank in FY12.

1.4.3 Small Scale Salt Waste Processing Facility

The high curie and actinide salt waste is the remaining material not segregated into the two streams discussed in Section 1.4.1. This material will be evaluated to determine what level of cesium and actinide removal will be required to meet the performance requirements so it can be stabilized and disposed at Saltstone. For materials unsuitable for disposal by these methods, a small scale Caustic Side Solvent Extraction (CSSX), or other backup technology facility, would be deployed.

1.4.4 Additional Salt Waste Processing Capacity

An estimated total of 80 Mgal of salt solution is assumed to require processing over the life of the HLW Program per the "Bases, Assumptions, and Results (BAR) of the Flowsheet Calculations for the Decision Phase Salt Disposition Alternatives" (WSRC-RP-99-00006, Revision 3, May 2001). The cases assume that processing of HLW waste is completed by 2027 (allows 1 year margin from the 2028 STP commitment). Processing values and startup dates for this category on the table were developed to ensure that the STP commitment was met. Additional salt waste processing capacity was calculated in two steps. First, additional capacity is calculated assuming the small scale SWPF and Low curie actinide removal programs are successful. Second, after startup of these programs, capacity is then sized to meet the FY27 completion date.

NOTE: Computer modeling for Revision 13 resulted in a new estimate of the total salt solution to be processed (approximately 83 Mgal versus the 80 Mgal assumed in the Salt Waste BAR). When Case 3 was modeled, this resulted in the completion of salt processing in FY28 versus the targeted FY27. Case 3 could have been remodeled with an additional salt waste processing capacity design flowrate of 60% versus the 50% originally assumed to bring the processing completion date back into FY27.

1.4.5 Canister Production Rate

The canisters produced between FY01-06 are the same for all cases. HLWD intends to manage to avoid a DWPF feed break. However, Cases 1 and 2 assume a break in FY07-FY09 because of reduced funding that impacts the ability for sludge processing. As such, Sludge Batch 4 feed is delayed until the beginning of FY10. The average canister production rate for coupled operations (*i.e.* salt and sludge processed together at DWPF) was modeled in SpaceMan II™ at 230 canisters per year for all three Cases. GlassMaker modeling of the sludge batches showed that individual Case yearly canister rates may range from 223 to 230 canisters per year dependent on the characteristics of the sludge and salt streams being coupled in a particular year. Case 3 canister production assumes that additional funding from Congress is obtained or that additional savings are implemented to maintain sludge feed to DWPF without a feed break.

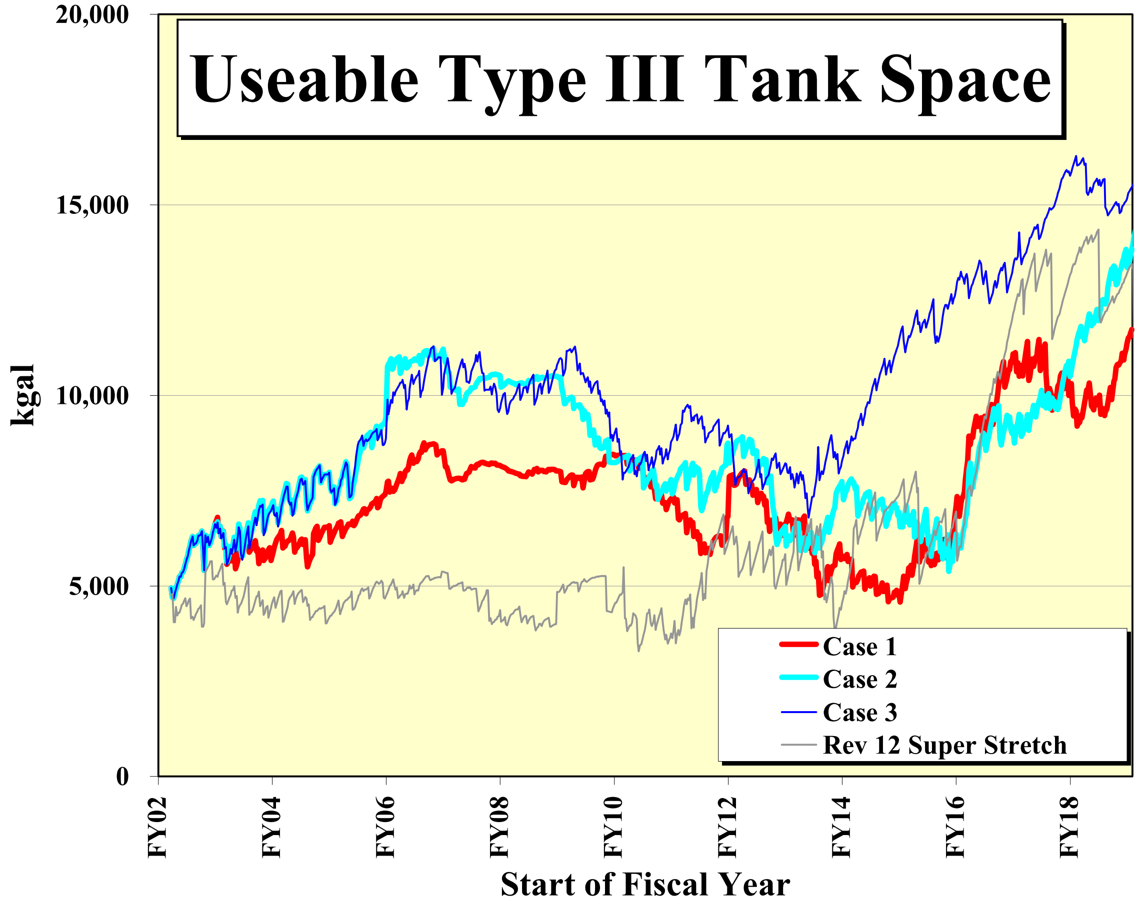


Figure 2

Useable Space Table (Start of Fiscal Year)

kgal	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18
Case 1	6,367	5,975	6,460	7,145	8,697	8,212	8,032	8,192	7,325	6,180	6,541	5,503	4,922	6,089	10,264	9,872
Case 2	6,367	6,914	7,945	8,631	11,031	10,459	10,481	8,637	7,645	7,979	7,881	6,803	7,066	6,103	9,728	9,644
Case 3	6,367	6,772	7,954	8,983	10,982	10,148	10,201	10,121	8,546	9,182	8,192	8,539	10,966	11,862	13,147	15,086
Rev 12	4,496	4,722	4,290	4,837	5,264	4,770	4,023	5,250	3,965	6,086	5,798	4,733	6,978	6,660	10,570	11,850

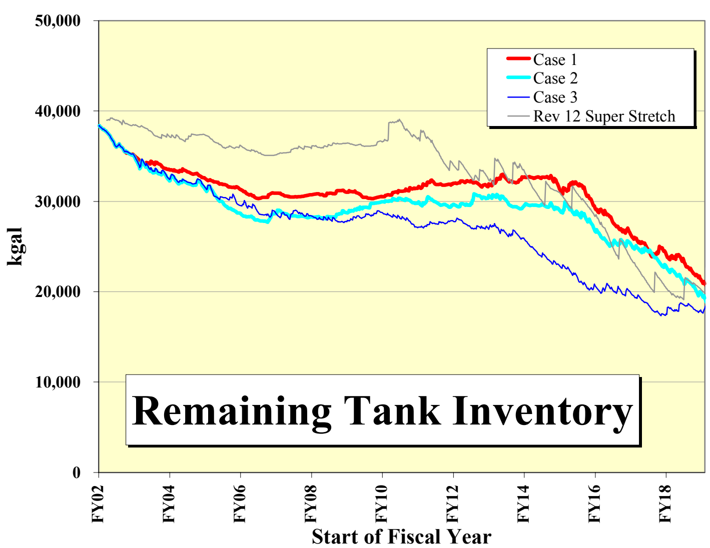


Figure 3

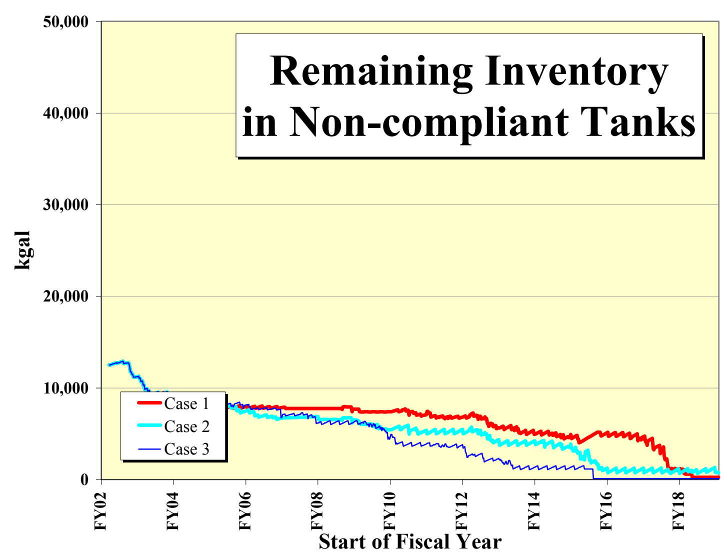


Figure 4

1.5 *Salt Sensitivity Case Results Summary*

There are three key metrics that provide the easiest comparison of the results of the three cases over time. They are the Remaining Tank Inventory, the Remaining Inventory in Non-Compliant Tanks and the Useable Type III Tank Space. Charts are provided for comparison.

The summary of the modeling results for the Salt Sensitivity Cases is provided in the key milestones in Section 2 along with a comparison to the Revision 12 cases.

1.5.1 Salt Disposition Strategy - Case 1 Results Summary

The Salt Disposition assumptions for Case 1 are considered to be the most pessimistic of the three cases due to the later start of the SWPF and the lack of success in any alternative salt processing. As shown in the charts above, the results of modeling revealed that of the three cases, Case 1 —

1. Meets the STP regulatory commitments to have waste removed from all waste tanks by 2028,
2. Meets the final Federal Facility Agreement commitment of 2022, however, it fails to meet the individual tank closure schedule,
3. Provides the slowest risk reduction for waste removal from high risk tanks,
4. Provides the slowest total Tank Farm inventory reduction,
5. Provides the least contingency of the 3 cases for meeting process commitments until the start of the SWPF. That is, Type III tank space is the lowest of the 3 cases at the date of SWPF startup.

Though not formally modeled, an assessment was performed on the impacts of the Case 1 results assuming no FY07 – FY09 feed break resulting in the shutdown of DWPF during these years. Essentially, the following additional streams would have to be received and processed during these years to support the preparation of Sludge Batches 4 and 5 and an assumed DWPF canister production rate of 200 can/year.

Influent Stream	Volume	Space Recovery Factor	Space Impact after Evaporation
DWPF Recycle	3.1 Mgal	0.95	0.2 Mgal
ESP Washwater	3.4 Mgal	0.85	0.5 Mgal

Therefore, a net total impact to Type III tank space of 0.7 Mgal would result between FY07-09. The Useable Type III Tank Space chart and associated table shows that there is adequate Type III tank space in this time period to accommodate the impact of a Case 1 scenario with no DWPF feed break.

1.5.2 Salt Disposition Strategy - Case 2 Results Summary

The Salt Disposition assumptions for Case 2 are considered moderately optimistic due to the improved start of the SWPF and some assumed success in alternative salt processing. As shown in the charts above, the results of modeling revealed that of the three cases, Case 2 —

1. Provides improvement in risk reduction for waste removal from high risk tanks as compared to Case 1,
2. Provides improvement in Tank Farm inventory reduction as compared to Case 1,
3. Meets the STP regulatory commitments to have waste removed from all waste tanks by 2028,
4. Meets the final Federal Facility Agreement commitment of 2022 for the non-compliant tanks, however, it fails to meet the individual tank closure schedule,
5. Provides improved contingency over Case 1 for meeting process commitments until the start of the SWPF. That is, more Type III tank space is forecast at the date of SWPF startup.

1.5.3 Salt Disposition Strategy - Case 3 Results Summary

The Salt Disposition assumptions for Case 3 are considered the most optimistic due to the earliest start of the SWPF and the improved success in alternative salt processing. As shown in the charts above, the results of modeling revealed that of the three cases, Case 3 —

1. Provides the fastest risk reduction for waste removal from high risk tanks,
2. Provides the fastest total Tank Farm inventory reduction,
3. Meets the STP regulatory commitments to have waste removed from all waste tanks by 2028,
4. Meets the final Federal Facility Agreement commitment of 2022 and the commitment to have a certain number of tanks closed by designated years,
5. Provides the most contingency of the 3 cases for meeting process commitments until the start of the SWPF. That is, Type III tank space is the highest of the 3 cases at the date of SWPF startup.

As can be seen in the Key Milestones in Section 2, Case 3 results in an additional estimated 79 canisters being produced versus the canister totals for Cases 1 and 2 (6,120 cans for Case 3 versus 6,041 cans for Cases 1 and 2). The additional 79 canisters result from a salt-only campaign required at the end of the program due to sludge processing being completed in FY24, three years ahead of the end of salt processing. To eliminate a three year salt-only campaign for Case 3 and reduce the total canisters produced, the additional salt waste processing capacity would need to provide an additional 70% of the design flowrate starting in FY13 versus the 50% design flowrate assumed in this case. Overall life cycle costs of the program would also be reduced by approximately $1 billion since waste processing would be completed 3 years earlier.

1.6 *Comparison of HLW System Plan Revision 12 versus Revision 13 Useable Type III Tank Space Forecasts*

A comparison of Type III tank space for the Revision 12 Super Stretch Case versus the three Salt Sensitivity Cases is shown in the Useable Type III Tank Space Chart above. For the three of the Revision 13 cases, the available Type III tank space is significantly better through the startup of the SWPF than what was forecast in Revision 12. The increase in available Type III tank space can be attributed to the following main factors.

1. The 3H Evaporator performance for FY01 and the first 5 months in FY02 has exceeded what was forecast by Revision 12 by over 1.6 million gallons. (2.4 Mgal space recovered actual versus 0.8 Mgal forecast). The improved 3H performance is a result of the implementation of initiatives to overcome evaporator bottoms receipt tank (Tank 30) cooling issues. Therefore, the 3H Evaporator has been able to outrun the Revision 12 forecast.

   The 3H Evaporator performance has allowed for more effective use of recently recovered storage space such as in Tank 49. In Revision 12, to support processing commitments associated with the operation of DWPF and the canyons, Tank 49 was used to store waste that had not fully been concentrated (~ 5.0 molar caustic). This was directly related to the assumption that 3H Evaporator operations would be limited by cooling issues. In the Revision 13 cases, Tank 49 can be reserved for storing high caustic wastes from the evaporator systems that has been fully concentrated (~9.5 molar caustic).

2. For Cases 2 and 3, planned success in alternative salt disposition initiatives (low curie and actinide removal) on Tanks 41, 31 and 38 (Case 3 only), creates space (1,500 kgal and 3,000 kgal, respectively) in Type III tanks through the removal of saltcake from the Tank Farm.

3. The successful recovery of Tank 48 for storage of waste provides an additional 1 Mgal of Type III tank space starting in FY06 for Cases 2 and 3 and in FY12 for Case 1.

1.7 *Salt Disposition Sensitivity Strategies Risk Comparison Summary*

As described above, the improved 3H Evaporator performance for FY01 and the continued improved forecast for FY02 results in a significantly better Type III tank space forecast through the startup of the SWPF than was predicted in Revision 12. However, even with this improvement, there are risks associated with operation of the HLW system that could impact processing commitments. Some of the major risks include:

1.7.1 Evaporator performance able to match assumed operating rates.

The best way to ensure evaporator performance meets forecast objectives is to maintain the best feed material available in front of each evaporator system. This would maximize the ability of the evaporators to efficiently recover space previously lost from the receipt of influent streams from the canyons, DWPF and internal sources (*i.e.* sludge washing decants, transfer dilution, flushes, etc.). Maximizing the efficiency of the evaporator operations requires the following:

- Maintaining salt receipt space in evaporator drop tanks (See Section 1.7.2 below)
- Maintaining concentrated high caustic (referred to as *liquor*) storage space in tanks outside the evaporator systems
- Maintaining qualified feed available for evaporation.

Emergent technical or physical issues associated with evaporator operations would also impact evaporator performance. Examples in recent years include loss of 2H Evaporator operations for ~21 months that resulted from chemistry issues and impacted operations of the 3H Evaporator in FY01/FY02 that resulted from cooling issues in the concentrate receipt tank (Tank 30).

To address the risks associated with successfully integrating the activities required to meet processing commitments and achieve evaporator performance, a Water Management (WM) Team was chartered to develop and monitor a HLW transfer and evaporator feed health plan. The WM Team is co-chaired by Operations and Process Engineering and consists of cross-functional representation with expertise in process chemistry, program planning and scheduling, and Tank Farm and DWPF operations and engineering. Operating the evaporators and performing the associated transfers per the Water Management plan allows for the most efficient recovery of space in the Tank Farm system.

As can be seen in the following charts, the assumed evaporator performance parameters used in the Plan are comparable to those used in Revision 12 of the Plan. It should be noted that in FY01 and through the 1st Quarter of FY02, the evaporators recovered an actual 3,100 kgal of space versus the 2,600 kgal forecast by the Revision 12 Super Stretch Case.

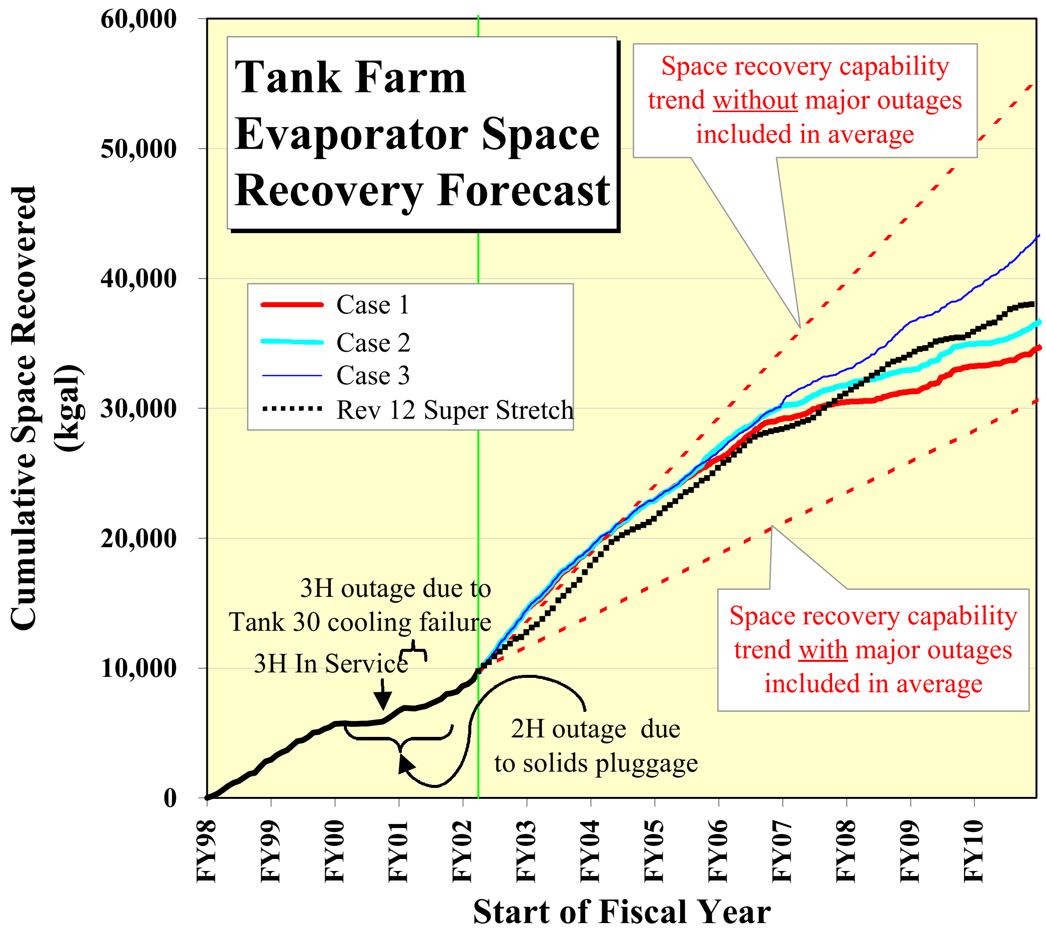


Figure 5

The assumptions are also comparable with historical performance for the evaporator systems. Actual evaporator performance for FY98 through the beginning of January 2002 is shown. As discussed above and as illustrated on the charts, two major evaporator outages occurred during this time period. Based on actual performance during this period, two historical trend lines are projected on the charts. One trend line projects the evaporator performance capability with all outages included. The second trend line removes the impacts of the two major outages. The second trend line does include the other planned and unplanned outages that occurred during this period such as feed pump replacements, flushes, mercury issues and Tank 30/32 cooling. The Tank Farm

Evaporator Space Recovery forecast shows that the Revision 13 assumptions are bound by the two historical trend lines.

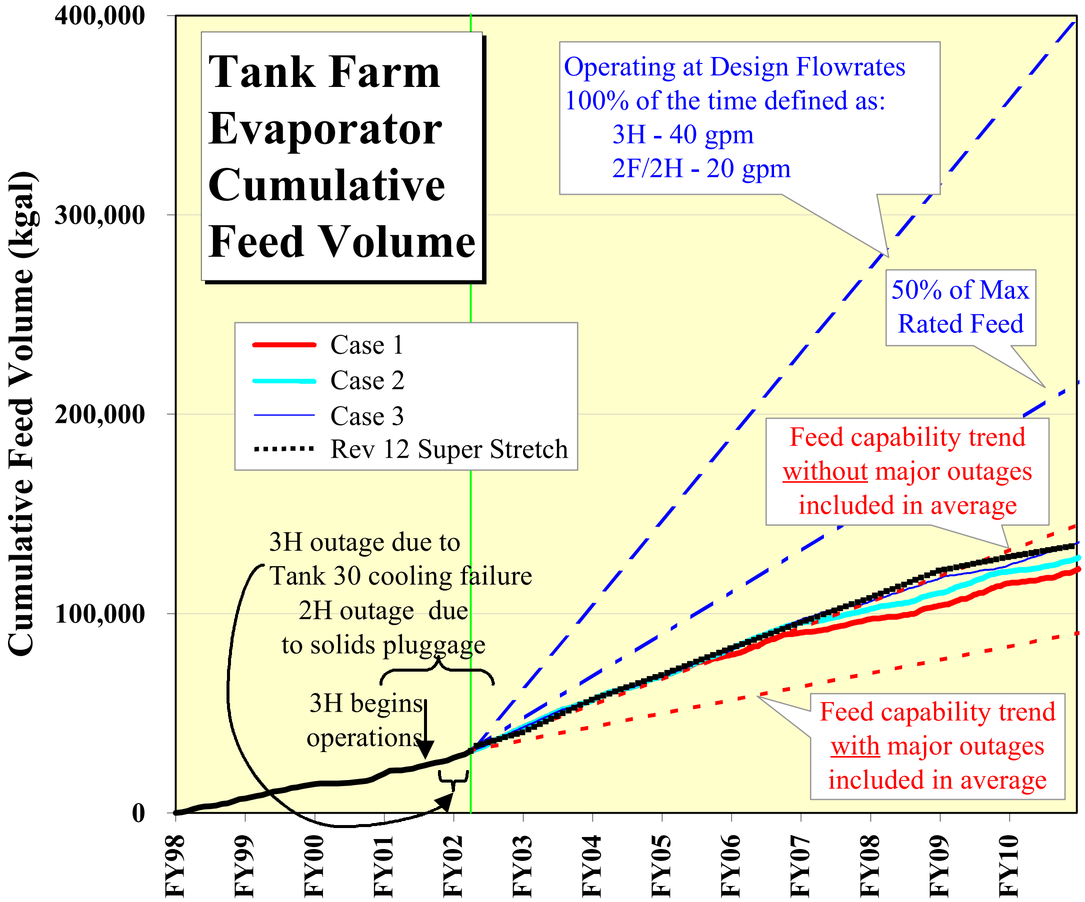


Figure 6

1.7.2 Successful implementation of planned low curie and actinide removal salt disposition plans.

The successful implementation of the low curie and actinide removal salt disposition plans to the levels that are assumed provides increased Tank Farm flexibility by freeing up Type III tank space. The inability to implement these alternative salt dispositioning techniques impacts the efficiency of evaporator operations due to limited salt receipt space.

During the evaporation process salts are formed in the evaporator concentrate receipt tank and the tank becomes saltbound. Either an alternative concentrate receipt tank must be made available or a salt dissolution campaign must be performed to remove the salt out of the evaporator system. In Case 1, which assumed no low curie and actinide removal success, four different Tank 37 salt dissolution campaigns were required between FY02 and FY13 to provide salt receipt space to maintain 3H Evaporator operation. Cases 2 and 3 required less salt dissolution campaigns in the 3H Evaporator concentrate receipt tank due to the success of alternative salt processing. The impact to evaporator operations and to other processing commitments could be even more severe if more salt is formed than is forecast.

Impacts are also seen for the 2H and the 2F Evaporator systems but to a lesser degree. Current modeling shows that Tank 38, the concentrate receipt tank for the 2H Evaporator, becomes saltbound by FY07 requiring an alternative concentrate receipt tank to be available. For all cases, Tank 46, (concentrate receipt tank for the 2F Evaporator), becomes saltbound by FY04 and Tank 27 is modified to allow its use as the concentrate receipt tank.

Another consequence associated with low curie and actinide removal is that if a large volume of saltcake is dissolved and does not meet the Saltstone WAC requirements, there is limited salt receipt space in the evaporator systems to re-concentrate the resultant salt solution back to a saltcake form. This would have a negative impact on Type III tank space depending on how much saltcake was dissolved.

1.7.3 Ability to integrate transfers required to support sludge and salt processing.

Significant planning integration will be required in the outyears to remove waste from tanks to ensure feed is available to meet sludge and salt processing forecasts.

1.7.4 Ability to prepare salt solution quickly enough to meet SWPF feed assumptions.

For the cases in the Plan, the yearly requirements for salt solution feed to the SWPF ranges from 4.2 to 6.6 Mgal/yr Three tanks (Tanks 48, 49 and 50) are forecast to be the feed tanks for the SWPF. To meet the yearly feed requirements and allow time for transfers and feed characterization, salt removal will often be required from multiple tanks during the same time period. Salt removal techniques must be robust enough to provide approximately 1 to 1.2 Mgal of salt solution every 2 months to meet salt processing needs.

1.7.5 Potential for increased influents above those that have been forecast.

The cases are based on the latest forecasts for future influents to the Tank Farms. Influents significantly greater than forecast could impact processing commitments depending on the volume and time that they are received. An example of a potential influent impact would be if the DWPF steam atomized scrubbers (SAS) in the DWPF melter off-gas system had to be returned to operation prior to the start of the SWPF. This would be required if higher cesium levels than expected were seen in future sludge-only batches being processed at DWPF. Operation of the SASs results in an approximate 700 kgal increase in the annual DWPF recycle stream to the Tank Farm.

Another potential source of increased influents is from the canyons. Shutdown flows for F Canyon have not been well defined. The volume of waste sent to the Tank Farms could vary widely depending on the final flushing requirements for shutting down the facility.

1.8 *Conclusion*

Detailed modeling of the three Salt Disposition Sensitivity Cases reveals that, as expected, higher levels of accelerated success with salt processing, by means of the SWPF or by alternative methods, results in

- Faster reduction of total Tank Farm waste inventory
- Improvement in risk reduction for waste removal from high risk tanks
- Ability to meet FFA commitments for closure of the non-compliant tanks by year through FY22
- Increased Type III tank space providing higher levels of flexibility and contingency for handling emergent technical and physical processing impacts.

To reduce risks associated with meeting the HLW mission and to maximize the health of the Tank Farms, efforts to further accelerate salt disposition initiatives should continue to be pursued. The only way to truly gain space in the Tank Farms is to remove salt. Evaporation only partially recovers space that was previously lost when influent streams were received.

It is also evident that efforts should be made to couple the salt and sludge streams to complete at the same time. This minimizes the total number of HLW canisters produced and eliminates the need for the development of a salt-only flowsheet. It also reduces the life cycle costs of the program by approximately $1 billion since waste processing would be completed 3+ years earlier.

A review of results also reveals that adequate Tank Farm space can be maintained to support the case specific processing commitments for the three cases based upon assumptions used for the HLW system modeling. The cases have SWPF start dates ranging from FY08 – FY12 and varied levels of alternative salt processing success. Though early evaporator space recovery success is assumed for the three cases, the assumed processing rates are not unrealistic when compared to historical actual values. In FY01 and during the 1st Quarter of FY02, the actual space recovered from evaporation was ~3.1 Mgal versus a Revision 12 Super Stretch forecast of ~2.6 Mgal. The challenge will be to maintain the HLW system (evaporators, transfer systems, and other associated infrastructure) so that existing stored *backlog waste* and future influent streams can be efficiently processed to maximize the space recovery.

Some preliminary assessments were made to determine if impacts to processing commitments would result if the existing backlogged waste could not be worked off as aggressively as planned in these cases (roughly over the next two to four years). Though these changes in evaporator assumptions were not modeled, a review of the case results indicate that an adequate margin in Type III tank space is provided to allow space recovered from the processing of backlogged waste to be accomplished over a longer period of time (4 – 6 years) and still meet planned processing commitments. As shown in the Useable Type III Tank Space Chart, the Type III tank space margin in the early years indicates more useable Type III tank space in these years than was forecast in Revision 12. The improved performance of the 3H Evaporator in FY01 and in FY02 (to date) and Tank 49 being returned to HLW use has resulted in an actual useable space volume of 2.2 Mgal in Type III tanks, as of January 1, 2002, versus the 1.4 Mgal that was forecast in the Revision 12 Super Stretch Case. Continued early success in the evaporation of the backlogged waste is projected.

2. Planning Bases

2.1 *Reference Date*

The reference date for the mathematical modeling (SpaceMan II™ and GlassMaker) of the Plan is January 1, 2002. Schedules, forecasted budget, milestones, cost estimates, and operational plans were current as of that date.

2.2 *Funding*

The funding required to support the Plan is shown in Appendix I.1, J.1 and K.1 for Case 1, Case 2 and Case 3 respectively, by individual projects. Note that funding to upgrade the facilities to comply with 10CFR830 requirements is not defined and has not been included in the Plan. Key milestone dates required to remove waste from storage, process it into glass or saltstone grout, and close HLW facilities shown in Table 2-A are supported by the budget as described in the Appendixes.

Table 2–A Key Milestones

Key Milestone	Rev 12 Base Case	Rev 12 Stretch Case	Rev 12 Super Stretch Case	Rev 13 Case 1	Rev 13 Case 2	Rev 13 Case 3
Total Number of Canisters Produced	5,914	5,914	5,871	6,041	6,041	6,120
DWPF Sludge Production (in average canisters per year)						
• FY01	163	220	255	227(Act)	227(Act)	227(Act)
• FY02	111	150	150	150	150	150
• FY03	155	210	240	210	210	240
• FY04	163	220	240	220	220	240
• FY05	111	150	150	150	150	150
• FY06	147	200	115	193	193	143
• FY07	200	Outage	200	Outage	Outage	200
• FY08	107	Outage	200	Outage	Outage	150
• FY09	Outage	Outage	200	Outage	Outage	230
• FY10	150	100	150	200	150	230
• FY11	200	230	250	200	230	230
• FY12	200	230	250	150	230	230
• FY13 to End of Sludge Processing	200	230	250	230	230	230
• Salt-only Cans at End of Program	0	0	0	0	0	79

Key Milestone	Rev 12 Base Case	Rev 12 Stretch Case	Rev 12 Super Stretch Case	Rev 13 Case 1	Rev 13 Case 2	Rev 13 Case 3
Salt Processing Information						
• Low Curie and Actinide Success				No	Yes	Yes
• Years Processed				n/a	FY03-05	FY03-07
• Saltcake Processed				n/a	1.5 Mgal	3.0 Mgal
Date Salt Waste Processing Facility Becomes Operational	FY10	FY10	FY10	FY12	FY10	FY08
• % Operational Flowrate (100% equals 6 Mgal/yr at 6.44 [Na])	100%	100%	100%	10%	15%	20%
Date Additional Salt Waste Processing Capacity provided				FY16	FY15	FY13
• % Additional Operational Flowrate (100% equals 6 Mgal/yr at 6.44 [Na])	n/a	n/a	n/a	100%	80%	50%
• Max Yearly % Operational Flowrate	100%	100%	100%	110%	95%	70%
Salt Solution Processing Rate(Kgal/yr)						
• FY08						1,200
• FY09						1,200
• FY10	3,000	3,000	3,000		900	1,200
• FY11	6,000	6,000	6,000		900	1,200
• FY12	6,000	6,000	6,000	600	900	1,200
• FY13	6,000	6,000	6,000	600	900	4,200
• FY14	6,000	6,000	6,000	600	900	4,200
• FY15	6,000	6,000	6,000	600	5,700	4,200
• FY16 until end of program	6,000	6,000	6,000	6,600	5,700	4,200
Key Risk Reduction Dates						
Date when all high risk tanks are emptied	FY16	FY16	FY14	FY18	FY15	FY13
Date when all non-compliant tanks are emptied	FY19	FY17	FY15	FY18	FY18	FY15
Date when all non-compliant Tanks are closed	FY21	FY20	FY18	FY20	FY20	FY17
Date by which salt processing is completed	FY24	FY22	FY22	FY27	FY27	FY28
Date by which sludge processing is completed	FY29	FY27	FY23	FY27	FY27	FY24
Regulatory Commitments						
Are all STP commitments met?	No	Yes	Yes	Yes	Yes	Yes
Are all FFA regulatory commitments met?	No	No	Yes*	No	No	Yes*
	* Yearly closure commitments (total number of tanks/yr) are met					
Canister Storage Locations						
• Make additional 450 GWSB 1 locations usable	FY05-07	FY03-05	FY03-05	By FY04	By FY04	By FY04
• Begin work on additional Canister Storage locations (GWSB 2 or Modules)	Module #1 FY07	Module #1 FY10	Module #1 FY04 Module #2 FY07	Module #1 FY07	Module #1 FY08	Module #1 FY04 Module #2 FY07
• Place GWSB 2 or Modules into Radioactive Operations	Module #1 FY10	Module #1 FY13	Module #1 FY07 Module #2 FY10	Module #1 FY10	Module #1 FY11	Module #1 FY07 Module #2 FY10

Key Milestone	Rev 12 Base Case	Rev 12 Stretch Case	Rev 12 Super Stretch Case	Rev 13 Case 1	Rev 13 Case 2	Rev 13 Case 3
Waste Removal						
• Tank 7 ready for sludge removal	Oct-03	Jul-02	Jul-02	Jul-02	Jul-02	Jul-02
• Tank 11 ready for sludge removal	Apr-08	Apr-08	Apr-05	Apr-08	Apr-08	Apr-05
• Tank 26 ready for sludge removal	Dec-10	Jan-11	Sep-07	May-10	May-10	Jul-07
Tank Closures						
• Complete closure of Tank 19	Apr-03	Apr-03	Apr-03	Apr-03	Apr-03	Apr-03
• Complete closure of Tank 18	Apr-04	Apr-04	Apr-04	Apr-04	Apr-04	Apr-04
• Complete closure of 5th Tank	FY10	FY10	FY08	FY10	FY10	FY09
• Complete closure of 6th Tank	FY11	FY11	FY09	FY10	FY10	FY09
• Complete closure of 7th Tank	FY13	FY13	FY10	FY10	FY10	FY10
• Complete closure of 24th Tank	FY21	FY20	FY19	FY20	FY20	FY17
Key Space Management Activities						
• Return Tank 48 for waste storage/ Salt Feed tank service	FY10	FY10	FY10	FY12	FY06	FY06
• Reuse Tank 49 for waste storage	Jul-01	Jul-01	Jul-01	Jul-01	Jul-01	Jul-01
• Reuse Tank 50 for waste storage	Sep-02	Sep-02	Sep-02	Jul-02	Jul-02	Jul-02
• Tank 37 modification completed for 3H Evaporator Drop Tank	Sep-02	Sep-02	Sep-02	Aug-02	Aug-02	Aug-02
• Tank 37 Salt Dissolution #2	n/a	Mar-05	Mar-04	Jan-04	Jan-04	Jan-04
• Tank 37 Salt Dissolution #3	n/a	n/a	n/a	Oct-06	Oct-06	n/a
• Tank 37 Salt Dissolution #4	n/a	n/a	n/a	Oct-13	n/a	n/a
• Tank 31 modification completed for 3H Evaporator Drop Tank	n/a	n/a	n/a	n/a	n/a	Nov-06
• Tank 27 modification completed for 2F Evaporator Drop Tank	Mar-06	May-06	Feb-05	Jul-04	Jul-04	Jul-04
• Tank 42 modification completed for 2H Evaporator Drop Tank	Feb-12	Feb-11	Feb-10	n/a	n/a	n/a
• Tank 41 modification completed for 2H Evaporator Drop Tank	n/a	n/a	n/a	Oct-06	Oct-06	Oct-06
Repository Activities						
• Start shipping canisters to the Federal Repository	FY10	FY10	FY10	FY10	FY10	FY10
• Complete shipping canisters to Federal Repository	FY39	FY39	FY39	FY39	FY39	FY40
Facility Deactivation Complete	FY40	FY40	FY40	FY40	FY40	FY41

3. Planning Methodology

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

3.1 *Planning Oversight*

Some uncertainty is inherent in the 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-SR, and WSRC personnel are continuously evaluating the uncertainties in the Plan and incorporating changes to improve planning and scheduling confidence. WSRC refines and updates the 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 Team** 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.

Waste Acceptance Criteria (WAC) are in place for 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 **HLW Management / Nuclear Materials Interface meetings** ensure clear communication of needs between NMMD 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 routine basis between the working level planners and waste forecasters.

3.1.1 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 the Plan was the WCS datafile of January 1, 2002.

The **Space Management Model (SpaceMan II™)** is a Windows® 98 program used to forecast outyear tank farm conditions. 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, waste transfers, evaporation, waste removal (including salt dissolution and sludge removal), sludge processing, blending, and tank status (fill limits, jet heights, closure, reuse, etc.). The program automatically steps through each week and tracks available space, inventory, and tank chemistry. Tank supernate is tracked depending on its location in the waste forms (free supernate or interstitial liquid in salt and sludge). 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 and numerous data files, which are used to construct reports and charts.

The **GlassMaker Model** is a program which takes its compositions from the WCS. Caustic Side Solvent Extraction (CSSX) is the process of choice for the SWPF. The modeling of SWPF feed to DWPF has been simplified and is done on an annualized basis. As noted previously, the remaining sludge is accounted for in

Sludge Batch 10. Monosodium titanate is added to the appropriate sludge batch as TiO_2 to adsorb strontium and alpha emitting radionuclides.

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 II™, GlassMaker, and the Financial Model were used to generate the production planning and financial data contained in the Appendixes I thorough L of the Plan.

Several additional models are available but were not used to provide input into the 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 the 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 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. Extended Sludge Processing (ESP) sludge washing endpoints are established based on CPES and PCCS analyses. GlassMaker incorporates the PCCS algorithms.

3.2 *Regulatory Constraints*

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

Site Treatment Plan (STP)

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 radioactive 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."*

Federal Facility Agreement (FFA)

The production plans for the cases in the Plan meet this commitment. The SRS Federal Facility Agreement (FFA) was executed January 15, 1993 by DOE, the EPA, and the 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 HLW Removal Plan and Schedule (WRP&S)" was submitted to EPA and SCDHEC on March 7, 2002. The schedule provides end dates for the 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, 7 and 8 could be used to store concentrated supernate after the completion of bulk waste removal. However, due to tank leaks experienced in Tanks 5 and 6 during FY01, no transfers are planned into the Type I tanks other than those required to support waste removal activities in the old style tanks.

The current FFA schedule 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 F to see the approved schedule.

The production plans for Case 3 as depicted in Appendix K fully meets and exceeds these requirements. Cases 1 and 2 as depicted in Appendix I and J of the Plan do not fully meet this commitment. In these cases, there are several years when the number of closed tanks falls behind the required number in the FFA. The number of tanks behind schedule ranges between 1-2 tanks in these years. However, in both of these cases all FFA non-compliant tanks are closed by 2020, two years ahead of the overall schedule commitment of 2022.

National Environmental Policy Act (NEPA)

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

- DWPF Supplemental Environmental Impact Statement (SEIS) (DOE/EIS-0082-S)
- Final Waste Management Environmental Impact Statement (EIS) (DOE/EIS-0200)
- SRS Waste Management EIS (DOE/EIS-0217)
- Interim Management of Nuclear Materials (IMNM) EIS (DOE/EIS-0220)
- Environmental Assessment (EA) for the Closure of the High Level Waste Tanks in F- and H Areas at SRS. (DOE/EA-1164)
- SRS Salt Processing Alternatives SEIS (DOE/EIS-0082-S2)

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, South Carolina on January 9 and 11, 2001. The final EIS is due out by May 2002.

4. Key Issues, Assumptions and Vulnerabilities

Key issues, assumptions and vulnerabilities affecting the HLW System have been identified and are described below. The system plan is based on the outcomes listed in the assumptions for each issue or vulnerability. Potential contingency actions are also described, should the assumptions prove to be incorrect.

Matériel Readiness Program

The successful implementation of the Plan relies on the continued reliable operation of the many aging Tank Farm facilities, systems and components as well as the newer facilities, systems and components that comprise other major facilities such as DWPF. In addition, it assumes the success of numerous and sometimes complicated key activities.

In order to effectively identify and abate critical vulnerabilities that might prevent implementation of the Plan and improve overall system reliability and performance, HLWD has begun development and implementation of a Matériel Readiness Program (based on the Institute of Nuclear Power Operation's (INPO) "Equipment Reliability Process"). Many of the Matériel Readiness Program required key elements already exist, but need to be modified, enhanced or better integrated in order to achieve the level of system and component reliability needed to meet the Plan goals. This program includes:

- Identification of key mission-related HLW System vulnerabilities, development of appropriate vulnerability handling strategies (VHS) and funding of VHSs on a prioritized, risk-based basis.
- Performance Monitoring (at the system and component level)
- Identification of Critical Components
- Continuing Reliability Improvement and Life Cycle Management
- Corrective Action Development, Implementation and Tracking

As the first step to implementing a continuing process that systematically identifies key mission related vulnerabilities in the HLW System, a HLW Tank Farm Vulnerability Assessment (TFVA) was recently completed. This assessment identified Tank Farm related vulnerabilities that may impact implementation of the Plan. It also, identified Vulnerability Handling Strategies to accommodate contingencies, and to reduce the high-risk vulnerabilities in implementing the plan. The HLWD management team set up to develop the Matériel Readiness Program has developed a database and is tracking the implementation of the high risk vulnerabilities handling strategies that were identified in the study. A significant amount of detail regarding these vulnerabilities and vulnerability handling strategies is included in this revision of the Plan. However, in the future, as the Matériel Readiness Program matures and a tracking system is established, specific vulnerabilities will be briefly mentioned as needed in the Plan but not described in detail.

As part of the Matériel Readiness Program, identification of other HLW System mission-impactive vulnerabilities (mainly DWPF-related) is in progress and should be completed by November 2002.

Funding

Progress toward the ultimate goal of immobilizing all the HLW at SRS is highly depended on available funding. When funding levels are reduced, the first priority is to continue to fund activities that ensure the safe storage of waste. Funding above that level is then used to continue current risk reduction activities including immobilization.

HLW System Issues

4.1 *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 location 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 systems cannot be shut down as they contains approximately 38 million gallons of highly radioactive waste, much of which is in a mobile form.

It should be noted that HLWD has continued to make progress during the past year on infrastructure improvement via the Tank Farm Support Services F Area Line Item.

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 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) FY03-FY07
  - Continued smaller improvements will be made with Capital Equipment/General Plant Projects (CE/GPP)
- Leak detection piping and systems will continue to be repaired as needed.

Vulnerabilities: The following HLW Facilities vulnerabilities were identified:

1. Transfer System Infrastructure may fail. This may result in delays in accepting transfers from waste generators, transferring feed to an evaporator or may prevent planned waste preparations for disposal (*i.e.* DWPF or Saltstone feed). This includes:
   - 1.1 Waste Tank transfer jets/pumps (including Telescoping Transfer Jets/Pumps) may fail when needed. [E[1]]
   - 1.2 Pump Tank transfer jets may fail when needed. [E]
   - 1.3 Transfer lines with associated secondary containment and leak detection capability may fail periodic testing. [A]
   - 1.4 Waste Transfer Lines may plug [B]
   - 1.5 Transfer jumpers may leak at nozzle or isolation valves [C]
   - 1.6 Isolation valves may fail to seat or open. [E]
2. Transfer lines are required to be seismically qualified per the Authorization Basis (AB). The current seismic configuration of these lines may not satisfy the seismic requirements nor can they be reasonably modified to meet the requirements. [D]
3. Cooling Water system may fail (e.g. condenser, tower, pumps) [E]

Vulnerability Handling Strategy:

A. Accept Risk of Transfer Line(s) Failure because there is no environmental consequence of failure and no practical vulnerability handling strategy could be identified to address the miles of piping. [1.3[2]]

B. Develop methods to unplug transfer lines. (The Tanks Focus Area (TFA) has assigned this task to Florida International University. Process development is funded and in progress.) [1.4]

[1] Letter indicates the vulnerability handling strategy that addresses each vulnerability
[2] Number indicates the vulnerability associated with the vulnerability handling strategy

C. Perform an evaluation to ensure alternate Canyon receipt path is available. (Acceptable primary transfer paths are available to continue receiving waste from both Canyons. H Canyon also has an acceptable secondary transfer path. However, the secondary path for F Canyon is plugged. HLWD will work with NMMD to reach agreement on a method to unplug the secondary transfer path for F Canyon by October 2002.) [1.5]

D. Accept risk of inability to meet seismic design requirements for transfer lines or other process areas. (To date, no transfer line has failed to be qualified. Therefore, probability is low. Also, the transfer lines that are routinely used are qualified. It is only those that would be used for short durations such as to remove waste. This is a limited time of vulnerability and is considered acceptable.) [2]

E. Ensure adequate spare parts are identified and on hand to support the Transfer System and Cooling System Infrastructure. (An assessment of the existing spare parts program is underway. It is scheduled to be completed by 9/30/02. This assessment will identify programmatic changes as well as identifying critical spare needs. Findings from the assessment will be prioritized by (high, medium, low) with the high priority findings being items which if not corrected could lead to a one month or greater outage. The high priority items will be scheduled and tracked to completion.) [1.1, 1.2, 1.6, 3]

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 and/or fail.
- Obtain additional funding.

4.2 *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. Two of these tanks have been closed. Twelve of the remaining 49 tanks have a leakage history (eleven have evidence of leaks from the primary tank wall and one has 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 F) 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 38 million gallons of high-level radioactive waste is stored in the Tanks Farms, much of it in a mobile form.

Per the Plan, many of these tanks will be well over 50 years old before they are closed. In the last 4 years, additional tank integrity issues have arisen with these tanks:

- Tank 15 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.
- 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. Liquid in this tank was removed to a level below the known leak sites. No waste was released to the environment.
- In early 2001, a transfer of low source term waste was made into Tank 5. Shortly thereafter, small leaks into the annulus were observed. Liquid in this tank was removed to a level below the known leak sites. No waste was released to the environment.

Although SRS maintains an aggressive program to monitor the integrity of the 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.
- Tank inspections will monitor known leak sites and detect any new leak sites in old style tanks, if they occur, so that appropriate compensatory actions can be taken. Ultrasonic Testing (UT) of Type III tanks will inspect for potential degradation so that compensatory actions can be planned prior to leaking.
- 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 radioactive waste in underground tanks.

Vulnerabilities: The following HLW Waste Tank vulnerability was identified:
- A significant leak in a HLW Waste Tank may occur. This would result in several month impacts to one or more key missions. If the leak were to be at the lowest part of the Waste Tank, this would require the emptying of the entire Waste Tank inventory and potentially require the use of existing Contingency Space.

Vulnerability Handling Strategy:
- Accept the risk that a significant HLW tank leak will occur based on the existing leak detection and inspection programs (i.e., leak would be detected and contained to prevent a release to the environment).

Contingencies:
- 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.

4.3 *Tank Farm Waste Storage Space*

Issue: The Tank Farms' useable waste storage space is continuing to be consumed during this period of sludge-only DWPF processing and continued receipts of Canyon wastes. If the waste generating facilities perform as planned, the implementation of additional space management initiatives will be necessary to avoid exceeding the tank farm storage capacity prior to operation of the SWPF.

Background: All parts of the HLW System at SRS are operational except salt processing. Work on salt processing was suspended in January 1998 due to technical issues with the ITP Facility in January 1998. In October 2001, the DOE approved an ROD for the SRS Salt processing Alternative Supplemental Environmental Impact Statement, identifying Caustic Side Solvent Extraction (CSSX) as the technology to be used for separation of radioactive cesium from SRS high-level waste. In December 2001, a Request for Proposal for a two-phased design/build process for design, construction, and commissioning of a SWPF using CSSX technology was issued. In parallel, evaluation of other salt processing alternatives for specific waste portions that would not need to be processed in the CSSX facility is underway. The evaluation of alternatives and potential operations is being undertaken to maintain operational capacity and flexibility in the HLW system and meet commitments for closure of high-level waste tanks.

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, most of the sludge processed in the earlier sludge batches is stored in non-compliant tanks targeted for closure. 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 begins.

The effective management of tank space is essential to HLWD meeting process commitments. For this reason, the Tank Farm space management strategy is routinely evaluated, expanded upon and updated. During FY01, two space management reviews were chartered. The SMT2 was chartered in April 2001 to consider new ideas and approaches to safely and efficiently manage Tank Farm space. This team took into account updated conditions since the SMT1 completed its evaluation in August 1999. Also, at the request of HLWD, an independent review of the SRS Tank Farm space management program was undertaken in July 2001. The purpose of the review was to provide an assessment of the Tank Farm space management and waste processing strategies and to recommend alternatives and strategies to provide additional waste storage capacity in the Tank Farm.

Based on a review of current operating conditions and input from the two Tank Farm space management reviews, the current group of space management initiatives required to provide adequate space until the Salt Waste Processing Facility becomes operational is listed below:

1. Continue to evaporate liquid waste, including the backlog of liquid waste that is waiting to be fully concentrated.
2. Continue to use Tanks 21-24 as interim storage for low curie content waste.
3. De-inventory and modify Tank 50 for use in supporting low curie salt and actinide removal processes (manage the ETF concentrate without using Tank 50 as a temporary storage location).
4. Disposition existing organics in Tank 48 and return it to HLW storage service.
5. Maintain DWPF Recycle Stream reduction initiatives.
6. Retrofit additional tanks as evaporator concentrate receipt tanks.
7. Process Tank 26 sludge in an earlier sludge batch to provide additional space.
8. Implement the small volume gain ideas to achieve small incremental storage volumes.
9. If required reduce the minimum Contingency Transfer Space (presently set at 2,600 kgal for the F & H Tank Farms) to a level not to be less than the Authorization Basis (AB) minimum requirement of 1,300 kgal.

Assumptions:

- The Canyon's waste stream volumes and the DWPF recycle volumes will be less than or equal to the forecast.
- The 2H, 2F, and 3H Evaporators will operate as planned and achieve their 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.
- The backlog of dilute supernate 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.
- Identified tanks can be modified for use as concentrate receipts tanks to provide salt storage.

Vulnerabilities: The following Tank Farm Waste Storage vulnerability was identified:

- Operation of the DWPF SASs may be required prior to the start of salt processing. This would result in significantly increasing the amount of DWPF Recycle volume sent to the Tank Farms.

Vulnerability Handling Strategy:

- Continue to run as is. Ensure adequate spare high efficiency mist eliminator (HEME) filters are available as replacements are required. Establish a disposition path for HEME filters that will dissolve HEMEs at DWPF. (Approval of the HEME dissolution-related procedures is scheduled for completion by April 2002. Dissolution of the first three HEME filters is scheduled for May 2002.)
- Develop salt processing alternatives and sludge preparation alternatives that maximize the use of DWPF recycle water, instead of the addition of inhibited water. An alternative study with a system approach recommended that the DWPF recycle be utilized for salt dissolution and sludge washing with pursuit of DWPF acid evaporator sequenced to follow. The use of DWPF recycle water for sludge washing is being evaluated and a recommendation will be made by July 2002. Also, the use of DWPF recycle water for salt dissolution is being evaluated for the Low curie salt process and a recommendation will be made by October 2002.

Contingencies:
- Implement other recommended new strategies that increase available space.
- Salt processing may resume earlier than forecast.
- 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.

4.4 *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 the HLWD's ability to successfully support planned processing commitments due to a lack of Tank Farm waste storage space.

Background: The SMT2 was chartered in April 2001 to consider new initiatives and approaches to safely and efficiently manage Tank Farm space (accounting for updated conditions since the SMT1 completed its evaluation in August 1999). The SMT2 consisted of a cross-functional team providing expertise in HLW chemistry, Systems Engineering, Process Engineering, Tank Farm and DWPF Operations and Engineering and local public perspective. The SMT2 reviewed the SMT1 final report, DNFSB Recommendation 2001-1, and present Tank Farm conditions to determine if a change to the tank space management strategies for volume management of HLW supernate, salt and sludge inventories is warranted.

Also, at the request of HLWD, an independent review of the SRS Tank Farm space management program was undertaken in July 2001. The purpose of the review was to provide an assessment of the Tank Farm space management and waste processing strategies and to recommend alternatives and strategies to provide additional waste storage capacity in the Tank Farm. The SRS Tank Farm space management review panel also examined potential risks and vulnerabilities that could impact operations. The panel was comprised of senior personnel with extensive experience in nuclear operations, engineering and science, both within and outside the DOE complex. No panel member had any direct responsibilities for the management of the facility; therefore, they were free to provide an objective review of the issue. The panel's final report was issued in July 2001.

The Tank Farm 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 5.1.2.

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 radioactive 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.

Vulnerabilities: The following Tank Farm space assumption vulnerabilities were identified:

1. Tank Farm may become saltbound due to more salt being deposited than predicted. [A, B]
2. Tank Farm Evaporator models are based on waste tank temperatures that are no longer applicable to today's operation. [A, B]

Vulnerability Handling Strategy:

A. Develop an Evaporator Flowsheet to better predict salt formation. (A computer model has been developed that simulates the 2H evaporator, the feed tank (Tank 43) and the drop Tank (Tank 38). The model tracks the major salts in SRS wastes. The first version of the model was released in March 2002 for validation. The plan is to validate the model versus past performance of the 3H evaporator during cold runs. The next major step following this validation is development of the Phase 2 model, which is targeted for early completion by 8/1/02. The Phase 2 model is intended to include more complex chemistry such as sodium aluminosilicate formation and mercury chemistry as well as an improved user interface.) [1, 2]

B. Develop alternate salt removal capabilities. (By the end of FY02: DOE will evaluate bids from vendors for the SWPF; Low curie salt direct to saltstone will be initiated with supernate transfers out of Tank 41; and the Actinide Removal Process will begin restoring the existing Latewash Facility to its original operational status. The Saltstone processing facility will complete its restart in April. This will allow the processing of the existing Tank 50 waste material so Tank 50 can be used as the staging tank for the low curie salt direct to Saltstone initiative.) [1, 2]

Contingencies:

- Implement other recommended new strategies that increase available space.
- Salt processing may resume earlier than forecast.
- 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.

4.5 *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: The Plan assumes the accepted weight percent solids in settled sludge in the waste tanks 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 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.

A Process Engineering group within HLWD Engineering coordinates process interfaces and process chemistry internal to HLWD and between HLWD and NMMD. 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 before they are implemented. A primary purpose of this team is to communicate so that the facilities are using the same data or assumptions for operating or planning activities.

Waste sample analyses are being refined to obtain additional information without increasing the number of samples. Operating experience in facilities throughout the HLW System will improve our understanding of the relationships among waste composition, waste characteristics, and waste processing.

Empirical processing data from Sludge Batches 1A, 1B, and 2 provides information to better predict production 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 SWPF and ESP will compensate for any transient (high or low) conditions in individual waste tanks.

Vulnerabilities: The following Tank Space Assumption vulnerabilities were identified:

1. Actual waste composition may be different from the data in the WCS. [A]
2. 2H and 3H Evaporator concentrates may not be able to be mixed. [B]

Vulnerability Handling Strategy:

A. Determine if WCS is adequate for sludge and salt processing. Improve/obtain additional insoluble solid samples to improve WCS. [1] (WCS has been successfully used to forecast sludge compositions for the first three macrobatches of sludge processed through DWPF. WCS will continue to be evaluated to determine what additional sampling is necessary and that sampling will be incorporated in the annual sampling plan. To improve the overall process, a Sample Management Improvement Plan will be developed by May 2002 to better manage annual tank farm samples through an annually prepared sample plan. Part of the preparation of the annual sample plan is to address potential upcoming issues for future sludge batches and salt processing plans and assess the need to obtain better waste characterization information as appropriate.)
B. Provide technical basis for 3H and 2H waste segregation criteria identifying: a) the chemical and physical conditions necessary to form and/or control aluminosilicate solids; and b) aluminosilicate/ uranium interactions. Research the consequences of mixing aluminum-rich and silicon-rich evaporator concentrate solutions. (The research activities are in progress, and are scheduled to be complete by October 2002. Based on the results of the research activities, the 3H and 2H evaporator segregation criteria will be developed.) [2]

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 HLW program could be lengthened.

4.6 *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 HLWD operating strategy, particularly with regard to 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 Cases 1 and 2, funding is inadequate to maintain continuous feed to DWPF. Waste removal and feed preparation, given the state of legacy high-level radioactive waste now in the tanks, is a first-of-a-kind process abundant with challenges and uncertainties.

Background: Lessons learned from past waste removal work indicate that unexpected challenges will occur during waste removal construction and preparation. These have included unexpected tank riser interferences, higher than expected radiation rates, and waste characterization issues.

Assumptions:

- Batch 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. (Case 1 and 2 will have outages.)

Vulnerabilities: The following vulnerability to maintaining sludge feed was identified:

- Extended Sludge Processing (ESP) Tanks 40 and 51 Slurry Pumps may fail.

Vulnerability Handling Strategy:

- Rebuild and maintain two slurry pumps for Tank 40 and 51 ready to replace. (Two of the pumps removed from Tank 49 are being refurbished.)
- Procure additional spare Slurry Pumps by FY05. (On the Funding priority list for FY05)

Contingencies:

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

4.7 *Use of Tank 50 for Alternative Salt Waste Processing*

Issue: The plan is to make Tank 50 available for alternative salt waste processing use in FY02. Before using Tank 50 for this purpose, the current material in Tank 50 must be processed at Saltstone. This prevents the use of Tank 50 for storage of HLW.

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 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. The 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 to support alternative salt waste processing (specifically the low curie salt and actinide removal processes).

Since Tank 50 will be required for alternative salt waste processing, the processing of ETF concentrate at Saltstone must be continued on a periodic basis until the startup of the SWPF. After the SWPF startup, the Saltstone Facility must be continuously operated to support the large volume filtrate stream from Salt Processing and ETF.

Physical modifications are underway to allow Tank 50 to be used for alternative salt waste processing in FY02.

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 and be made to Tank 50 to support alternative salt waste processing.

Vulnerabilities: The following vulnerability to returning Tank 50 to waste storage service was identified:

- Tank 50 may be required for alternate salt processing needs, which would preclude its use for waste storage service. (This was identified as a high-risk vulnerability because loss of this waste tank space to alternate salt processing could impact the capacity to de-liquor an evaporator system. This was judged to have the potential to shutdown an evaporator for an extended time. The use of Tank 50 for alternate salt processing was assessed per the Plan, which showed that Tank 50 could be used for alternate salt processing without impacting the evaporator systems.) [Closed]

Contingencies:

- Implement other recommended new strategies that increase available storage space as covered in Section 4.3.

4.8 *2H and 2F Evaporator Operation Constraints*

Issue: As part of the 2H Evaporator recovery effort, 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. Current plans are to continue 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 to preclude the generation of solids similar to those that were produced in the 2H Evaporator in 1999.

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 were obtained from the bottom cone area for analysis anticipating an end of 2000 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 evaporator operations were suspended. Cleaning of the 2H Evaporator has now been completed and it was returned to service on October 6, 2001.

Assumptions:

- 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.
- Tank Farm space management program will ensure sufficient tank space is available to continue processing feed for DWPF.

Vulnerabilities: The following 2F and 2H Evaporator vulnerabilities were identified:

1. Resumption of SAS operation for off-gas scrubbing at DWPF would increase the amount of DWPF recycle sent to the tank farms. [A, B]
2. The 2H and/or the 2F Evaporators vessels may fail. [C, D, E]
3. The 2H and/or the 2F Evaporator systems may fail (e.g. condenser, AIV, TCV, condensate controllers, feed pumps, etc.) [F]

Vulnerability Handling Strategy:

A. Pursue qualification of DWPF recycle for the 2F and 3H evaporators. (A qualification plan and strategy has been developed in conjunction with the HLW Water Management Team. The Plan provides contingencies and targets DWPF recycle to the 2F and 3H evaporator where possible. Existing Research and Development (R&D) has provided a means to conservatively qualify DWPF recycle for these evaporator systems. Additional R&D work to be completed by October 2002 is aimed at providing additional flexibility for processing DWPF recycle water in the 2F and 3H evaporators by removing conservative constraints as this technical basis is developed. Additionally, an understanding of the role of uranium incorporation into the sodium aluminosilicate matrix is being developed in order to remove 2H JCO restrictions on uranium enrichment.) [1]

B. Develop salt processing and sludge preparation alternatives that maximize the use of DWPF recycle water, instead of the addition of inhibited water. (An alternative study with a system approach recommended that the DWPF recycle be utilized for salt dissolution and sludge washing with pursuit of DWPF acid evaporator sequenced to follow. The use of DWPF recycle water for sludge washing is being evaluated and a recommendation will be made by July 2002. Also, the use of DWPF recycle water for salt dissolution is being evaluated for the Low curie salt process and a recommendation will be made by October 2002.) [1]

C. Accept risk that 2H and 2F Evaporators vessels may fail. (The likelihood that they would fail simultaneously is low.) [2]

D. Consider preparing the existing spare 2F/2H evaporator vessel for installation in 2F Evaporator. (A cost/benefit determination will be performed by June 2002. The results will be reviewed by the HLWD Business Team. The Plant Modification Traveler (PMT) will be initiated by August 2002 to begin the modification process, if that direction is given.) [2]

E. Accept impact if 2H Evaporator fails first requiring the spare evaporator to be modified for 2H service. [2]

F. Ensure adequate spare parts are identified and on hand to support the 2F and 2H Evaporator Infrastructure. (An assessment of the existing spare parts program is underway. It is scheduled to be completed by 9/30/02. This assessment will identify programmatic changes as well as identifying critical spare needs. Findings from the assessment will be prioritized by (high, medium, low) with the high priority findings being items which if not corrected could lead to a one month or greater outage. The high priority items will be scheduled and tracked to completion.) [3]

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.

4.9 *3H Evaporator Operation Constraints*

Issue: The 3H Evaporator operations are adversely affected because of cooling limitations in Tank 30, the concentrate receipt tank.

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 were implemented which included the addition of a stop-leak material to the cooling water system to minimize leakage of cooling water into Tank 30 and maximize the use of two of the existing coils. This has been successful and in combination with other measures to promote cooling (transfers, elimination of steam heating to the annulus, maintaining a high liquid level in Tank 30) has allowed continued operation of the 3H Evaporator. Though production achieved normal rates between May and December 2001, operation is temperature limited during the second quarter of FY02.

The cumulative effect of the short-term recommendations, however, falls far short of supporting long term 3H Evaporator operation. Therefore, to restore full 3H Evaporator capacity, Tank 37 will be converted from salt cake storage to evaporator receipt service. This requires the completion of a drop line from the 3H Evaporator to Tank 37 as well as the removal of salt from Tank 37. These modifications are expected to be complete by the end of FY02.

Assumptions: The addition of stop-leak material in the two tank 30 cooling coils will continue to be effective allowing the 3H Evaporator to continue operations on a limited basis until the modifications to Tank 37 are complete.

Vulnerabilities: The following 3H Evaporator vulnerabilities were identified:

1. Salt formation in Tank 32 may bind the feed pump and line. [A, B]
2. 3H Evaporator feed pump may fail [C, D]
3. 3H Evaporator vessel may fail [E]
4. 3H Evaporator systems may fail (e.g. condenser, AIV, etc.) [F]

Vulnerability Handling Strategy:

A. Continue operational strategy to minimize salt formation in Tank 32. [1]
B. Develop the 3H Evaporator flow sheet. (A computer model has been developed that simulates the 2H evaporator, the feed tank (Tank 43) and the drop Tank (Tank 38). The model tracks the major salts in SRS wastes. The input/output for the 2H model is being written. The first version of the model was released in March 2002 for validation. Then the model will be converted to a 3H Evaporator model and compared to actual 3H data.) [1]
C. Procure a spare feed pump (Project S-W339 is underway to procure a spare pump.) [2]
D. Investigate a temporary modification as a contingency if the feed pump fails prior to the spare feed pump is procured. (A proposed temporary modification scope will be presented to the HLWD Business Team in May 2002.) [2]
E. Accept the risk that the 3H vessel will fail. The materials that the components of the evaporator are designed for a 30-year life. 3H Evaporator is presently 2 years old. [3]
F. Ensure adequate spare parts are identified and on hand to support the 3H Evaporator Infrastructure. (An assessment of the existing spare parts program is underway. It is scheduled to be completed by 9/30/02. This assessment will identify programmatic changes as well as identifying critical spare needs. Findings from the assessment will be

prioritized by (high, medium, low) with the high priority findings being items which if not corrected could lead to a one month or greater outage. The high priority items will be scheduled and tracked to completion.) [4]

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.
- Planned Canyon programs could be slowed down until the Tank Farms are in a better position to support them.

4.10 *Salt Processing Disposition and Resumption of Operations*

Issue: The ability to maintain the tank closure schedule with less than a 100% capacity (17.5 gpm) SWPF relies on the success of the Low curie salt and actinide removal initiatives.

Background: All parts of the HLW System at SRS are operational except the salt processing plant. Processing at the ITP Facility was suspended because the facility could not cost effectively and simultaneously meet both the safety and production requirements for the HLW System.

DOE and WSRC have chosen a multi-pronged path for Salt Waste disposition. The strategy shift was to take a graded approach to Salt Waste processing. The new integrated Salt Disposition Strategy is to:

- Treat low curie salt waste and dispose at Saltstone
- Create an Actinide Removal Process (ARP) to enable disposal of additional low curie/high actinide salt waste & potentially provide actinide removal for the high curie demonstration CSSX facility
- Dispose of high curie salt waste by removing cesium in a small scale demonstration CSSX processing facility
- Tailor follow-on high curie salt waste processing capability depending on the success of early low curie salt disposal.

Assumptions:
- This revision of the Plan assumes certain capacities and start dates for the demonstration SWPF using CSSX technology. (See Section 1).
- The WCS is suitable for tank identification for low curie salt and the Actinide Removal Process.
- Funding will be available to support the schedule for construction and startup of the demonstration SWPF.
- Resources will be available to support the schedule for low curie salt and the Actinide Removal Process.
- Low curie salt and Actinide Removal initiatives relies on:
  - Low activity stream meeting Saltstone WAC,
  - Actinide removal stream meeting DWPF WAC, and
  - The ability to shield Saltstone

Vulnerabilities: The following salt processing vulnerability was identified:
- SWPF may come on line late or operate below forecast rate.

Vulnerability Handling Strategy:
- Develop alternate salt removal capabilities. (By the end of FY02: DOE will evaluate bids from vendors for the SWPF; Low curie salt direct to saltstone will be initiated with supernate transfers out of Tank 41; and the Actinide Removal Process will begin restoring the existing Latewash Facility to its original operational status. The Saltstone processing facility will complete its restart in April. This will allow the processing of the existing Tank 50 waste material so Tank 50 can be used as the staging tank for the low curie salt direct to Saltstone initiative.)

Contingencies:
- Implement other recommended new strategies that increase available space.
- High curie salt processing may resume before FY10, if the SWPF 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.

4.11 *Safety Basis Document Upgrades*

Issue: The effort to finalize the development and implementation of Safety Basis (SB) documents that reflect all requirements of 10CFR830 for Tank Farm facilities is scheduled to be complete by February 2003. If it is determined that new engineered controls or significant equipment upgrades are required, current funding levels for full implementation are insufficient.

Background: Bringing the Tank Farm 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. Additional training, procedure, and surveillance revisions will be necessary to comply with 10CFR830. In addition, equipment upgrades or new engineered controls may be required to meet Evaluation Guides for reduction of risk in each facility.

In order to maximize the efficiency of these upgrades, WSRC has developed a plan and schedule for a consolidated graded-approach Documented Safety Analysis (DSA, formerly known as the Safety Analysis Report or 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 DOE requirements. 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 cost-effective implementation.

SB upgrades will provide an improved safety basis for Tank Farm operations and consist of the following:

a) Update the hazards analysis to incorporate facility worker hazards not previously assessed. New analyses for facility worker hazards and reviews of existing accident analyses are required. This ensures that hazards to the public, facility workers, and the environment associated with facility operations have been identified and assessed for impact. Additional new analyses will evaluate the combined and sequential effects of postulated accidents and their progression. These analyses ensure that safety functions are identified to prevent or mitigate the consequences of every accident.

b) Finalize the selection of systems, structures, and components (SSCs) that will become the new set of SB controls. Engineered controls or administrative controls will 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, new equipment designed to perform the safety function. Since the new set of controls will prefer engineered controls over administrative controls, development of new engineered controls can represent a significant cost, due to both the stringent and exacting requirements associated with safety class or safety significant equipment and the number of tanks involved. (The current plan requires that any significant equipment upgrades will be managed as new scope as described in the assumptions below.)

c) Complete uncertainty analysis to ensure that instrumentation utilized for prevention and mitigation of accidents operates in compliance with assumptions in the accident analysis.

d) Complete final functional classification to ensure that SSCs selected to prevent or mitigate accidents are capable of performing their safety function when needed. For safety class and safety significant equipment, this effort requires a vulnerability review for equipment qualification, equipment interaction, structural analysis, and a Backfit process described in the E7 Manual, Procedure 3.41, "Backfit Analysis Process". Necessary actions resulting from the equipment review could include replacement, modification, and/or additional testing of SSCs.

e) Develop procedures and training that reflect the revised SB. The functional classification of additional SSCs as safety class or safety significant also imposes an increased burden on the operation and maintenance of the equipment.

Assumptions:
- SB upgrade and implementation will be completed by February 2003 if continued sufficient funding is allocated.
- Traditional method for consequence calculation will be augmented by a statistical method based on reasonably conservative estimations of analytic parameters to eliminate unrealistic over-conservatism in the analysis. This technique supports the use of existing hardware whenever possible and prefers a reduced reliance on administrative controls.
- If existing equipment is acceptable for use as safety equipment, it will be credited and functionally upgraded.
- New systems or significant equipment upgrades will be treated as new scope and can only be implemented if additional funding above the Base and Stretch Case funding levels is obtained.

Vulnerabilities: The following vulnerability was identified in relation to Authorization Basis (AB) on trapped gasses:
- The amount of Hydrogen (H_2) built up in tank(s) must be kept below the lower flammability limit (LFL). During certain types of sludge preparation, hydrogen (H_2) is generated in the sludge preparation tank due to the chemical reaction of the various substances in the sludge with the wash water. There is a risk that sludge preparation will require a longer preparation time because there will be an increased number of smaller washes.

Vulnerability Handling Strategy:
- Resolve AB trapped gas limits by collecting data on upcoming sludge washings and salt dissolutions. (Gas chromatography equipment is planned to be installed on Tank 37. A test plan has been issued. This is planned and scheduled for the summer of 2002.)

Contingencies:
- Tank Farm operations will continue under the revised interim SAR and TSRs. This will continue until SB documentation is developed and implemented to achieve full compliance with 10CFR830 in the Tank Farm 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.

4.12 *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 practically 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.

A Waste Incidental to Reprocessing Determination is underway 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.

Vulnerabilities: The following tank closure vulnerabilities were identified:

1. Closure of Tank 14 by 2010 not planned. [A, B]
2. Waste Tank annulus cleaning has not been developed. [C]
3. Tank 19 may not meet cleanliness requirements for closure. (Analysis has subsequently shown that Tank 19 does meet the cleanliness requirements for closure.) [Closed]
4. Tank 18 transfer line may fail testing. (Tank 18 transfer line has subsequently been successfully tested.) [Closed]

Vulnerability Handling Strategy:

A. Negotiate an alternate tank to close in place of Tank 14 (If VHS "B" below is unsuccessful.) [1]
B. Continue to investigate alternate salt removal technologies. [1]
C. Fund and develop Waste Tank cleaning technology (A Systems Engineering Evaluation (SEE) is in progress with the objective of identifying low cost alternatives to the annulus cleaning project baseline. Scoring of the initiatives is in progress. Also, the TFA is actively working with Russian scientists to apply their experience to SRS tanks.) [2]

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 Nuclear Regulatory Commission (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."

4.13 *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 (DCSs) at F Tank Farm (FTF), DWPF and H Area Diversion Box 8 (HDB-8) which were installed 15 or more years ago, can be characterized as being technologically obsolete. Therefore, projects to replace the DCSs in FTF, DWPF and H Tank Farm (HTF) are included in the funding requirements over the next four years.

Background: There are 52 Mission Essential computer systems in the HLW Division. These include 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 FTF DCS, the DWPF DCS, the HDB-8 DCS, the Waste Removal/3H Evaporator DCS, and the Waste Pre-Treatment (WPT) heating and ventilating PLC and DCS.

Projects are underway to replace the FTF and DWPF DCSs, with replacements scheduled in FY02 and FY03, respectively. The HDB-8 DCS is the next most urgent of the systems requiring replacement. This system is essential to HLW operations as it controls HTF intra-area, FTF/HTF interarea and DWPF recycle transfers; yet it contains the same obsolete hardware and software components as the existing DWPF DCS. The HDB-8 DCS can be replaced at a cost of approximately $800K, and initial project funding is forecasted for FY03. The Waste Removal/3H Evaporator and WPT DCSs are next in line for replacement, with estimated replacement costs of $4.7M and $5.0M, respectively, and with work to be completed by FY05.

The vision for HLWD process controls is to have a single control system architecture deployed across the Division. The DWPF DCS Replacement Project has established Emerson's DeltaV™ process control system as that new architecture. The combination of this new Division architecture coupled with the consistent application of configuration conventions and standards will provide a common user interface between facilities, resulting in a more versatile and flexible workforce. This will allow for better implementation of new technology and process changes, permit interconnectivity of control rooms, improve information flow across Division facilities, and reduce the life cycle costs of these systems. This would also serve as an enabler for potentially significant reductions in operating costs through future initiatives in control room consolidation. Replacement and integration of high-maintenance panelboard-based controls (e.g., 242-1H and 241-28H control rooms) with the new DeltaV™ architecture may also prove to be economically advantageous when factored into control room consolidation initiatives.

Assumptions:

- Outages at each affected facility will be scheduled and staffed in order to accomplish the replacements.
- Replacement of existing facility production systems will include replacing the associated development and simulator 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.
- Engineering will develop the manual operating capability required to allow for the temporary removal of automatic control during the control system replacements.
- Process models and simulators will be enhanced and/or extended to the extent necessary to support procedure and operator readiness for the replacement production systems.

Vulnerabilities: The following Control System vulnerabilities were identified:

1. Saltstone DCS may fail. [A]
2. H Area Diversion Box-8 (HDB-8) Facility DCS may fail. [B]

Vulnerability Handling Strategy:

A. Saltstone DCS is scheduled to be replaced in FY03. [1]
B. Fund project to replace HDB-8 Facility DCS. [2] (PMT for the control system replacement modification is scheduled to be complete by 3/31/02. Funding for this replacement is planned beginning in FY03.)

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 system failures. Facilities could be shut down until replacements can be made

5. Integrated Production Plan

5.1 *Overview*

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

- Availability of funding as shown in Appendixes I.1, J.1, and K.1 for Cases 1-3.
- 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 salt processing initiatives.

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 5.1.3 describes the effect of each influent and effluent stream in the Tank Farms, and its impact on Tank Farm operations. Sections 5.2 through 5.10 describe the production requirements for each HLW facility to support the Plan.

5.1.1 Tank Farm Waste Storage Space

Tank space, if not managed properly, could adversely affect 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 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 space. The useable space has the following distinctions:

- 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 28,080 gallons less than the TSR limit of 1,298,700 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. With very limited exceptions, the Tank Farm Industrial Wastewater Operating Permit does not allow waste to be added to tanks that leak or have leaked.
- Tanks 48, 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. Tank 50 is planned to store waste in the form of a low curie salt supernate. In addition, evaluations are also underway to return Tank 48 to HLW storage service.
- ESP Tank 40 is excluded from the useable 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 51 begins feeding sludge for Sludge Batch 3 to DWPF in FY04, its volume will be removed from the useable space calculation and the Tank 40 volume will be added.

The useable 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 January 1, 2002, the F- and H Tank Farms have a combined 2,200 kgal of useable tank space as is illustrated in Table 5-A. Due to the operations associated with the 2F, 2H and 3H Evaporators and the return of Tank 49 to HLW service, useable tank space increased from 1,359 kgal at the beginning of FY01 to the 2,175 kgal as of January 1, 2002. Implementation of the tank space management strategy outlined in Section 5.1.2 will increase useable tank space to levels that provide higher flexibility in meeting process commitments.

Table 5-A Useable Space				
	No Tanks	Volume (millions of gallons)		Comments
	51			Original total number of tanks
Less	2			Tanks 17 & 20 Closed (filled with grout)
Equals	49	54.8		Total Maximum Capacity (TSR/OSR Limit)
	49	47.3		Total Working Capacity (Tank Operating Limit)
			19.7	*Total Stored Supernate*
			15.6	*Total Stored Salt*
			3.0	*Total Stored Sludge*
Less		38.3		Total Stored Waste (including process tanks 48,50,&51)
Equals		9.0		Total Working **Freeboard**
Less	22	2.9		Freeboard in Types I, II, and IV tanks
Less	3	1.3		Freeboard in Processing Tanks (Tanks 40, 48, & 50 – unavailable for reuse)
Less		2.6		Contingency Transfer Space (reserved in the event of a tank leak)
Equals	24	2.2		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	24	0.9		**Available Space** (useable space less working space)

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

Table 5-A reflects the goal to always maintain a minimum of 1,300 kgal of useable space in the Type III tanks to support evaporator operations, canyon receipts and ESP processing. Though no AB requirements are violated if useable space drops below 1,300 kgal, the low working inventory level impacts the ability to support processing plans. For example, sludge batch preparation would be affected because of the large volumes of water required (several hundred thousand gallons) to carry on sludge washing operations. HLWD is working diligently to implement the Tank Space Management strategy outlined below to maximize the available space in the Tank Farm while supporting processing commitments.

Operation of the evaporators is crucial to recovering the Tank Farm space needed to support mission needs. With tank space tight, evaporator space recovery rates must, as a minimum, be able to keep pace with influents. In addition to the handling of new influents to the Tank Farm, HLWD must also evaporate approximately 8,200 kgal of backlogged supernate stored in Type III tanks to recover additional tank space. The evaporation of the backlogged waste is expected to reclaim up to 4,500 kgal of space over the period FY02-FY05. An additional 5,300 kgal of low source term DWPF recycle (in Tanks 21, 22, 24, 6 and 8) and Receiving Basin for Offsite Fuels (RBOF) receipts (in Tank 23) must also be evaporated or used as slurry water for sludge or salt removal. Evaporation, or use of this low source term backlogged waste, would reduce the total Tank Farm waste volume by approximately 5,000 kgal.

It must be noted that the contingency transfer space and useable space (working space and available space) are not consolidated one or two convenient tanks but dispersed in tanks across the Tank Farms. A graphic representation of the tanks space in the various tanks is shown in Appendix H (High Level Waste Tank Usage).

5.1.2 Tank Farm Space Management Strategy

The current useable space in the Tank Farms has improved over the last year. The major two factors for the increase of Usable Space from Revision 12 of the Plan to Revision 13 are

- The successful return of Tank 49 to waste storage service in October 2001,
- Better evaporator performance than what was forecast in Revision 12.

However, even with the improvement, the lack of adequate useable space continues to be a major risk associated with meeting process commitments, especially until the start of salt 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 FY02:

- DWPF recycle water 1,000 kgal in 200 receipts
- Canyon wastes 1,100 kgal in 350 receipts
- RBOF 120 kgal in 20 receipts.

These receipts are reduced by evaporation (the Tank Farm evaporation systems evaporate approximately 70% to 99% of these receipts depending on the influent source), but the negative effect 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 overall net space loss in Type III tanks. This is especially true between now and FY10-12 when sludge is mainly being removed from high-risk non-compliant tanks. Once backlog waste is fully evaporated, then 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.

Additional Tank Farm Space Management Reviews

Based on the assumptions used in the development of the Plan, the Tank Farms will run out of available storage capacity in Type III tanks without the successful implementation of a Tank Farm space management strategy. Since the issuance of Revision 12, two major Tank Farm space management reviews have been completed to assess previously recommended space management initiatives.

Tank Space Management Team 2

The SMT2 was chartered in April 2001 to consider new initiatives and approaches to safely and efficiently manage Tank Farm space. This team took into account updated conditions since SMT1 completed its evaluation in August 1999. The SMT2 Team consisted of a cross-functional team providing expertise in HLW chemistry, Systems Engineering, Process Engineering, Tank Farm and DWPF Operations and Engineering and local public perspective. The SMT2 Team reviewed the previous HLW SMT1 Team Final Report, DNFSB Recommendation 2001-1, and present Tank Farm conditions to determine if a change to the tank space management strategies for volume management of HLW water, salt and sludge inventories is warranted.

The SMT2 Team used an SEE process, similar to that used in 1999, to identify, evaluate, and select recommendations. The final report of the SMT2 Team was issued in May 2001.

SRS HLW Tank Farm Space Management Review Panel

At the request of HLW, an independent review of the SRS Tank Farm Space Management program was undertaken in July 2001. The purpose of the review was to provide an assessment of the Tank Farm space management and waste processing strategies and to recommend alternatives and strategies to provide additional waste storage capacity in the Tank Farm. The SRS Tank Farm Space Review Panel also examined potential risks and vulnerabilities that could impact operations. The Panel was comprised of senior personnel with extensive experience in nuclear operations, engineering and science, both within and outside the DOE complex. No Panel member had any direct responsibilities for the management of the facility; therefore, all were free to provide an objective review of the issue. The Panel's final report was issued in July 2001.

Updated Tank Farm Space Management Strategy

Based on a review of current Tank Farm operating conditions and input from the two Tank Farm space management reviews discussed above, an updated Tank Farm space management strategy was developed and incorporated into the approved assumptions used in modeling of the Revision 13 Cases. A summary of the tank space management initiatives to be implemented is:

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 for storage of low source term supernate.
3. Maintain DWPF Recycle Stream reduction initiatives.

4. If required, reduce the minimum contingency transfer space in Type III tanks for the F- and H Tank Farms below the currently maintained 2,600 kgal to a value not to be less than 1,300 kgal (AB minimum requirement).
5. Retrofit additional tanks for use as salt receipt tanks for the Evaporator Systems.
6. Disposition existing organics in Tank 48 and return it to service as a HLW storage tank.
7. Maintain Tank 26 in one of the earlier sludge batches and place the 2F Evaporator in standby.
8. Small volume gain initiatives.

In addition to the strategies mentioned above, alternative salt processing methods are planned over course of the program and described in Section 5.5.2. The early success of these processes results in additional Type III tank space for Cases 2 and 3.

Highlights of tank space initiative successes and major changes from the Revision 12 space management strategy are highlighted as follows:

Tank Space Initiative Successes

- Tank 49 was successfully returned to HLW storage service in 2001 providing 1.3 million gallons of useable Type III tank space. Note this is an improvement over Revision 12 which only credited 1.0 million gallons of useable space.
- Headway was made over the last year in the evaporation of backlog waste. This was accomplished through the successful resumption of 2H Evaporator operations in October 2001 and through the implementation of innovative Tank 30 cooling issue resolution initiatives to allow for greater than forecast 3H Evaporator operations. An aggressive transfer and evaporator feed health plan is being pursued in FY02 to reduce the storage of backlog in an efficient manner in order to maximize useable space and increase system flexibility.
- The 3H evaporator, because of improved operation, concentrated the waste to a higher solids concentration, thereby taking up less space in Tank 49.

Major Changes from the Revision 12 Space Management Strategy

- The use of Type I tanks to receive and store low source term waste is no longer included in the tank space management strategy. No planned transfers will be made into Type I tanks other than those required to support waste removal activities.
- The plan to return Tank 48 to HLW storage service has been added. This will require the successful disposition of existing organics in this tank

The combined actions in the updated tank space management strategy will adequately manage tank space until the start of salt processing in the year specified in the individual Plan Cases. 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, (beginning of January 2002), ~ 8,200 kgal of supernate waste exists in Type III tanks that can be evaporated to recover ~4,500 kgal of additional Tank Farm space. This unconcentrated supernate can be divided into three main categories.

Evaporator System Tanks - The supernate in the evaporator system tanks will be evaporated as part of normal operations. 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

According to computer modeling, approximately 1,700 kgal of space can be recovered by further concentration of ~3,500 kgal of waste in the evaporator systems.

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, evaporating canyon wastes in the 2F Evaporator, to maximize use of salt storage space, requires that major transfers from Tank 39 through the interarea line (IAL) must be coordinated with other process driven transfers. It is estimated that 900 kgal of space can be recovered by evaporation of ~1,200 kgal of existing canyon receipt inventory.

Other Tanks – Approximately 3,500 kgal of unconcentrated supernate also exists in Tanks 34, 35, 42 and 49 that can be evaporated further to recover ~ 1,900 kgal of 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 waste in these tanks. To add to the complication of evaporating the waste in tanks 35 and 42, the supernate in each of these tanks contains a large quantity of concentrated DWPF recycle waste that is higher in silicon. At this time, efforts are underway to sample these tanks and qualify them for evaporation in the 3H Evaporator. The existing waste in Tank 49 is made up of material moved over from Tank 38 to support the startup of the 2H evaporator and from DWPF that had been stored in Tank 22. The Tank 49 waste will be evaporated in the 2H Evaporator in FY02 Extra space can be obtained from Tank 35 if the transfer jet (presently bottomed out at 153 inches) is replaced with one that can extend to 36 inches from the tank bottom. This action would result in an additional 200 kgal of recovered space.

The logistics of making the waste transfers supporting both evaporation of backlog waste and DWPF processing continues to be a major challenge for HLW. The number of annual Tank Farm transfers has increased significantly over the last few years. There are risks in operating the evaporators and infrastructure on such a demanding schedule. Evidence of this was seen in FY00 and FY01 where evaporator operations were impacted by the 2H Evaporator solids accumulation issue (See Section 4.8) and the 3H cooling issue (See Section 4.9). The successful resumption of the 2H Evaporator and the implementation of innovative resolutions to address 3H cooling issues to provide greater than forecast 3H operations has allowed for steady progress on the processing of the backlog waste in FY01 and early FY02. For all cases in the Plan, it is anticipated that space can be recovered from backlog waste via evaporation by mid-FY05.

Though not included in Type III tank space, approximately 5,300 kgal of low source term supernate (stored in Tanks 6, 8, and 21 through 24) can be evaporated to achieve ~5,000 kgal of reduced total tank farm inventory.

2. Continue use of Tanks 21-24 for storage of low source term supernate

The 2H Evaporator is being used to process DWPF recycle (in Tanks 21, 22, 24, 6 and 8) and RBOF receipts (in Tank 23) during FY01 and earlier. Current plans are to continue to use Tanks 21 and 22 as receipt tanks for DWPF recycle waste. After allowing any solids to settle out, the stored recycle waste will be periodically transferred into the 2H Evaporator system for processing.

The principal vulnerability with this strategy is a leak in a tank used to store low source term waste. With the current tank space conditions, such a situation could result in an adverse impact on HLW processing commitments. The impact will be lessened as the 2H continues to process newly generated DWPF recycle receipts and works off backlogged DWPF recycle that has been stored in Tanks 21-24.

3. Recover Tank 50 for High Level Radioactive Waste Storage

Tank 50 is presently used as a receipt tank for Effluent Treatment Facility (ETF) concentrate, an aqueous waste that is ready for final treatment and disposal as Saltstone. All of the cases described in the Plan assume that Tank 50 can be returned to HLW waste storage in FY02. Returning Tank 50 to service requires that the ETF concentrate stored in Tank 50 (approximately 800 kgal as of January 2002) be treated using Saltstone in FY02. Tank 50 will initially be used in all cases in the Plan to support low curie salt processing and actinide removal processes. Modifications at Tank 50 are underway at the time of the Plan to support Tank 50's use for this alternative salt processing. In the long term when the SWPF has started operations, Tank 50 will be required as a prep tank to feed salt solution to the SWPF.

4. Continue DWPF Recycle Stream reduction initiatives.

Several initiatives have been implemented to 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 initiatives to reduce the amount of recycle being sent to the Tank Farm. Since January 2000, DWPF has been processing without operating the SASs in the melter off-gas system. It was determined that operation of the SASs was not required during sludge-only processing at DWPF as long as the Cesium levels in the sludge were below prescribed levels. The SASs will be required when DWPF receives a feed stream from the SWPF. This initiative resulted in an annual ~700,000 gallon reduction in recycle being sent to the Tank Farm. Initiatives associated with the frit transfer system and reductions in sample line flushes have also resulted in additional water generation reductions. Through the implementation of these initiatives, the annual recycle being sent to the Tank Farm has been reduced from approximately 2,200 kgal at a 250 can/yr production rate to approximately 1,000-1,300 kgal.

The principal vulnerability associated with continuation of the existing DWPF recycle reduction initiatives would be if the SASs in the DWPF melter off-gas system had to be returned to operation prior to the start of the SWPF. This would be required if higher cesium levels than expected were seen in future sludge-only batches being processed at DWPF.

Reducing or eliminating DWPF recycle would have several benefits. It would result in additional space savings, reduce the risk associated with returning to service the SASs in the DWPF melter off-gas system, and reduce the number of transfers affiliated with evaporating the recycle stream HLWD performed a structured evaluation to determine viable alternatives for reducing or eliminating the DWPF recycle. Some of the alternatives considered are listed below:

- Use of DWPF recycle for salt dissolution for slow curie salt initiative
- Use of DWPF recycle for sludge slurry transfers and initial sludge washing
- Use of DWPF recycle for salt dissolution for actinide removal process
- Burn DWPF recycle at the consolidated incinerator facility
- DWPF recycle waste acid evaporator
- DWPF recycle ion exchange treatment
- Direct saltstone disposal of DWPF recycle
- DWPF recycle waste to the general purpose evaporator at H Canyon
- Solids filtration of acid recycle waste (removes silicon only)

The use of DWPF recycle water for salt dissolution represents an efficient and timely way to minimize the DWPF recycle stream to the tank farm evaporator systems while also supporting initiatives to accelerate closure of tanks. Therefore, it is recommended to include using DWPF recycle for salt dissolution as a space savings initiative. As a contingency, recycle could also be sent to Saltstone provided WAC limits are met. If these activities cannot be accomplished, a dedicated recycle evaporator located at DWPF, would be considered.

5. If Required, Reduce the minimum contingency transfer space in Type III tanks for the F and H Tank Farms below the currently maintained 2,600 kgal to a value not to be less than 1,300 kgal (AB minimum requirement)

The long-standing practice of maintaining 1.3 million gallons of contingency transfer space in the H Tank Farm and the F Tank Farm (2.6 million gallons total) was 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 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.

Since upgrades on the IAL controls were completed in 1997, a number of successful transfers were through the line. The transfers include the completion of a sludge transfer in January 2001 from Tank 8 to Tank 40 (ESP) to prepare for Sludge Batch 2. The Plan continues to include the routine use of the IAL to support HLW processing commitments over the life of the program.

This initiative states that the minimum contingency transfer space would be reduced, as required to support processing commitments, from its current value of 2.6 million gallons, to a level that would not be lower than the Authorization Basis (AB) defense-in-depth value of 1.3 million gallons.

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

The 3H Evaporator cooling issues have adversely affected the planned storage of saltcake formed in the evaporation process in Tank 30. 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 over the life of the HLW program. For this revision of the Plan, it is assumed that modifications will be required to allow alternative tanks in each of the three evaporator systems to be used for concentrate receipt service to store saltcake. The specific tanks to be modified and when they must be available vary by case. A more detailed discussion of evaporator salt inventory management is discussed in Section 5.1.4.

7. Recover Tank 48 for High Level Radioactive Waste Storage

This initiative requires Tank 48, which had previously been allocated as a salt processing tank, to be returned to the Tank Farms for HLW storage. However, Tank 48 contains approximately 250 kgal of benzene-bearing solution from ITP demonstration runs that must be dispositioned prior to its return to waste storage service.

A multi-disciplined task team has been established to evaluate possible methods for the disposition of the Tank 48 organics. The team is to make a recommendation in FY02. For Cases 2 and 3, it is assumed that Tank 48 will be available to receive waste supernate in FY06. Case 1 assumes that early attempts to dispose of existing organics are unsuccessful, but the tank can be made available for use as a salt solution feed tank for the SWPF in FY12.

The principal risk with the return of Tank 48 to HLW waste supernate storage service is that a treatment process for the existing organics has not been identified. The inability of the reaction to reach a satisfactory end point in a timely manner could significantly delay the return of Tank 48 to waste concentrate storage.

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 the 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 after sludge is removed from Tank 26 and the tank is returned to waste storage service.

The Plan also provides an additional 200 kgal of working space in F Tank Farm from placing the 2F Evaporator System in standby in the FY09 time period.

9. Small Volume Gain Initiatives

In 1999, the Space Management Task Team identified a list of initiatives that have the potential to yield smaller increases in available space. The group of initiatives 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 savings from these initiatives are small, they could result in better forecasting to manage the available space. If successfully implemented, the small volume gain initiatives could also result in overall cost savings if they eliminate the need for other more costly space gain initiatives. The implementation of small volume initiatives 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 initiatives include:

- *Install Telescoping Transfer Jets (TTJ) in Selected Tanks or New Fixed-length Transfer Jets 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) was implemented to provide for more efficient operation of the 3H Evaporator. The previous fixed length jet in Tank 30 is 4 inches 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 was transferred. The installation of a TTJ allowed HLW to provide less concentrated and slightly cooler feed material for evaporation. This modification resulted 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 initiative 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 initiative 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 and cooling coils 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 has been made on this strategy in the last two years. 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. NMMD is actively reviewing all waste campaigns for similar waste savings.
  - A System Engineering evaluation (SEE) process was completed in FY01 involving Tank Farm personnel and representatives of each of the major waste generators. No major near-term initiatives were identified to save tank space. However, the results of this evaluation are under review for possible implementation in future years.

5.1.3 HLW System Volume Balance

The Useable Type III Tank Space chart shown in Appendix L.1 (for the various cases) was created from data generated by SpaceMan II™. Volume by tank type is shown in Appendixes L.2 through L.7. The Tank Farm Volume Balance, shown in Appendixes I.3, J.3, and K.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 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 – F Canyon and H Canyon

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 NMMD. 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):

- Experimental Breeder Reactor (EBR) II and Mark-42 processing will be completed, generating approximately 96 kgal of LHW and 88 kgal of HHW.
- Rocky Flats Scrub Alloy (RFSA) and Mark-42 compacts have been processed and approximately 11 kgal of LHW remains to be discarded.
- New SRS sand , slag, and crucible waste will be processed and generate approximately 32 kgal of LHW.
- A portion of the new SRS sand, slag, and crucible waste will be discarded directly to HLW, generating approximately 20 kgal of LHW.
- The Am-Cm disposition is expected to generate approximately 30 kgal of HHW to be sent directly to Tank 51.
- Outside Facilities operations (General Purpose evaporator) will generate approximately 4-8 kgal of LHW per month. It is 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.
- De-inventory flushes are forecasted to generate approximately 75 kgal of LHW and 75 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 22 charges is scheduled to generate about 22.5 kgal per month of LHW though March 2003 and 35.7 kgal per month of LHW from April 2003 through June 2003. Thereafter, Mark 22 will generate approximately 32 kgal per month of LHW from July 2004 through March 2004.
- A hot canyon process vessel vent (PVV) filter flush is scheduled for April 2002. It will generate approximately 20 kgal of relatively dilute waste to be transferred to the Tank Farm in April 2002.
- Anion exchange recovery of neptunium in HB-Line is being planned, but is not scheduled.
- Unirradiated off-specification Type II highly enriched uranium (HEU) alloy will generate about 23 kgal per month from April 2004 to December 2007.

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- 1,300 kgal per year of DWPF recycle to the Tank Farms over the next several years depending on the can production. The principal vulnerability associated with DWPF recycle is the possible resumption of operation of the DWPF SASs. This would significantly increase the recycle volume. While several options are being pursued (Sections 4.3 and 4.8) to address reducing or eliminating the recycle, none are credited in the Plan.

Influents – 299-H: The 299-H repair facility is forecasted to send approximately 12 kgal/year to the tank farm. It is assumed that input from this facility will be inconsequential when the last evaporator system is permanently shutdown.

Influents – RBOF: The tank farms are expected to receive approximately 120 kgal from the RBOF through mid-FY06 at which time RBOF is scheduled for shutdown.

Influents – ETF: ETF evaporator effluents are assumed to be sent directly to Saltstone after FY02 and are not included in the material balance tabulation. However, tank farms will still be able to receive from ETF if the Saltstone flow path becomes unavailable.

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 assumed that all of the ESP washwater will be sent to an evaporator system. However, some washwater may be used for sludge removal or to dissolve salt. For more details on ESP, refer to Section 5.5.1.

Salt Dissolution Water: Inhibited water is added to dissolve the saltcake 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 the Plan, salt dissolution is performed in Tank 37 to allow for its use as the 3H Evaporator concentrate receipt tank (see Section 4.9). 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 water used for this activity is very dilute and can be nearly 100% eliminated through evaporation. The volumes are expected to be inconsequential relative to those used for ESP wash water and saltcake dissolution, and are therefore not included in SpaceMan II™ modeling (and are not included in the Material Balance tabulation). The Plan assumes that all tanks are water washed. However, as operational closure requirements are established water washing may not be required for all tanks.

Note: Vulnerability handling initiatives include using DWPF influents for ESP wash water and salt dissolution water, but no credit for this use is included in the Plan.

Influents - Other: Other influents include:

Jet Dilution: Transfer jets are used to transfer waste from tank to tank. Steam is used as the motor force for operation of the transfer jets. As the steam condenses, volume is added to the waste. This condensed steam, or jet dilution, is roughly 4% of the transfer mass based on historical information. The amount of jet dilution added is directly proportional to the mass of waste transferred. An additional 12% dilution is assumed for any IAL transfer to ensure that no pluggage occurs over this greater than two mile transfer route.

Sludge Volume: Settled and compacted sludge expands in volume when slurried. This is counted as a volume addition.

Effluents – Space Recovered from Evaporation: The 2F, 2H, and 3H Evaporators reduce the volume of dilute, influent waste streams. To maintain available space in the Tank Farms until salt processing starts up, the evaporators have begun to evaporate dilute supernate (backlog) from Type III tanks. In FY01, approximately 1,850 kgal of space was recovered in the 2F and 3H Evaporator systems by the evaporation of waste that had been stored in Tanks 26, 29, 30, 32, 33, 39 and 46. Additional tank space will be gained over the period FY02-FY05 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 partially recover space lost from waste additions as saltcake, concentrated supernate (caustic liquor), and sludge accumulant. 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 5.2.2 and 5.3.2.

Effluents – Salt Solution to Saltstone: This category includes the waste sent from Tank 50 to saltstone in FY02 (composed primarily of ETF evaporator effluent) and qualified salt solution from the Low-Curie Salt and Actinide Removal Program. Decontaminated salt solution from the SWPF is not included in the material balance tabulation.

Effluents – Salt Solution to Processing: Space gain occurs when concentrated supernate, unconcentrated supernate, or dissolved saltcake is fed to the SWPF. The Plan credits recovered space immediately when it is fed to the SWPF. 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 the Plan assumes that space gain is achieved using caustic side solvent extraction technology. For more details on salt processing, refer to Section 5.5.2

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

Effluents – Other: Mixing waste forms of differing compositions results in volumes that are not arithmetically additive. Noticeable space recovery can be achieved when a light solution (such as DWPF recycle water) is mixed with concentrated supernate. This phenomena occurs whenever highly disparate waste solutions are mixed, but becomes more obvious during years in which large amounts of DWPF recycle or ESP wash water is mixed with thick concentrate (as in blending operations).

5.1.4 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 HLWD 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 recovery (often referred to as space gain) is defined as the difference between evaporator feed and evaporator concentrate, corrected for flush water, steam and chemical additions necessary to operate the evaporator system. Space recovery is predicted based on evaporation of each waste stream, given its chemical constituents. The Spaceman II™ 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 H, 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 has salt receipt space in Tank 30. However, as discussed in Section 4.9, cooling issues in Tank 30 have limited its use for concentrate or salt receipt. Therefore, a salt dissolution campaign in Tank 37 is planned for FY02 to allow its use for a concentrate (or salt) receipt tank for the 3H Evaporator. After dissolution, the salt solution will be stored in Tank 35 and eventually 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 5.2.2 and 5.3.2).

In running the Spaceman II™ model for the various cases in the 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 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 II™ modeling runs indicate that additional salt receipt space must be made available in all evaporator systems. This is true for all cases in the Plan even when assuming varying levels of success with low curie salt waste and actinide processing. The continued buildup of saltcake in the concentrate receipt tanks eventually affects the efficiency of evaporator operations. At first, the number of evaporator recycle transfers would steadily increase due to the decreasing salt space in the receipt tanks. Eventually the concentrate receipt tank becomes saltbound unless another concentrate receipt tank is made available or unless salt is removed. For all cases it is predicted that the 2F and 2H Evaporator systems would run out of salt receipt space in FY04 and early FY07, 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 41 to be used as an evaporator receipt tank for the 2H system. For Tank 41, it is assumed that salt is successfully dissolved and removed to Saltstone, for Cases 2 and 3. For Case 1, it is assumed that some salt is dissolved back into solution in Tank 41 freeing up a limited amount of salt receipt space. The modifications would include the installation of a new backflush valve and other associated equipment.

For each of the cases in the Plan, additional salt dissolution campaign(s) must be performed in Tank 37 to support continued 3H Evaporator operations. Additional salt dissolution campaigns are required in FY04 for all three cases, early FY06 for Cases 1 and 2 only, and in early FY13 for Case 1 only. In Case 3, where greater low curie salt waste and actinide removal success is assumed, Tank 31 has all salt removed and it can be modified for salt receipt space for the 3H Evaporator in early FY06.

Without success in salt processing through the operation of the SWPF or by alternative salt disposition methods, each of the three evaporators would eventually become saltbound. This would prevent the continued preparation of sludge feed for DWPF and the operation of DWPF. This does not occur for the three cases in the Plan based on the assumptions used.

5.2 *H Tank Farm*

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

5.2.1 H-Tank Farm Useable Space

The H Tank Farm includes twelve non-compliant waste storage tanks, seventeen new-style tanks, and three evaporator systems. At the time of the Plan (January 1, 2002), H Tank Farm has approximately 2,100 kgal of useable space (or working inventory) available.

5.2.2 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 Plan. Resolution of major evaporator issues such as those described in Section 4.8 and 4.9, 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 H-Canyon LHW stream and the DWPF recycle stream, both of which have been received in Tank 43 and evaporated. 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 the Plan, it is assumed that the 2H will only be used for processing DWPF recycle (both newly generated and stored backlog) and other high silicon streams.

Based on the new operating strategy of the 2H Evaporator, DWPF recycle will be received into Type IV tanks (Tanks 21-24) and fed forward to the 2H system as production schedules dictate. Note that the receipt of DWPF recycle into Type IV does not affect tank farm useable space since only Type III tanks are used in determining the useable space volume.

It is not anticipated that the 2H Evaporator will foul in the future with aluminosilicates. However, if the evaporator requires cleaning, downtime and chemical additions will adversely affect performance. Depleted uranyl carbonate (as an enrichment control) would be added to the feed tank. This lowers feed quality and therefore affects performance.

An evaporator feed qualification program evaluates existing DWPF recycle stored in Tanks 21-24, as well as other tanks containing DWPF recycle, for potential evaporation in the 2F and the 3H Evaporator systems. The 2H Evaporator is forecast in the Plan to process the 1,000 - 2,500 kgal received yearly into the Tank Farms from DWPF. The ability of the 2H Evaporator to meet these higher early year production rates was demonstrated in FY98 and FY99 when over 2,000 kgal of space gain was recorded in each year. Since the Plan primarily assumes that the evaporation of DWPF recycle is limited to the 2H Evaporator, its continued operation is key to the success of ensuring DWPF canister production if recycle continues to be sent to the tank farms.

The **3H Evaporator system**, was initially put into service in FY00, and includes one feed tank (Tank 32) and two salt receipt tanks (Tank 30 and 29). Tank 30 is the active receipt tank and has limited cooling capability due to failed cooling coils; Tank 29 is mostly full of salt and is used as the evaporator vent tank. Over the past year (FY01), the 3H Evaporator recovered ~1,185 kgal of space and created 2,500 kgal of overheads by evaporating backlog waste that was stored in Tanks 30, 32 and several large transfers from Tank 40 (ESP washing process for SB2). The 3H ran better than forecasted during FY01 largely due to the temporary modification to add what amounted to a stop leak solution into two of the leaking cooling coils in Tank 30. This temporary solution, which originally had a working life of 21 days, has turned out to work effectively and allow the 3H system to operate on a normal cycle from May 2001 through December 2001. For the purpose of the 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 will evaporate ESP washwater and further reduce the volume of previously evaporated waste. For the outyears, Tank 37 will be used as the evaporator concentrate receipt tank. Tank 37 has a more robust cooling system, which is the reason for improved operational confidence. In this capacity, the 3H Evaporator is an essential element in ensuring adequate Tank Farm space is maintained until the start of salt processing. As discussed in Section 5.1.4, 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.

5.2.3 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 5.1.4 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.

In addition, initial efforts are underway to demonstrate low curie salt removal in Tank 41 in FY02. The existing interstitial cesium bearing supernate will first be removed from the tank. The remaining saltcake, that should be low in cesium, will then be dissolved, sampled and transferred to Tank 50. The resultant dissolved salt solution will be processed at Saltstone if it meets established criteria. If successful, this process will continue over the next several years to gain Type III tank space.

Sludge Removal

Sludge processing of Sludge Batch 1B was successfully completed in December 2001. The washed sludge in Tank 40 (Sludge Batch 2) is being fed to DWPF. This operation will continue until sometime in FY04 based on projected DWPF canister production rates.

Sludge removal facilities are being completed on Tank 7 and Tank 18 in preparation for the washing of Sludge Batch 3 in Tank 51. This batch must be ready to feed in FY04 or earlier to support planned canister production.

5.2.4 H-Tank Farm Waste Removal Project

Tank 11 – design and construction activities on the Tanks 9-16 gang valve and Tank 11 tanktop services were completed in FY01. The tank was 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 was initiated in FY01 to enable Tank 37 to serve as a concentrate receipt tank for the 3H Evaporator in lieu of Tank 30. Construction and testing activities are on track to be completed and the tank turned over to Operations in FY02.

Tank 50 – design and construction of modifications to return Tank 50 to service were initiated in FY01. Construction and testing activities are on track to be completed and the tank turned over to Operations in FY02.

5.3 *F Tank Farm*

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

5.3.1 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 the Plan (January 1, 2002), F Tank Farm has approximately 34 kgal of useable space available.

<u>5.3.2 F-Tank Farm Evaporators</u>

As can be seen in Appendix H 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 full of high hydroxide concentrated supernate. The current plan calls for the 2F Evaporator to concentrate canyon waste from both F- and H Canyons. In addition, the 2F Evaporator will process the backlogged DWPF waste that is stored in Tanks 6 and 8, as well as some supernate waste in Tank 7 (to support Sludge Batch 3 preparation) in FY02. Under all cases in the Plan, the 2F Evaporator is expected to continue to operate until FY09. A 6 month outage is allowed in FY03 to account for an expected evaporator vessel tube bundle failure. HLWD experience in operating HLW evaporators indicates that the average life expectancy of evaporator vessels is 10.5 years. The 2F Evaporator vessel will reach 12.5 years of service in April 2002. The plan is to operate the 2F Evaporator until failure, so a specific replacement outage is not scheduled. 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 FY01 the 2F Evaporator system achieved a space gain total of approximately 686 kgal. During the year, the 2F system experienced several planned and unplanned outages that varied from utility infrastructure problems (instrumentation, feed pump failure) to TSR implementation of key components.

<u>5.3.3 F/H Interarea Transfer Line</u>

The capability to transfer between F- and H Tank Farm is vital to the success of the Plan. Transfers are made through the 2.2 mile IAL. In the past two years, HLW has successfully made several IAL transfers including the Tank 8 to ESP sludge transfer recently completed in January 2001. To successfully support the current processing commitments for Sludge Batch 3 preparation and planned space management activities, a total of five to six IAL transfers are planned over the next 12 months. The IAL will continue to be used over the life of the program to support waste removal and space management activities.

<u>5.3.4 F-Tank Farm Waste Removal Operations</u>

<u>Salt Removal</u>

With the delay in salt processing, the next several years will be focused on maintaining sludge feed to DWPF.

<u>Sludge Removal</u>

Tank 8 – The first sludge removal campaign since the late 1980’s was completed in January 2001 when Tank 8 sludge was successfully slurried and transferred to Tank 40 in ESP.

Tank 7 – The construction of sludge removal facilities will be completed on Tank 7 in FY02 to support a transfer to Tank 51 in early FY03.

Tank 18 – The construction of sludge removal facilities will be completed on Tank 18 in FY02 to support a transfer to Tank 51 in early FY03.

Tank 19 – The waste removal line item project and the TFA provided the following facilities:

- Three 50-hp submersible mixers (made by ITT Flygt)
- A main transfer pump. A 250 gpm submersible centrifugal pump (made by ITT Flygt) was inserted into the tank on a stationary support mast
- A tank de-watering pump. The project installed a 50 gpm air piston pump capable of pumping to a ½-inch tank heel (manufactured by Chicago Industrial Pumps)
- 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 August 2000. A graded readiness assessment was completed and waste removal operations were started in September 2000. 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 main transfer pump was initially installed on top of a 40" mound of hard sludge/zeolite. The submersible mixers were unsuccessfully operated to slurry or erode the solids mound so that the main transfer pump could be lowered to the tank floor. A 7,000 psi hydraulic lance was used to break up the solids mound and the main transfer pump was lowered to the tank floor. From September 2000 to June 2001, heel removal was performed on the estimated 33,000 gallons of material remaining in Tank 19. In this campaign, the submersible mixer in the Southwest Riser failed after 266 hours of operation. The remaining mixers in the East and West Risers operated in varying orientations and completed approximately 3,000 hours of operation. Forty-six transfer cycles were made out of Tank 19. In August 2001, a spray washing jet in the center riser was used to drench the interior tank walls with inhibited water to the highest historical waste level (377 inches from the tank bottom) to dislodge contamination remaining after bulk waste removal. It is estimated that 15,000 gallons of wet solids and 2,000 gallons of free supernate remain in the Tank 19 heel.

5.3.5 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:

- FY01 Activities: completed installation of shielding on riser 2, installation of pump platforms on risers 1 and 3, development and testing of an improved prototype slurry pump (manufactured by Lawrence Pumps Inc.), installation of all four improved slurry pumps, installation of the transfer pump and tie in of the transfer line.
- FY02 Activities: complete installation of the heating, ventilation, air conditioning (HVAC) skid, installation of instrument and electrical controls and services, testing of new instruments and equipment, testing, and a graded readiness assessment.
- FY03 Activities: bulk waste removal.

Evaluations of sludge composition in Tank 7 are underway to determine the effects of high oxalates, coal, and sand on DWPF operation.

Tank 18 – the sludge removal technical baseline originally included the replacement of the three failed slurry pumps with new pumps with a different discharge configuration. A Systems Engineering Evaluation, completed in February 2001, recommended a high capacity Advanced Design Mixer Pump (ADMP) mounted in the center riser rather than three standard slurry pumps mounted in the outside risers. The evaluation also recommended a sump-style transfer pump placed in the northeast riser in lieu of a standard telescoping transfer pump. Development of the safety strategy and equipment design started in March 2001. Waste removal activities on Tank 18 are scheduled as follows:

- FY02 Activities: Design, construction, testing, and turnover of the transfer system will be completed by June 2002. The ADMP refurbishment design, construction, testing, and turnover will be completed by October 2002. Truss modifications will be completed by June 2002. Supernate transfers will be complete September 2002. A graded readiness assessment will be completed and bulk sludge mixing will begin October 2002
- FY03 Activities: Bulk sludge mixing completed. Tank Closure begins.
- FY04 Activities: Tank closure completed.

Tank 19 – Tank isolation design activities, grout procedure activities, and removal of Tank 19 from the Authorization Basis controls continue in FY02.

5.4 *Waste Removal*

5.4.1 Sludge Removal Technical Baseline

Four standard 150-hp slurry pumps per sludge tank form the technical baseline for sludge removal. A slurry pump is a vertical shafted centrifugal pump with the drive motor mounted topside and the pump submerged in the liquid. A coupled shaft connects the motor and pump. Suction is drawn into the pump and is discharged from two nozzles (aimed in opposite directions from each side of the pump). The nozzles are shaped such that high velocity jets eject into the liquid. The pump rotates on a turntable thereby spinning the jets in the horizontal plane. This forms a circular pattern of suspended sludge known as the *effective cleaning radius*. The pumps are installed in available risers such that the effective cleaning radius of each individual pump overlaps with the adjacent pump so the entire tank contents can 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. The pumps will typically suspend what sludge that can be suspended (at that slurry pump elevation setting) within a few days. The pumps are then lowered in 10 to 17-inch increments, more water is added if needed, and the next layer of sludge is suspended. This is repeated until the slurry pumps are at the lowest elevation, typically 10 inches above the tank floor. The transfer pump is then lowered to its lowest elevation, typically

6 inches above the tank floor. The sludge is then transferred out of the tank. To obtain the proper weight percent suspended solids, more than one transfer may be required. Sludge removal in this manner is referred to as *bulk waste removal*.

Additional attempts may be made to remove residual sludge, after bulk waste removal is complete, by adding more water, slurrying, and transferring. This is typically repeated until no longer effective 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 additional attempts to remove residual sludge due to the water additions required. There is presently no baseline for heel removal. It is likely that chemical cleaning will be needed for many of the sludge tanks.

5.4.2 Sludge Removal Demonstrations

Two alternate sludge suspension technologies are being developed via the TFA: the ADMP and submersible mixers. The latter was demonstrated in Tank 19 in an attempt to remove an estimated 33 kgal of solids. The ADMP, or a modified version , will be demonstrated in Tank 18 in FY02.

5.4.3 Salt Removal Technical Baseline

Three slurry pumps per salt tank form the technical baseline for salt removal. The pumps are positioned just above the saltcake and water is added to the tank. The water is stirred by the pumps and dissolves the top layer of salt The solution becomes nearly saturated with dissolved salt and is transferred to SWPF. The slurry pumps are then 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:

- Fast salt removal was needed to support a 405 canister per year production rate
- Vigorous agitation was desired to remove insoluble solids known to be in all salt tanks
- A single agitator design for sludge and salt removal was desired to take advantage of cost discounts through bulk purchase
- Water addition requirements were required to be kept at a minimum

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

5.4.4 Salt Removal Demonstrations

Initial efforts are underway to demonstrate low curie salt removal in Tank 41 in FY02. The existing interstitial supernate, which is high in cesium, will be removed from the tank. The remaining saltcake, which should be low in cesium, will be dissolved, sampled and transferred to Tank 50. The solution will be sent to Saltstone if it meets established criteria. If successful, this process will continue over the next several years to continue to gain Type III tank space.

As described in Section 5.1.4 there will be a salt dissolution campaign in Tank 37 during FY02. The tank is needed as an evaporator receipt tank as part of the 3H Evaporator cooling resolution. Valuable information on salt dissolution will be obtained from this limited salt removal campaign.

5.4.5 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.

5.4.6 Waste Removal Sequencing Considerations

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

- Maintain contingency transfer space per the Tank Farm Authorization Basis (AB)
- Control tank chemistry, including radionuclide and fissile material inventory
- Enable continued operation of the evaporators

- Ensure blending of processed waste to meet salt processing, DWPF, and Saltstone feed criteria
- Remove waste from tanks with a leakage history
- Remove waste from tanks that do not meet FFA requirements
- Provide continuous radioactive waste feed to DWPF
- Maintain acceptable feed for the salt processing facility
- 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 the non-compliant tanks before the FFA commitment date of 2022. However, once SWPF 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.

In addition, as described above, efforts are underway in FY02 to demonstrate low curie salt removal in Tank 41. If successful, this technique will be continued on other identified salt tanks.

Summary of Waste Removal Sequencing Changes

The sludge batch sequencing for the Plan is the same as was used for Revision 12 with the exception of Sludge Batches 7 and 8. To make blends with larger DWPF operating windows for these two batches, Tanks 33 and 39 were split between the two batches as shown below.

	Rev. 12	Rev. 13
Sludge Batch 2	Tk 8 & 40	Tk 8 & 40
Sludge Batch 3	Tk 7, 18 & 19 (70% of all)	Tk 7, 18 (70% of all)
Sludge Batch 4	Tk 7, 18 & 19 (30% of all), 11	Tk 7, 18 (30% of all), 11
Sludge Batch 5	Tk 15 & 26	Tk 15 & 26
Sludge Batch 6	Tk 5, 6, 12 & 13 (30%)	Tk 5, 6, 12 & 13 (30%)
Sludge Batch 7	Tk 13 (70%), 4 &33	Tk 13 (70%), 4 &33 (66%) & 39 (34%)
Sludge Batch 8	Tk 21, 22, 23, 34, 39 &47	Tk 21, 22, 23, 33 (34%), 34, 39 (66%) &47
Sludge Batch 9	Tk 32 & 43	Tk 32 & 43
Sludge Batch 10	Tk 35 & Misc. heels	Tk 35 & Misc. heels

The last three of the ten batches in the Plan are not acceptable for DWPF feed per existing acceptance criteria (*i.e.* not all requirements for inhalation dose or shielding are met). Two of the sludge batches (Sludge Batches 8 & 9) exceed dose and shielding SAR bases by small margins and likely can be processed as is, with refinements to the safety basis calculations. Sludge Batch 10 accounts for the heel materials from numerous tanks. In actuality, this batch will end up being blended as the individual tanks have sludge removed.

5.4.7 Closure Program

The FFA waste removal plan and schedule requires Tank 19 to be closed in FY03 and Tank 18 to be closed in FY04. However, DOE-SR has requested approval from EPA and SCDHEC to delay Tank 19 closure until FY04 so that it can be closed concurrently with Tank 18.

Tank 19 - Two grab samples and one core sample from different locations of the heel were taken in 2001. The data from these samples was combined with two previous heel samples taken in 1996 and 2000 to estimate the tank solids chemical and radionuclide inventory. At the time of final sampling, there was very little liquid in Tank 19, making it difficult to obtain a supernate sample. Because supernate had been recycled numerous times between Tanks 18 and 19 during waste removal, a supernate sample from Tank 18 was used to estimate the inventory of the Tank 19 supernate.

The consistency between the sludge solids samples indicates that the remaining tank contents were well-mixed. The chemical inventory of the tank indicates that the 15 kgal heel is composed of only 1.3 kgal of PUREX Low Heat Waste. The remaining 13.7 kgal are predominantly zeolite and coating waste, which contain less important radionuclide levels from a Tank Closure perspective. To calculate the Tank 19 radionuclide inventory, a 95% confidence interval upper bound was placed on the average solids sample radionuclide concentration. The calculated Tank 19 inventory of Tc-99, the predominant radionuclide impacting the seepline radiation dose, is between the inventories of previously-closed Tanks 17 and 20. Preliminary Tank 19 fate and transport groundwater modeling indicates that the Tank 19 seepline radiation dose at the time of the peak F Tank Farm seepline dose will be 0.0044 mrem/yr, less than that of Tank 17 (0.022 mrem/yr) and Tank 20 (0.0055 mrem/yr). HLW recommends that Tank 19 be closed with the remaining residual heel. A closure module is being finalized for submittal to SCDHEC for approval to allow Tank 19 isolation activities to proceed.

Tank 18 will be the last tank closed in the Tank 17 - 20 cluster because it is the only one of the four that can transfer out to other tanks. The contents of Tanks 18 will be slurried and transferred to Tank 7. Tank 18 will be closed in FY04, thereby meeting 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 have evolved into insoluble aluminosilicates. 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.

5.5 *HLW Pretreatment*

5.5.1 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. The ESP facility consists of Tanks 40 and 51, which have been outfitted with four slurry pumps for sludge washing operation. As one tank is used to feed sludge to DWPF, the other is used to prepare the next sludge batch. As an example, Sludge Batch 2 is being fed from Tank 40 to DWPF, while Sludge Batch 3 feed preparation will begin in early FY03 in Tank 51.

Production Capacity

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:

- Sludge and associated transfer water is received from the source tank
- The tank contents are slurried using the transfer water and additional IW as required to remove as much soluble sodium as possible
- The slurry operation is stopped and the sludge is allowed to settle
- The supernate is decanted to an evaporator system
- The process is repeated as required until all the sludge is received in the ESP tank
- The sludge is sampled for sludge qualification.
- The sludge is qualified by producing test glass in the Savannah River Technology Center (SRTC) high level cells
- Additional wash and decant cycles are performed to achieve the desired dissolved sodium concentration (typically an estimated 4 to 5 additional wash cycles required)
- A final sample is taken to compare with the earlier characterization sample
- The sludge is ready to feed to DWPF.

The total duration for sludge preparation depends primarily on the number of washes, though many other factors 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. ESP can feed approximately 600 – 800 kgal of sludge every two to three years to DWPF.

Aluminum dissolution is not planned for 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 of Saltstone as originally predicted. While this slightly increases the number of canisters produced during the life of the program, it does not have negative effect 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.

Production Plan

Tank 51 will be used in early FY03 to prepare Sludge Batch 3. Sludge from Tank 7 (which also contains Tank 18 and 19 sludge), Am-Cm waste from F Canyon, plutonium from the Pu disposition program will be transferred into Tank 51 in early FY03 to make up Sludge Batch 3.

Tank 40 is being used to store and transfer ESP Sludge Batch 2 feed to DWPF. This sludge batch consists of sludge that had been stored in Tank 40 and sludge that was received from Tank 8 in FY01.

Tank 42 is now used for storage of supernate that was partially concentrated and the neutralized 2H Evaporator cleaning solution. 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.

5.5.2 Salt Processing

Salt Waste Processing Strategy: A final DOE technology selection for HLW salt solution processing was completed and a Salt Processing EIS ROD was issued in October 2001. The ROD designated Caustic Side Solvent Extraction (CSSX) as the preferred alternative to be used to separate cesium from HLW salt. Three alternatives were considered; Small Tank Tetraphenylborate (TPB) Precipitation, Crystalline Silicotitanate (CST) Non-Elutable Ion Exchange, and Caustic Side Solvent Extraction. In addition DOE and WSRC changed their strategy of total reliance on a single SWPF, to take a graded approach to salt waste processing.

The new integrated Salt Disposition Strategy is to:

- Treat low curie salt waste and dispose at Saltstone
- Create an Actinide Removal Process (ARP) to enable disposal of additional low curie/high actinide salt waste & potentially provide actinide removal for the high curie demonstration CSSX facility
- Dispose of high curie salt waste by removing cesium in a small scale demonstration CSSX processing facility
- Tailor follow-on high curie salt waste processing capability depending on the success of early low curie salt disposal.

Successful implementation of the low curie and actinide removal process will reduce the quantity of salt solution needing to be processed through the SWPF This supports timely closure of old type high-level radioactive waste tanks.

Salt Waste Processing: Of the 38 Mgal of high-level radioactive waste in storage, approximately 3 Mgal are sludge waste and 35 Mgal are salt waste. The sludge waste is insoluble and settles to the bottom of a waste tank. It generally contains the radioactive elements strontium, plutonium, americium, and curium in the form of metal hydroxides. The salt waste is soluble and contains mostly Cs-137. Also, some entrained insoluble actinides reside in the salt waste. The high curie/high actinide salt solution will be processed to remove the actinides and cesium. The low curie/high actinide salt solution will be processed to remove actinides only. The separated actinide and cesium streams will contain the majority of the radioactivity in the salt waste but should only be a small fraction of the total previous volume. The actinide and cesium stream is high activity waste, and will be transferred to DWPF for vitrification. (See simplified flow diagram in Appendix E). Some modifications at DWPF may be required to accommodate this stream. Low curie and low actinide solution will be sent directly to Saltstone. This stream is classified as low-level waste and will not exceed the revised Saltstone WAC.

Production Capacity

The salt solution feed rate (at an average of 6.44 M Na^+) is projected to average 6,000 kgal annually. This is based on logistical constraints imposed by the infrastructure of the Tank Farms. Under the disposition strategy, salt solution will be processed through three paths: low curie, ARP, and demonstration SWPF (via CSSX). The low curie path will send the salt solution directly to Saltstone. The ARP will produce a decontaminated salt stream to Saltstone and an MST-Sludge stream to DWPF. The SWPF will produce a decontaminated salt stream to Saltstone, an MST-Sludge stream to DWPF, and an acidified cesium stream to DWPF. Depending on the case being analyzed the amount of salt solution required for each of these paths varies. The demonstration SWPF will have an initial capacity less than 20% of the full-scale facility (17.5 gpm). The full scale SWPF will process 17.5 gpm when operating. This ensures the facility sustains a 6,000 kgal per year (running average) feed to SWPF. For this revision of the System Plan, salt dissolution, blending and batching for low curie, ARP and SWPF were planned in detail. Salt waste was processed in 68 batches (over the life of the salt processing program) in Tanks 48, 49 and 50 that will be fed to the SWPF. Compositions and volumes of these batches were estimated based on modeling using the Spaceman II™ model. This input was used to estimate the quantities of low curie salt, decontaminated salt solution, MST-Sludge solids and acidified cesium solution produced. The MST-Sludge solids and acidified cesium solution were matched in sequence with the sludge batches proposed in the Plan. Maximum loading of MST-Sludge solids and acidified cesium solution was determined and combined with the maximum quantities of sludge.

5.6 *Defense Waste Processing Facility (DWPF)*

DWPF is in sludge-only radioactive operations. As of January 1, 2002, DWPF has poured 1,221 canisters (64 in FY96, 169 in FY97, 250 in FY98, 236 in FY99, 231 in FY00, 227 in FY01, and 44 in FY02 through January 1, 2002). This represents completion of approximately 20% 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. 12 Super Stretch Case	Rev. 12 Stretch Case	Rev. 12 Base Case	Rev. 13 Case 1	Rev. 13 Case 2	Rev. 13 Case 3
Sludge-only	3,074	3,117	3,117	2,500	2,100	2,300
Coupled Salt and Sludge	2,797	2,797	2,797	3,541	3,941	3,741
Salt-only	0	0	0	0	0	79
Total	**5,871**	**5,914**	**5,914**	**6,041**	**6,041**	**6,120**

For every case in the Plan, there is an increase from the estimated canisters in the last revision of the Plan (Revision 12). The increase is primarily driven by the update of the overall HLW sludge inventory to include recent receipts of sludge waste from the canyon facilities.

Similar changes in the outyear estimates will occur as additional operating experience is gained in the understanding of 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 future batches. The attainment in Batch 1A and 1B ranged from 68.0% to 77.1%. Recent feed attainment data indicate that as the plant ages the long term average attainment for the facility is expected to be about 75%, not accounting for melter changeout outages. SRTC has successfully shown on a laboratory scale that higher melt rates can be expected if a new frit is used that produces lower viscosity glass. A new frit designated as Frit 320 is being evaluated. Plans are to demonstrate this frit in the SRTC slurry-fed mini-melter during the third quarter of FY02. If successful, Frit 320 will be use at DWPF during the fourth quarter of FY02 or the first quarter of FY03. Based upon laboratory data, an increase in DWPF melt rate of 5-15% is reasonable with Frit 320. A 10% increase in demonstrated DWPF melt rate (from 159 lbs/hr to 175 lbs/hr) would result in the following.

$$175 \text{ lbs/hr} \times \text{canister}/3800 \text{ lbs} \times 24 \text{ hr/day} \times 365.25 \text{ day/yr} \times 75\% \text{ attainment} \cong 300 \text{ cans/yr}$$

The annual production rate above does not include any deduction from the attainment percentage to incorporate future melter replacements.. To date, DWPF has not experienced a melter failure and therefore, there is no plant experience to improve predicting a melter failure or a melter outage.

DWPF is pursuing initiatives to improve production capacity and waste loading. SRTC developed an improved model relating glass liquidus temperature to waste composition which, when coupled with Frit 320, will increase waste loading as well as improve the melt rate. Sample analytical time requirements are not expected to present a near term restriction for sludge-only operation, but could reduce production at higher melt rates. DWPF implementation of these improvements are targeted for 4th quarter of FY04.

The current melter has operated past its expected life, chiefly because of lower than expected quantities of noble metals in the first sludge batches. High concentrations of noble metals tend to foul and eventually short out the melter electrodes. Based on the higher noble metal content of future sludge batches, the forecasted melter life is still estimated to be 2-3 years. Because 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

The melter pour spout inserts have degraded. Over time, erosion has caused the spouts to not seal. The insert design is being further refined to provide acceptable pour stream control with the degrading condition of the Melter 1 pour spout knife edge.

Production Plan

DWPF completed Sludge Batch 1B in November 2001. A total of 726 canisters were produced from Sludge Batch 1B.

DWPF is processing Sludge Batch 2 from Tank 40. Sludge Batch 2 is expected to make 470 cans, which provides feed until sometime in FY04 depending on the DWPF canister production rate.

The safety class nitrogen missile-shielding project has been completed to accommodate the higher curie content of Sludge Batch 2.

DWPF will continue sludge-only processing until feed is available from the SWPF, which is forecast for sometime between FY08 and FY12 depending on the case.

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 for Cases 1 and 2 in the Plan. In Case 3, the sludge completes processing three years before the end of salt processing. This results in an estimated 79 additional salt-only cans being produced at the end of the program. The increase life cost to the HLW program is an estimated $1 billion dollars. 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 For Cases 1 and 2, there is a three year DWPF feed break from FY07-09 due to the lack of funding to prepare sludge batches. Case 3 assumes that additional funding is received from Congress or that additional savings is realized to maintain waste removal on schedule to ensure no DWPF feed break.

Replacement Control Systems

The current DCS at DWPF is over 15 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 4.13 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 or the inability to install pour spout inserts because of continuing pour spout erosion. SRTC also predicts that melter life expectancy will average about two to three years. The melter presently in service (Melter 1) has been in operation for 7.5 years (6 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 4-6 months.

Melter 1 is in service. It began operating in June 1994, was used for DWPF startup testing, and is in radioactive service. At the time of the Plan, Melter 1 has already reached 375% 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 and of Sludge Batch 1B. Melter 1 will remain in service as long as it operates normally.

Melter 2 is being stored in 717-F. Construction modifications are complete and the melter is ready to install, pending two enhancements based on lessons learned from Melter 1: (1) replacement of existing dome heater bus bars with a new design which eliminates the primary source of Melter 1 water leaks, external copper tubing; (2) modification of the pour spout reclamation plate to minimize the potential for arcing to the drip edge extension. 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 scheduled for a specific date at this time.

The **Melter 3** vessel, frame, and most major components are on site. Assembly began, but has been on hold pending priority and funding. 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 modification in-house, based on lessons learned from Melter 1 pouring experience. Thermocouples and dome heater transformer bus bars are the primary remaining component procurement to be completed. With the current FY02 authorized funding, a procurement change request notice (PCRN) is being processed to the existing thermocouple contract, for the remaining thermocouples and bus bars. Once the components are on and the melter staged, final assembly of Melter 3 is expected to take approximately eighteen 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, up to 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 off-gas film cooler and the steam atomized scrubbers, use steam to cool and decontaminate the off-gas 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 2.

During melter feeding and pouring, additional recycle volume is generated. The slurry feed into the melter is 45-60 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 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 RCT 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 IAL. This line runs from DWPF through the low point pump pit (LPPP) to the HDB-8 complex. The HDB-8 complex redirects the DWPF recycle into one of several waste tanks (Tanks 21, 22, and 24).

The majority of the recycle stream is directed to Tank 22, with Tanks 21 and 24 available as needed. After any solids are allowed to settle, the stored DWPF recycle is periodically transferred over to the 2H System for evaporation.

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.

For sludge-only processing with low cesium content, the recycle transfer volume projection algorithm is forecast to be:

$$\text{DWPF Recycle} = 5{,}151 \text{ gallons} \times (\text{\# of cans/year}) + 143{,}000 \text{ gallons}$$

This algorithm incorporates the recycle reduction initiatives associated with the shut off of the melter offgas 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.

If waste is processed through DWPF with high enough cesium content to require that the SASs must be returned to operation then the algorithm would be the following:

$$\text{DWPF Recycle} = 5{,}312 \text{ gallons} \times (\text{\# of cans/year}) + 1{,}009{,}319 \text{ gallons}$$

The Plan assumes that the SASs do not need to be turned back on until the start of the SWPF.

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.

5.7 *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 unusable because the plugs are out of round relative to the floor liner. Actions will be taken to make 450 of these positions usable. To date, 89 positions have been recovered. Upon completion of these activities GWSB 1 will have a working capacity of 2,159 usable storage locations. At the time of the Plan, GWSB 1 was storing 1,221 radioactive canisters.

The Plan maintains the assumption (used in Revision 12) that additional canister storage will be provided by the construction of individual storage modules. Each module will have 585 canister positions. Cases 1 and 2 only require the construction of one additional module. Case 3, which does not assume a DWPF feed break in FY07-FY09, would require the construction of two additional modules. The detailed canister storage requirements are defined in Appendix I.6, J.6, and K.6 for the different cases.

5.8 *HLW Disposal*

HLW, consisting of glass filled canisters 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

5.9 *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 FY02. At the time of the Plan, the facility has treated about 10 million gallons (Fiscal Year to Date - FYTD). ETF Concentrate is transferred to Tank 50 for storage prior to disposal in the Saltstone Facility

5.10 *Saltstone Facility*

The Saltstone Facility treats and disposes the salt 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 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) concentrate, an aqueous waste that is ready for final treatment and disposal at Saltstone. The Plan assumes that Tank 50 can be returned to waste storage service in FY02. Tank 50 will initially be used to support low curie and actinide salt processing activities. (If this use is unsuccessful, Tank 50 will be returned to waste storage). Returning Tank 50 to waste service requires that the ETF concentrate stored in Tank 50 (an estimated 800 - 900 kgal by FY02) be processed at Saltstone beginning in mid-FY02. Operation of Saltstone will then continue, as required, for processing newly generated ETF concentrate and to support low curie and actinide salt disposition. After startup of the SWPF, the Saltstone Facility must be operated continuously to support the large volume filtrate stream.

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.

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 and a half cells out of twelve are filled), in lieu of filling Vault 1. Some deterioration of remaining Vault 1 cells has seen in the past due to rainwater in-leakage. The Plan assumes the continued use of Vault 1, pending the results of a review of vault integrity.

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, the Plan assumes that 6-cell vaults will be used until better a 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 processing technology alternative study and scheduled resumption of salt processing.

6. 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 TFA is specifically chartered to support the weapons complex high-level radioactive waste programs. 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 and melt rate improvements in DWPF
- Deployment of a corrosion probe
- Deployment of the ADMP in Tank 18
- Development and testing of advanced washable high efficiency particulate air (HEPA) filters
- Development of the technology to support a downselect of the preferred alternative for salt processing.

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

- Accelerate Salt Waste Retrieval, Processing and Disposition
- Accelerate HLW Immobilization
- Accelerate Waste Removal and Tank and Equipment Disposition.

As of this writing, the TFA as well as the other EM-50 Focus Areas are expected to be significantly restructured to conform to the Accelerated Cleanup vision articulated by EM-1. A Technology Program Plan and development proposal has been prepared and submitted to the TFA for technology needs in each of these areas for FY03 and out years. These plans are being restructured as outlined in the following paragraphs.

6.1 *Accelerated Salt Retrieval, Processing and Disposition*

Technology development to accelerate immobilization includes:

- Science and technology to investigate accelerating parallel paths for salt treatment to minimize costs
- Develop alternatives include saltcake dissolution and retrieval, lower cost alternatives for solid-liquid separation (including filter cleaning), cesium removal, and actinide removal, process monitoring, and disposal options for minimally-treated salt waste.

An extensive R&D program has been underway to address the issues associated with the deposition 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 to avoid formation of deposits in the future.

Several changes have been made in the past few years 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.

The Tank Farm presently employs paper HEPA filters in the ventilation systems of the high-level radioactive 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 National Energy Technology Laboratory (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.

6.2 Accelerate Waste Retrieval and Tank and Equipment Disposition

Technology development to accelerate waste retrieval includes:

- Increase feed rates of waste for disposition through improved technology to accelerate waste retrieval and reduce tank farm storage and operations bottlenecks.
- Develop alternatives include waste mixing and mobilization improvements for sludge, obstructed tank, unobstructed tank, and annulus retrieval, leak detection and mitigation, equipment size reduction and disposition, and tank farm water management.

Transfer of tank cleaning technology from the Russian nuclear program is 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.

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

Pipeline blockage detection and removal systems are planned and under development in cooperation with TFA, Florida International University (FIU), and 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 the event of a pipeline blockage

6.3 Accelerate HLW Immobilization

Technology development to accelerate immobilization includes:

- Enhance throughput and reduce the number of HLW canisters produced by DWPF to significantly reduce costs and accelerate the overall mission.
- Develop alternatives to include new or advanced melter designs and technology, development of the scientific basis for acceptance of multi-phase glasses, waste loading and melt-rate improvements, facility and flowsheet optimization to reduce bottlenecks, waste conditioning, and melter change out and disassembly.

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 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 underway at FIU and at Clemson University to address some of the design issues for the next generation of melters.

7. Support for Future Missions

A number of new programs are being evaluated or developed. Many of these programs have the potential to impact HLWD operations in the future. At the time of the Plan, there has been no decision to incorporate any of these programs into the baseline except for Am-Cm. The others are discussed in the Plan for information only.

The plutonium immobilization project is presently on hold pending the final decisions on the MOX project.

7.1 *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 other options is on hold pending the results of the studies of medical uses.

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.

7.2 *Pit Manufacturing*

SRS is being considered for the large-scale pit manufacturing mission, which will augment the small lots facility under construction at Los Alamos National Laboratory (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 FY18 time frame. The facility would generate a maximum of approximately 33,600 gal/yr of high-level radioactive waste. It has not been determined if the high-level radioactive waste would be treated as a part of the system described in the 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.

7.3 *Am-Cm Disposal*

Approximately 3,000 gallons of solution containing isotopes of americium and curium are stored in F-Canyon Tank 17.1. These isotopes were recovered during Pu-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).

Am-Cm is now considered to be excess material and a program initiated to incorporate requirements for final disposition to the Federal Repository. HLW investigated and approved the feasibility of a cost beneficial alternative for receiving and processing the Am-Cm material within the HLW system. There are considerable cost benefits to receive the Am-Cm material within the acceptable waste limits into F Tank Farm. The Am-Cm stream will be directed through the IAL into an ESP feed tank for processing in Sludge Batch 3. Detailed evaluations confirmed that the Am-Cm material could be successfully processed and vitrified in DWPF. The Am-Cm material will be transferred to Tank 51 in late FY02.

7.4 *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 NMMD 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 included in the Plan. Status of new NMMD missions will continue to be tracked and incorporated into future Plan revisions, as appropriate.

7.5 *Mixed Oxide Fuel Fabrication Facility (MFFF)*

The U.S. has declared a surplus of weapons-grade plutonium since the end of the cold war. 34 metric tons of this excess plutonium will be disposed at 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 (DCSW) 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. Various options for treatment/disposal of this waste stream have been considered. On February 13, 2002, the National Nuclear Security Administration (NNSA) and DCSW informed the NRC that they were changing the program baseline to a plan which constructs a new waste treatment facility for this and other waste streams associated with the Plutonium Disposition Program, independent from the existing SRS HLW system. However, the potential exists for this decision to revert to the original plan of disposing of this waste via the SRS HLW system if technical/cost issues show the new plan to be infeasible. If treatment/disposal occurs through the HLW system, various issues will need to be addressed. Although the volume of this stream is low (less than 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 WAC. The waste stream will also contain approximately 4 kg per 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 the 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 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.

8. History

8.1 *Introduction*

The SRS 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 38 million gallons of liquid, high-level radioactive waste 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 (twelve of the SRS tanks have a waste leakage history). Therefore, the 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 FY02, over 1,300 canisters of waste will have been vitrified. The canisters vitrified to date have 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. In early FY02 DOE selected Caustic Side Solvent Extraction (CSSX) as the technology to be used for salt waste processing. Planning for the SWPF is underway.

8.2 *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 Pu-238 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 sludge washing tanks, 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 SWPF can begin.

8.2.1 Waste Characterization System (WCS) Database

The Waste Characterization System (WCS) database is used to track the composition of the waste in each of the HLW tanks. Very accurate material irradiation and process records together with ongoing sampling results have been incorporated into the WCS. The available data in the WCS supports the ongoing HLW systems integration.

8.3 *HLW Facilities*

8.3.1 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 Tank Farm, with the remainder in the F Tank Farm.

The tanks are 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 original 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. Twelve 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 the 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	X	
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.

8.3.2 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 Btu/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 in lay-up mode.

The **2H Evaporator** was placed in service in 1982 and was originally used to evaporate low-heat waste. 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 has been to evaporate the H Canyon waste stream and the DWPF recycle stream, both of which have been received in Tank 43.

The 2H Evaporator vessel was replaced in 1996 and presently has four years of operating service. The 2H Evaporator experienced a significant outage (21 months) beginning in January 2000. Erratic lift rates were experienced due to the unexpected formulation and accumulation of sodium aluminosilicate and sodium diuranate solids in the evaporator pot. An investigation determined that these solids from in the presence of high silica feed (DWPF recycle). Modifications were made to the evaporator to allow chemical cleaning and the evaporator was restarted in October 2001.

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 the cooling coils in Tank 30 (the 3H Evaporator drop tank) had failed. This limited the operation of this evaporator. A project is 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 in 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 was originally 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 12.5 years of service in April 2002. 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 on hand. The new vessel will serve as a spare for either the 2F or the 2H Evaporator systems.

8.3.3 F/H Interarea Transfer Line

The H and F Tank Farms are connected by a 2.2-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.

8.3.4 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 the sludge without adding significant 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 8, 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

8.3.5 Tank Closure

SRS 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 Resource Conservation and Recovery Act and Comprehensive Environmental Response, Compensation, and Liability Act (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.

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 controlled low-strength material (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 partially suspend the sludge heel, and water monitors were used to sluice the suspended sludge toward a diaphragm pump for removal to Tank 18. Approximately 2,200 gallons of sludge 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 appeared to occur 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.

8.3.6 Sludge Preparation

A full-scale demonstration of sludge washing and aluminum dissolution 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	1,243*
2	22	40	1986	158*
2	8	40	1/11/01	460*

* Volume as received in Tank 40 before decanting transfer water

8.3.7 Salt Processing

Of the 38 million gallons of high-level radioactive waste in storage, approximately 3 million gallons are sludge waste and 35 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 a large amount of the radioactive element cesium.

Salt waste will be processed in several ways: low curie without actinide removal, low curie with actinide removal, and high curie with actinide removal. The high curie fraction (containing mostly radioactive cesium), along with the actinide portion, will be vitrified at DWPF. The low curie fraction, and any decontaminated solution from the high curie process, will be solidified at Saltstone.

8.3.8 Defense Waste Processing Facility (DWPF)

Historical Production Capacity

DWPF radioactive operation was initiated in FY96. In FY96, FY97, and the majority of FY98, substantial learning experience was gained from shakedown runs. By early FY00 DWPF had operated for approximately four years in a full sludge only production mode. At that time the production capacity of DWPF based on the knowledge of plant behavior versus the initial design capacity calculations was documented as follows:

For reference, 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 radioactive 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 previously noted, the pounds of glass per hour that was poured during Batch 1A was greater than was poured in Batch 1B. This was caused by the differing chemical composition of the two batches. For example, Batch 1B feed was more viscous than Batch 1A feed and was 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. The attainment percentage in Batch 1A and 1B ranged from 68.0% to 77.1% attainment.

Melter Pour Spout Inserts

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.

To solve this problem, a replaceable insert was developed and 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. 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. There are indications that insert life is decreasing as additional erosion occurs in the melter pour spout.

DWPF Production Summary

	Canisters Poured	**Curies Immobilized**	**Glass Poured** (lbs)
Sludge Batch 1A			
FY96	64	52,000	250,000
FY97	169	140,000	659,000
FY98	250	200,000	975,000
FY99	12	9,700	46,800
Sludge Batch 1B			
FY99	224	1,200,000	878,000
FY00	231	1,200,000	906,000
FY01	227	1,200,000	890,000
FY02*	44	230,000	172,000
TOTAL	**1,221**	**4,231,700**	**4,776,800**

* This represents the Sludge Batch 1B canisters produced in FY02, not the total FY02 production. Processing of Sludge Batch 1B sludge at DWPF was completed in the first quarter of FY02.

8.3.9 Glass Waste Storage

Glass Waste Storage Building 1 was built with 2,286 canister storage positions nominally available. Five positions are occupied by test canisters strategically located to monitor for possible corrosion and 572 of these positions are 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. However, innovative techniques have been employed which are expected to recover 450 of these positions for canister storage. To date, 89 plugs have been recovered.

8.3.10 Saltstone Facility

The Saltstone facility began operation in FY90 and operated until June 1998 (see production data, below).

	Salt Solution Processed (gal)	**Saltstone Produced** (lbs)	**Dry Materials Used** (lbs)	**Receiving Valult / Cell**
FY90	256,406	5,770,700	2,978,000	1-A
FY91	651,279	15,466,300	8,880,000	1-A, B
FY92	105,391	2,621,400	1,438,000	1-B
FY93	28,020	637,200	480,000	1-B
FY94	261,058	6,799,000	3,299,600	1-B, C
FY95	129,900	3,258,600	1,628,000	1-C
FY96	607,774	14,132,600	7,042,000	1-C
FY97	212,370	4,969,900	2,574,000	4-G
FY98	339,310	8,276,500	4,094,000	4-G
TOTAL	**2,591,508**	**61,932,200**	**32,413,600**	

Saltstone Vault Radionuclide Inventory (Curies)					
Nuclide	Vault 1-Cell A 10/1/02	Vault 1-Cell B 10/1/02	Vault 1-Cell C 10/1/02	Vault 4-Cell A 10/1/02	Vault 4-Cell G 10/1/02
H-3	1.30E+01	1.61E+01	7.50E+00		1.08E+01
C-14	5.00E-01	5.00E-01	3.00E-01		7.90E-02
Ni-59	<5E-04	<3.8E-03	3.00E-02		<8.9E-03
Co-60	1.10E-03	1.90E-03	2.60E-03		1.30E-03
Ni-63	1.90E-03	1.10E-02	9.60E-01		<8.4E-03
Se-79	1.00E-01	7.20E-02	1.30E-01		9.30E-03
Sr-90	<5.9E-03	6.50E-03	8.40E-03		4.60E-03
Nb-94	<8E-04	<6.8E-04	<1E-03		<5.2E-04
Tc-99	4.00E+01	3.57E+01	3.27E+01		1.65E+01
Ru-106	1.10E-03	1.10E-03	4.20E-01		1.80E-01
Sb-125	1.00E-01	8.50E-03	4.80E+00		1.10E+00
Sn-126	3.00E-01	2.00E-01	5.10E-01		4.10E-02
I-129	1.00E-02	1.80E-02	8.40E-02		6.00E-02
Ba-133	NR	NR	<3.6E-03		<2.9E-03
Cs-137	1.70E+00	2.30E+00	5.10E+00		3.30E+00
Sm-151	NR	<3.6E-02	1.40E-03		<9.7E-04
Eu-152	NR	<3.2E-04	<8.8E-03		<6.4E-03
Eu-154	<4.2E-04	<5.9E-04	<2.1E-03		<9.6E-04
Eu-155	NR	<2.8E-03	<7.8E-03		<3.3E-04
U-233/234	NR	NR	2.90E-01	3.20E+00	2.00E-01
U-235/236	NR	NR	3.20E-03	6.00E-02	4.80E-03
Np-237	3.00E-05	<6.4E-04	3.80E-03		7.10E-04
U-238	NR	NR	7.40E-03	1.00E-04	<9E-03
Pu-238	NR	2.60E-04	7.50E-03		3.60E-03
Pu-239/240	NR	7.50E-04	1.20E-02		2.70E-03
Pu-241	<2.8E-04	4.40E-03	4.10E-02		6.60E-03
Am-241	NR	NR	5.00E-04		1.10E-03
Pu-242	NR	NR	9.00E-04		<3.7E-04
other alpha	2.00E-01	1.00E-01	NR		NR

NOTES:
1) All activity reported was calculated in Q-CLC-Z-00001, revision 4.
2) Activity in Vault 4-Cell A resulted from encapsulation of Naval Fuels drums.
3) Activities listed as NR were not reported on applicable sample analyses.

A directive was issued in June 1998 to lay up the Saltstone Facilities for a projected period of two to five years. This lay-up was successfully achieved in November 1998. The lay-up involved processing the existing Tank 50 inventory down to a minimum level through the production of saltstone while concurrently de-inventorying both the dry material and liquid inventories within Saltstone.

Saltstone operations require periodic construction of additional vaults, capping of filled vault cells and construction of permanent vault roofs. Each vault cell can hold 242,500 cubic feet of saltstone grout, or approximately one million gallons of salt solution.

Construction of Vaults 1 & 4 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.

8.4 *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)									Total In
	F Canyon	H Canyon	DWPF Recycle	299-H	RBOF	ESP Wash Water	ETF Evap. Bottoms	Transfer Dilution/ Flushes	Other	
FY95										
FY96	405	92	1,087	16	132	700	185	Included in "other" column.	88	**2,705**
FY97	409	65	1,848	12	158	210	229		1,124	**4,055**
FY98	224	111	2,249	8	155	262	169		203	**3,381**
FY99	292	314	2,106	8	91	-	142		577	**3,530**
FY00	260	164	1,481	14	53	493	119		652	**3,236**
FY01	421	236	1,174	4	129	849	92	614	111	**3,630**

End of Year	Effluents (kgal)					**Total Out**	**Total Waste Volume Stored (49 Tanks) (kgal)**	**Canister Production @ DWPF**
	Space Recovered			Transfers to Saltstone	Sludge to DWPF			
	2F Evap	2H Evap	3H Evap					
FY95							**33,389**	
FY96	457	1,648	N/A	606	59	**2,770**	**33,324**	**64**
FY97	908	1,598	N/A	215	155	**2,876**	**34,502**	**169**
FY98	706	2,232	N/A	308	230	**3,476**	**34,407**	**250**
FY99	675	2,064	N/A	-	181	**2,920**	**35,017**	**236**
FY00	377	-	652	-	177	**1,206**	**37,047**	**231**
FY01	686	-	1,186	-	174	**2,046**	**38,631**	**227**

Tank Farm Transfers

Total number of transfers and amounts are shown below. Includes evaporator system recycle transfers and transfers from the canyons and DWPF. (Does not include routine evaporator overheads transfers to ETF in years FY96-FY98.)

	Number of Transfers	Amount (millions of gallons)
FY96		16.2
FY97		20.4
FY98		16.4
FY99	713	17.6
FY00	590	16.4
FY01	632	42.7

Major transfers are shown specifically below:

FY 96

Transfer	Amount (gal)
TK 51 to 43	500,000
TK 51 to 42	200,000
TK 42 to 43	298,000
TK 38 to 40	386,000
TK 26 to 34 (2 times)	421,000
TK 33 to 26	491,000

FY 97

Transfer	Amount (gal)
IAL H to F (3 times)	930,150
TK 42 to 43	112,320
TK 33 to 26	112,320
TK 17 to 6	280,800
TK 47 to 26	38,610

FY 98

Transfer	Amount (gal)
IAL H to F (2 times)	709,020
TK 29 to 32	35,100
TK 36 to 32	35,100
TK 29 to 32	35,100
TK 42 to 51(4 times)	421,200
TK 33 to 26 (2 times)	456,300
TK 26 to 34	245,700
TK 47 to 26	38,610

FY 99

Transfer	Amount (gal)
IAL H to F (2 times)	675,152
TK 35 to 32	669,000
TK 40 to 42 to 40 to 42 (4 times)	560,000
TK 33 to 26 (2 times)	238,680

FY 00

Transfer	Amount (gal)
IAL F to H, 26 to 35	193,000
TK 43 to 35 (2 times)	380,000
TK 40 to 42 to 40 to 42 (4 times)	842,000
TK 29 to 32	81,000
TK 33 to 26 (2 times)	291,000

FY 01

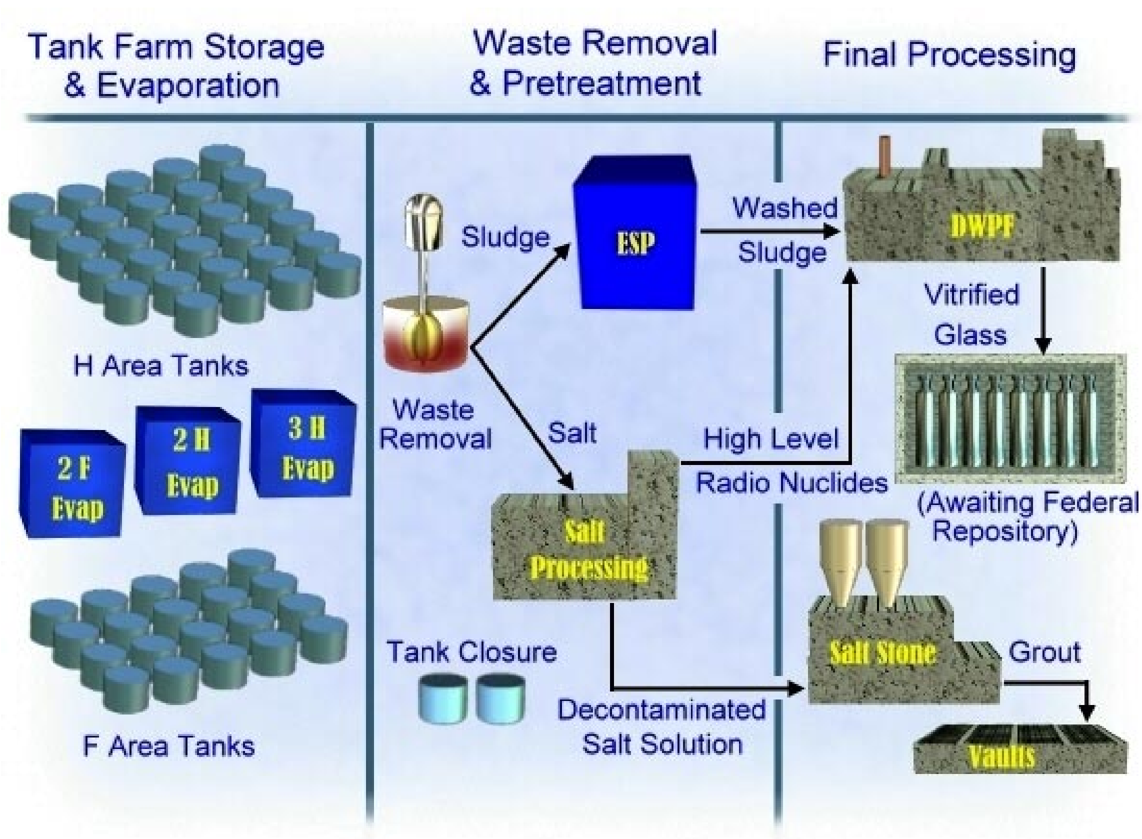
Transfer	Amount (gal)
TK 39 to 26	339,000
TK 22 to 6	315,000
TK 22 to 5 (2 times)	191,709
TK 40 to 5	66,100
TK 49 to 50	222,285
TK 40 to 30/32 (3 times)	1,175,685
TK 22 to 23	129,000
TK 22 to 34	252,614
TK 43 to 38	60,000
TK 29 to 32	43,278
TK 8 to 40	462,000
TK 26 to 32 (2 times)	335,556
TK 34 to 26	252,580
TK 33 to 26 (2 times)	334,666
TK 19 to 18	278,058
TK 19 to 18 to 19 (45 times)	13,915,536
TK 6 to 8 (2 times)	329,886
TK 5 to 46	268,561
TK 47 to 26	111,000

9. System Description

9.1 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 38 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 were 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.



9.2 Tank Storage

The 38 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 400 million curies of radioactivity.

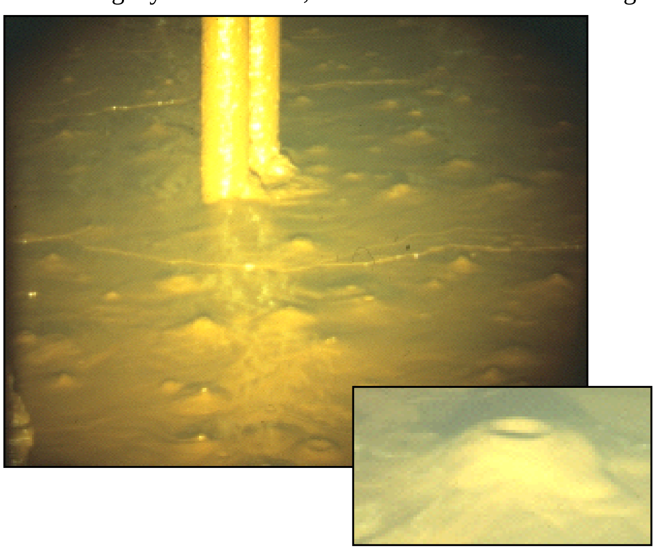
There are four types of underground waste storage tanks at SRS. The Type I and Type II tanks are described as being "high risk" because they do not meet current secondary containment and leak detection standards, sit near or at the water table, and together store 5.7 million gallons of waste and 143 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.

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

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.

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.

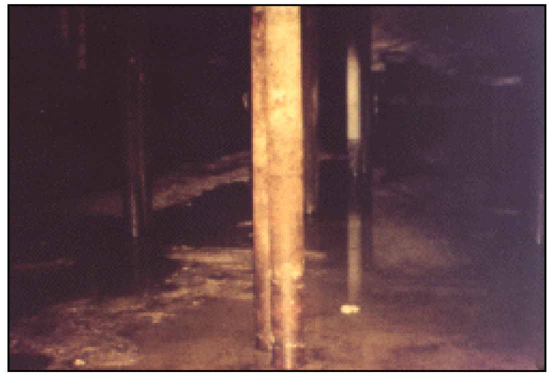
In 1997, a new kind of leak site, a horizontal crack approximately 18 inches in length, was found on one Type II tank, Tank 15. This leak site was discovered by SRS's extensive tank-integrity monitoring program. SRS has not determined the cause of this crack, although it may indicate that a different mechanism is affecting tank wall integrity. In addition, increased corrosion is being seen in several tank secondary containment pans. In FY01, after transfers of low source term waste into Tanks 5 and 6, waste was detected in the annuli. Extensive exterior wall inspections identified several leak sites. Waste was removed from Tank 5 and 6 to a level below the lowest leak sites. No transfers to the Type I and II tanks are planned in the future other than those required to support final waste removal and closure. These findings underscore the urgency to remove waste from these tanks as soon as possible.



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.

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 55% of the waste radioactivity (220 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 (35.4 million gallons) and 45% of waste radioactivity (180 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.



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

Volume Reduction — Evaporation

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 38 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.

Three evaporator systems are currently operating at SRS - the 2H, 3H, and 2F systems.

9.3 Waste Removal & Tank Closure

Waste Removal from Tanks

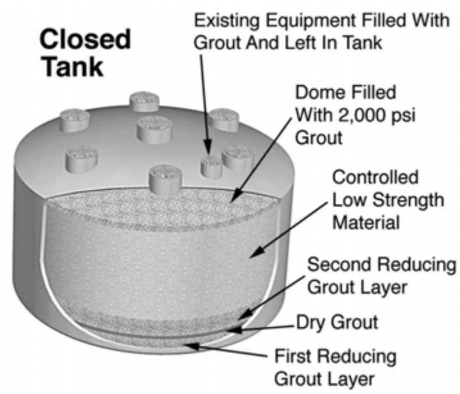
During waste removal, water is added to waste tanks and agitated by slurry pumps. If the tank contains salt, this water and agitation dilutes the concentrated salt or re-dissolves the salt cake. If the tank contains sludge, this water and agitation suspends the insoluble sludge particles. In either case, 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.

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.

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.

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. Cutting and capping all service lines (power, steam, water, and air) and sealing all tank risers and openings then isolates the tank. 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

A final DOE technology selection for HLW salt solution processing was completed and a Salt Processing Environmental Impact Statement (EIS) Record of Decision (ROD) was issued in October 2001. The ROD designated Caustic Side Solvent Extraction (CSSX) as the preferred alternative to be used to separate cesium from HLW salt. In parallel, DOE is evaluating the implementation of other salt processing alternatives for specific waste portions that would not need to be processed in the CSSX facility. The evaluation of alternatives and potential operations would be undertaken to maintain operational capacity and flexibility in the HLW system and meet commitments for closure of high-level waste tanks. The Final Salt Processing Supplemental Environmental Impact Statement (SEIS) acknowledges the possibility of offsite treatment or disposal for certain waste streams.

The new integrated Salt Disposition Strategy is to:

- Treat low curie salt waste and dispose at Saltstone
- Create an Actinide Removal Process (ARP) to enable disposal of additional low curie/high actinide salt waste & potentially provide actinide removal for the high curie demonstration CSSX facility
- Dispose of high curie salt waste by removing cesium in a small scale demonstration CSSX processing facility
- Tailor follow-on high curie salt waste processing capability depending on the success of early low curie salt disposal.

Successful implementation of the Low Curie and Actinide Removal Process initiatives will reduce the quantity of re-dissolved saltcake needing to be processed through the future Salt Waste Processing Facility (SWPF) and support the closure of old type high level waste tanks.

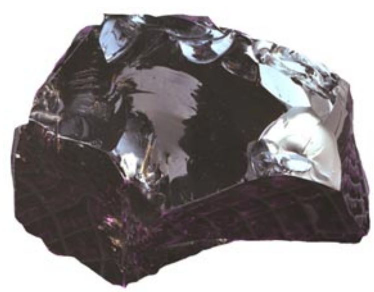
Sludge Processing: To produce "Washed Sludge"

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.

9.4 Final Processing

DWPF Vitrification

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.



Sample of Vitrified Radioactive Glass

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 filled over 1200 canisters. The 38 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 FY27.

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 FY40.

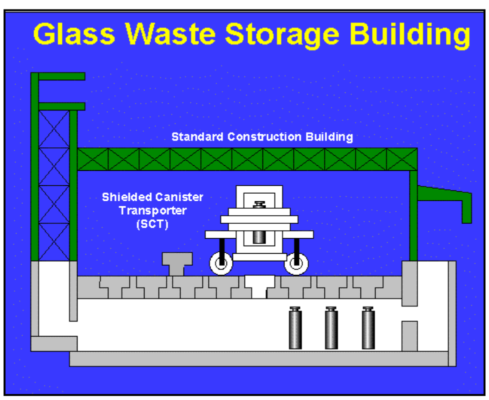


Diagram of Glass Waste Storage Building

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

Appendix A - Acronyms

2000-1	DNFSB Recommendation 2000-1, *Prioritization for Stabilizing Nuclear Materials and the HLW* (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*
AB	Authorization Basis
ADMP	Advanced Design Mixer Pump
Am-Cm	Americium and Curium
AOP	Annual Operating Plan
ARP	Actinide Removal Process
BAR	Bases, Assumptions, and Requirements
Btu	British Thermal Unit
CE/GPP	Capital Equipment/General Plant Projects (small capital funded projects)
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
Ci	Curies
Ci/gal	Curies per gallon
CFR	Code of Federal Regulation
CLSM	Controlled Low Strength Material
CPES	Chemical Process Evaluation System
CST	Crystalline Silicotitanate
CSSX	Caustic Side Solvent Extraction
CTS	Concentrate Transfer System
DB	Diversion Box (*e.g.* HDB-8 – H Area Diversion Box #8)
DCSW	Duke, Cogema, Stone & Webster
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DOE-HQ	DOE – Headquarters
DOE-MD	DOE – Material Disposition
DOE-SR	DOE – Savannah River
DSA	Documented Safety Analysis
DWPF	Defense Waste Processing Facility
DWTT	Decon Waste Treatment Tank
EA	Environmental Assessment
EBR	Experimental Breeder Reactor
EIR	External Independent Reviews
EIS	Environmental Impact Statement
EM	Environmental Restoration and Waste Management, usually as a prefix to a DOE office (e.g. EM-50)
EPA	Environmental Protection Agency
ESP	Extended Sludge Processing
ETF	Effluent Treatment Facility
FESV	Failed Equipment Storage Vault (DWPF)
FFA	Federal Facility Agreement
FTF	F-Area Tank Farm
FIU	Florida International University
FY	Fiscal Year (October through September)
FYTD	Fiscal Year To Date
gal	Gallons
GWSB	Glass Waste Storage Building
HAW	High Activity Waste
HDB	H-Area Diversion Box
HEME	High Efficiency Mist Eliminator
HEPA	High Efficiency Particulate Air (a type of air filter)
HEU	Highly Enriched Uranium
HHW	High Heat Waste
HLW	High Level Waste
HLWD	High Level Waste Division
HM	H-Canyon Modified Purex Process
HTF	H-Area Tank Farm
HQ	Headquarters, usually as a suffix to DOE
hr	Hour
HVAC	Heating, Ventilation, & Air Conditioning
IAL	Interarea Line
IMNM	Interim Management of Nuclear Materials
INPO	Institute of Nuclear Power Operators
ITP	In-Tank Precipitation
ITT	ITT Industries, Inc.
kg	Kilograms = 1,000 grams
kgal	Kilo-gallons = 1,000 gallons
LANL	Los Alamos National Laboratory
LAP	Low Assay Plutonium
LAW	Low Activity Waste
lb	Pound
LHW	Low Heat Waste
LLW	Low Level Waste
LMI	Logistics Management Institute, Inc.
LRWHF	Liquid Radioactive Waste Handling Facility
LPPP	low point pump pit
MD	Material Disposition
Mgal	Mega-gallons = 1,000,000 gallons
MOX	Mixed Oxide (Fuel)
MFFF	Mixed Oxide Fuel Fabrication Facility
MST	Monosodium Titanate
NEPA	National Environmental Policy Act
NETL	National Energy Technology Laboratory
NMMD	Nuclear Materials Management Division
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
OGCT	Off-Gas Condensate Tank (DWPF)
ORNL	Oak Ridge National Laboratory

Appendix A - Acronyms

PCCS	Product Composition Control System
PCO	Process Controls of Operation
PCRN	Procurement Change Request Notice
PHA	Precipitate Hydrolysis Aqueous
PIMS	Process Information Management System
PISA	Potential Inadequacy in Safety Analysis
PLC	Programmable Logic Controller
PMT	Plant Modification Traveler
PNNL	Pacific Northwest National Laboratory
PUREX	Plutonium Recovery and Extraction (process)
PVV	Process Vessel Vent
R&D	Research and Development
RBOF	Receiving Basin for Off-site Fuels
RCRA	Resource Conservation and Recovery Act
RCT	Recycle Collection Tank (DWPF)
RFSA	Rocky Flats Scrub Alloy
ROD	Record Of Decision
RWPC	Rolling Weather Protection Cover (Saltstone)
SAS	Steam Atomizer Scrubber
SAR	Safety Analysis Report
SB	Safety Basis
SCDHEC	South Carolina Department of Health and Environmental Control
SCT	Shielded Canister Transporter
SEE	Systems Engineering Evaluation
SEIS	Supplemental Environmental Impact Statement
SME	Slurry Mix Evaporator (DWPF)
SMECT	Slurry Mix Evaporator Condensate Tank (DWPF)
SMT1	Space Management Team No. 1
SMT2	Space Management Team No. 2
SNA	Snake River Alliance
SpaceMan II™	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
SSC	Systems, Structures, and Components
S&T	DOE's Office of Science & Technology
STP	Site Treatment Plan
SWPF	Salt Waste Processing Facility
TFA	Tanks Focus Area
TFVA	Tank Farm Vulnerability Assessment
Tk	Tank
TPB	Tetraphenylborate
TSR	Technical Safety Requirement
TTJ	Telescoping Transfer Jets
UT	Ultrasonic Testing
VHS	Vulnerability Handling Strategies
WAC	Waste Acceptance Criteria
WCS	Waste Characterization System
WIPP	Waste Isolation Pilot Plan
WIR	Waste Incidental to Reprocessing
WM	Water Management
WPT	Waste Pre-Treatment
WRP&S	Waste Removal Plan and Schedule
WSRC	Westinghouse Savannah River Company
yr	Year

Appendix B – Glossary

General

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.

Bulk Waste Removal
The process of removing sludge and salt waste from a storage tank using slurry mixer pumps for agitation and centrifugal pumps for transfer. This process typically removes 99% of the original waste volume from the tank.

High Risk
High risk tanks are identified having the following traits: no full secondary containment, inadequate leak detection, resides near in or in the water table, and contains large volumes of high activity radioactive waste.

HLW
Interchangeably used with *high level radioactive waste*. High level waste 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.

Hot Standby
Under the context of the Plan, a condition in which the facility is fully manned with a trained workforce ready to resume production immediately

Liquidus Temperature
Liquidus temperature is defined as the highest temperature at which the melted frit is in equilibrium with the primary crystalline phase. This property provides a measure of the nominal melt temperature to use to avoid the effects of crystallization in the melt pool.

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

Non-compliant Tank
A tank that does not have full secondary containment.

Old Style Tanks
Types I, II, and IV tanks which are Tanks 1-24.

Plan, the
Current revision of the HLW System Plan

Appendix B – Glossary

Salt and Sludge

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

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

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.

A single tank can contain sludge, supernate and salt cake, although an effort is made to segregate the sludge and salt by tank.

Salt Processing

Salt processing is performed by any of the following methods:

- Low cesium activity salt waste disposed at Saltstone
- Actinides are removed from the supernate as a sludge and sent to DWPF. The low cesium activity fraction is disposed at Saltstone.
- High cesium salt waste is separated out of solution and sent to DWPF

Salt Bound

A condition for an evaporator system where the receipt tank is filled with saltcake to a point that prevents operation.

Stop Leak

Is a compound that is added to a tank cooling system to temporarily seal leaks.

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

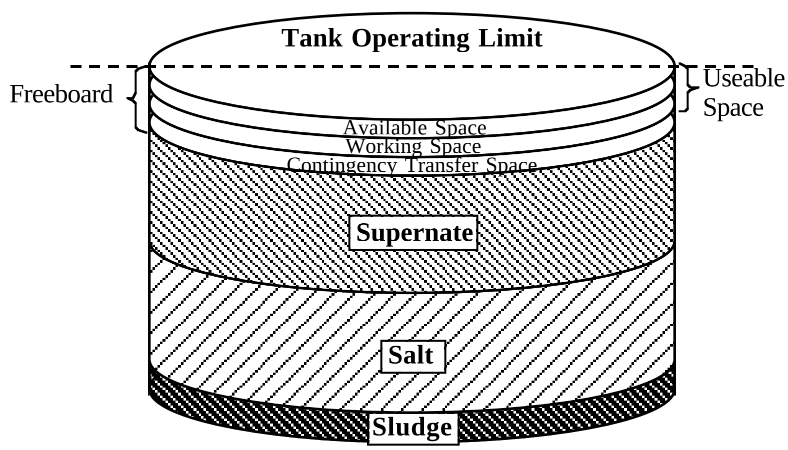
The minimum amount of freeboard required for normal tank farm operations, including waste receipts and evaporator operations. The amount of working space is determined by engineering estimates and operating experience. Working space is currently set at 200 kgals per evaporator system and 100 kgals per 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).



Appendix C - HLW 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.

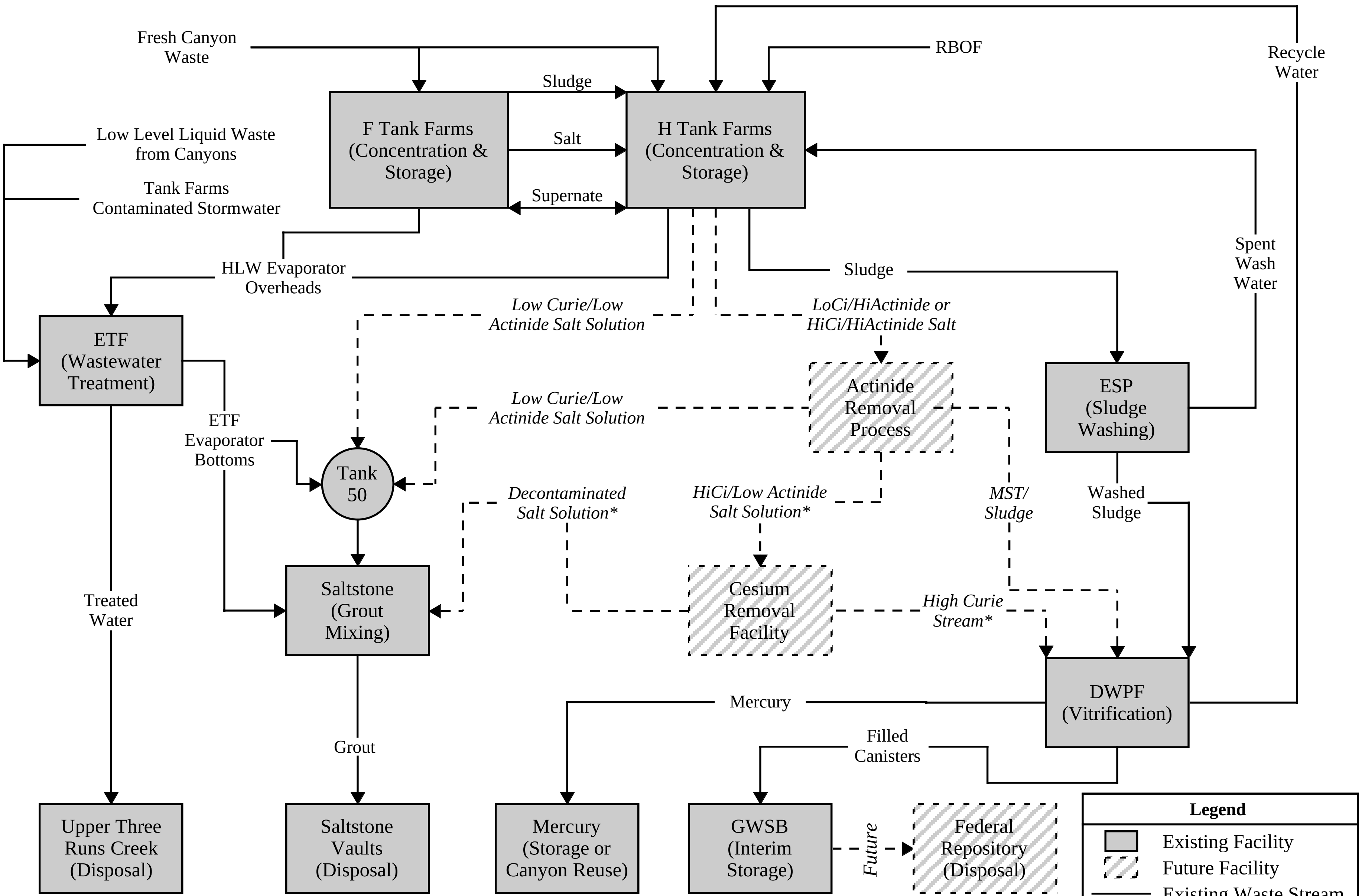
Appendix D - HLW System Scope

The High Level Waste System, as categorized in the FY03 Outyear Budget, is shown below. The major scope involved is shown within each PBS. The Effluent Treatment Facility and the Saltstone Facility are included because of the supporting roles they play for the HLW System. The groupings have changed slightly since Revision 12 of the system plan reflecting minor changes in some projects.

- 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*
- 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
  - *Low Curie*
  - *Actinide Removal Process*
  - *Salt Processing*
- SR-FA24: High Level Waste Facility Disposition

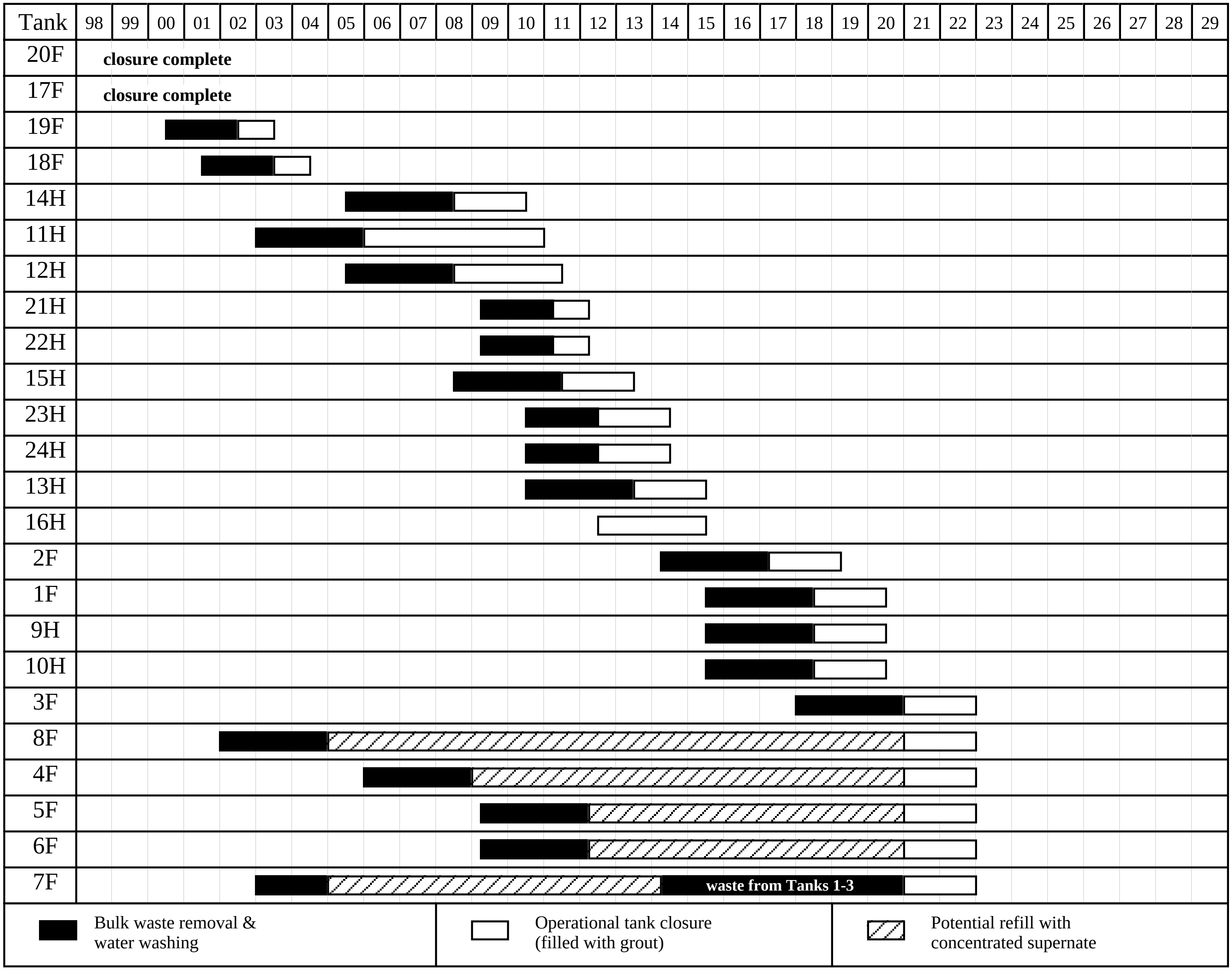
The inter-relationships of these facilities and projects are shown in Appendix E, Simplified HLW Flowsheet Diagram.

Appendix E - Simplified HLW System Flowsheet (Caustic Side Solvent Extraction)

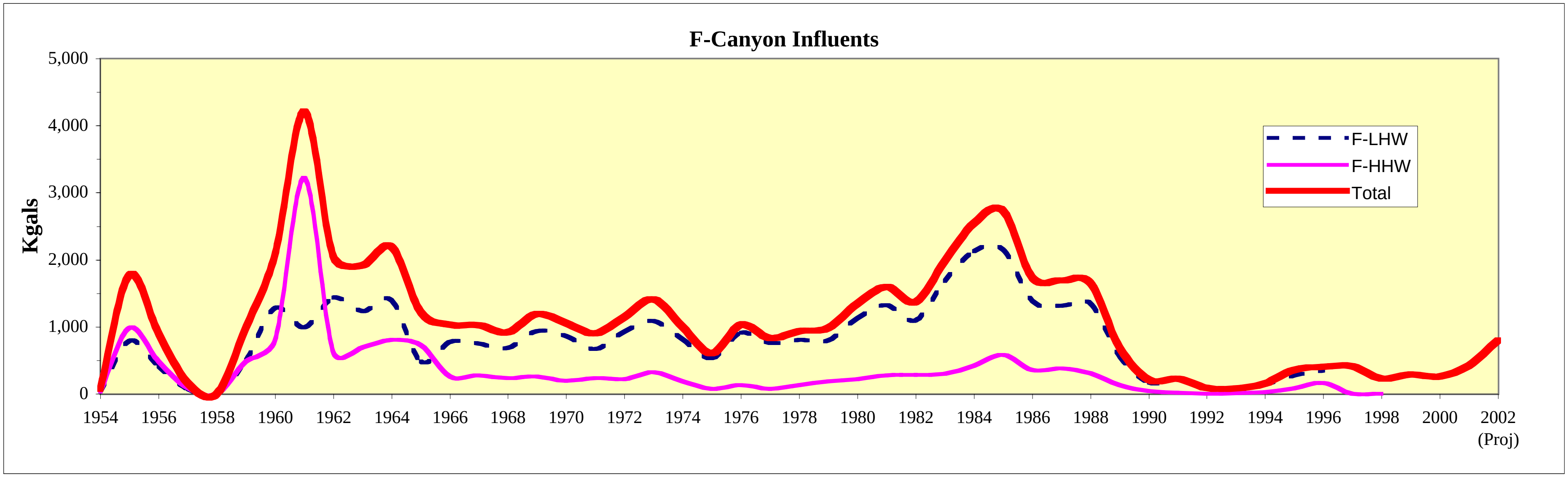


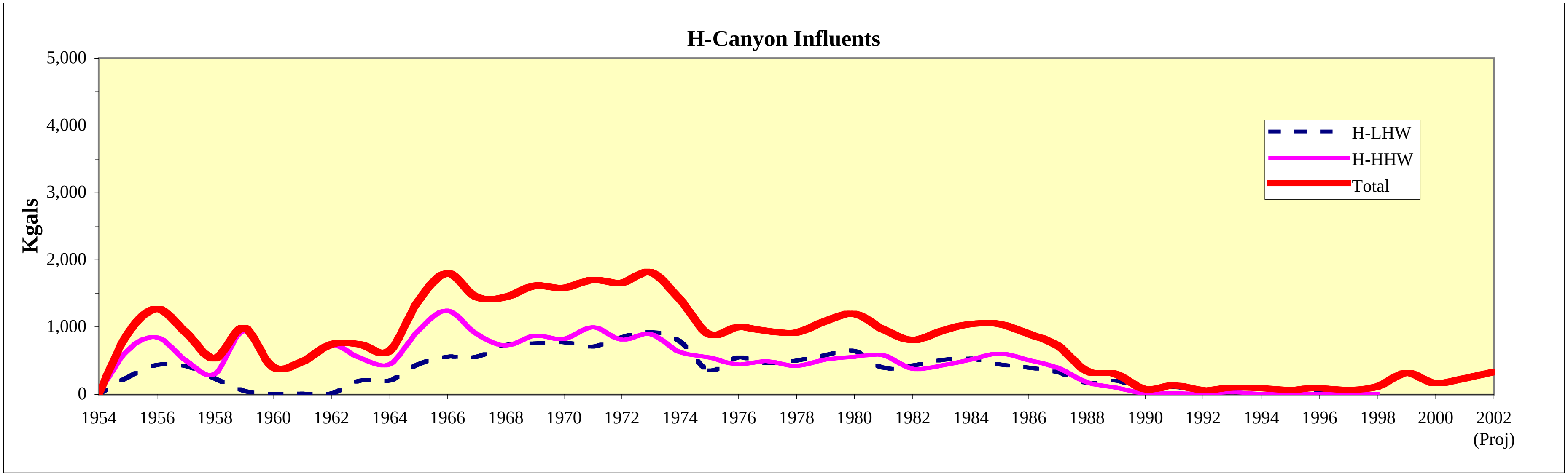
* These streams are based on the Caustic Side Solvent Extraction Salt Removal Process

Appendix F - Approved FFA Waste Removal Plan & Schedule

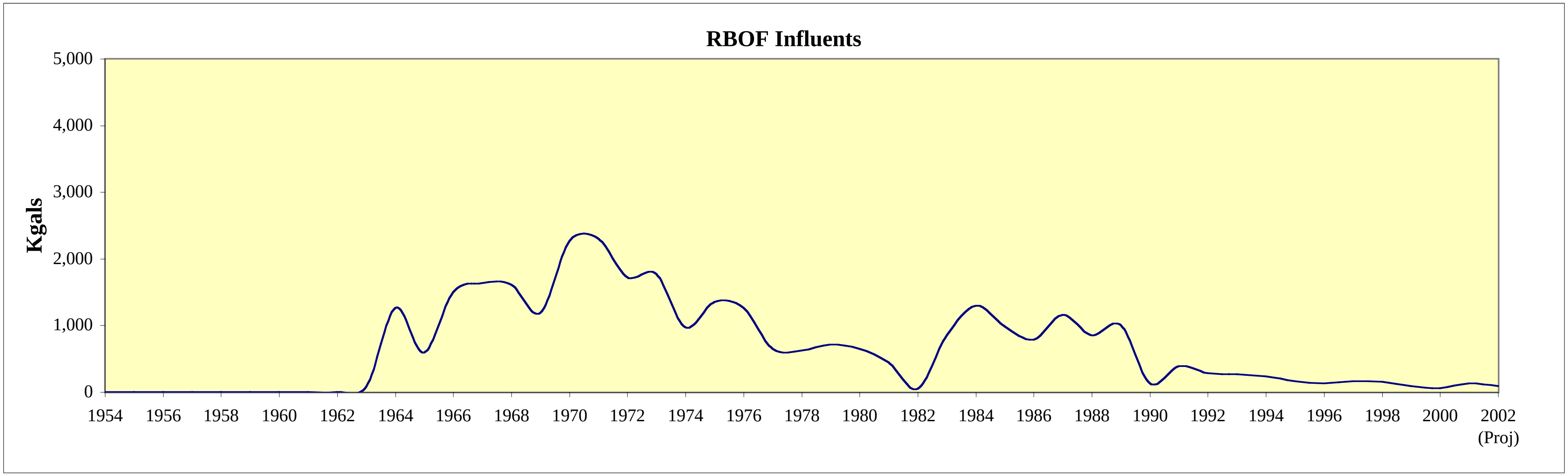


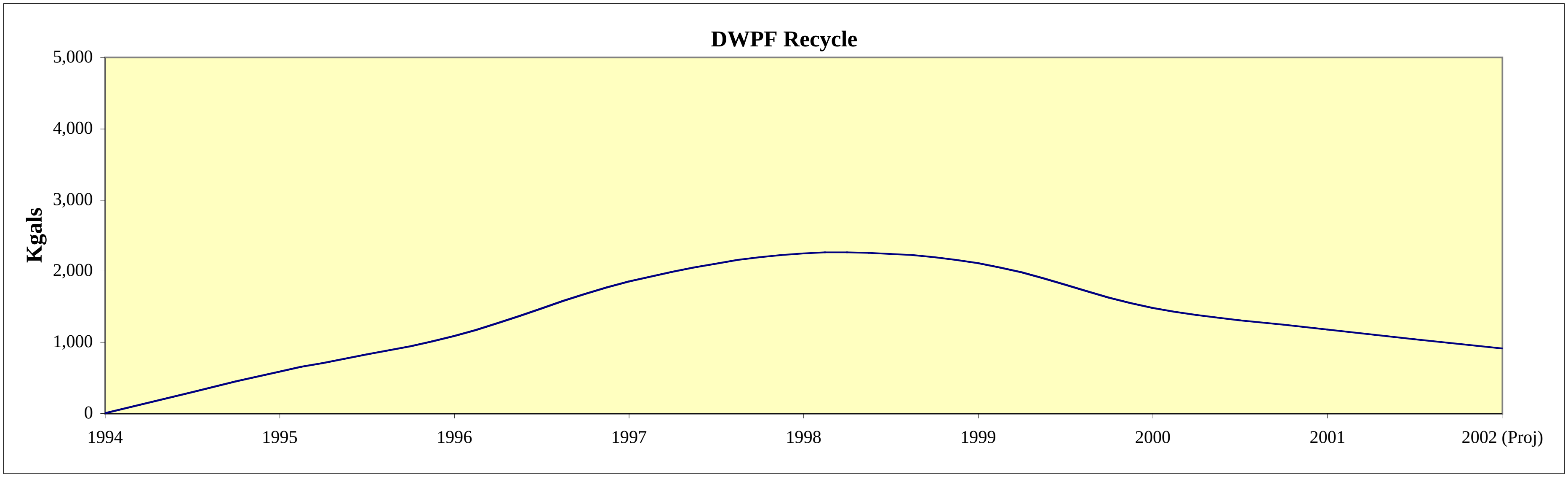
Appendix G - Historical Tank Farm Influents and Effluents



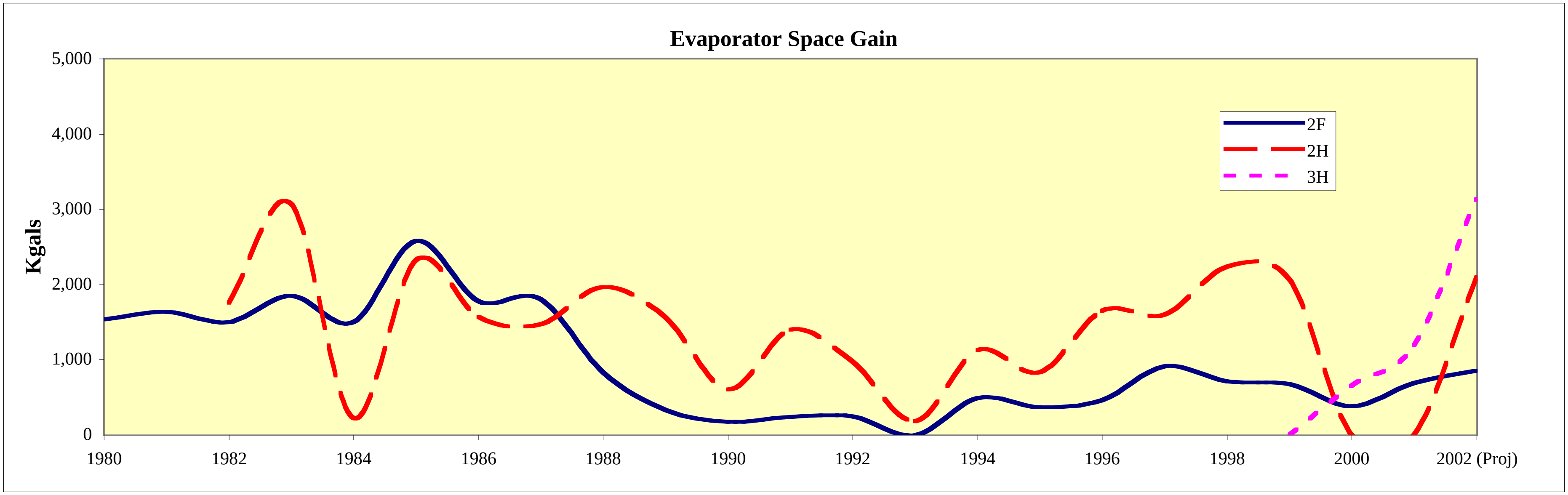


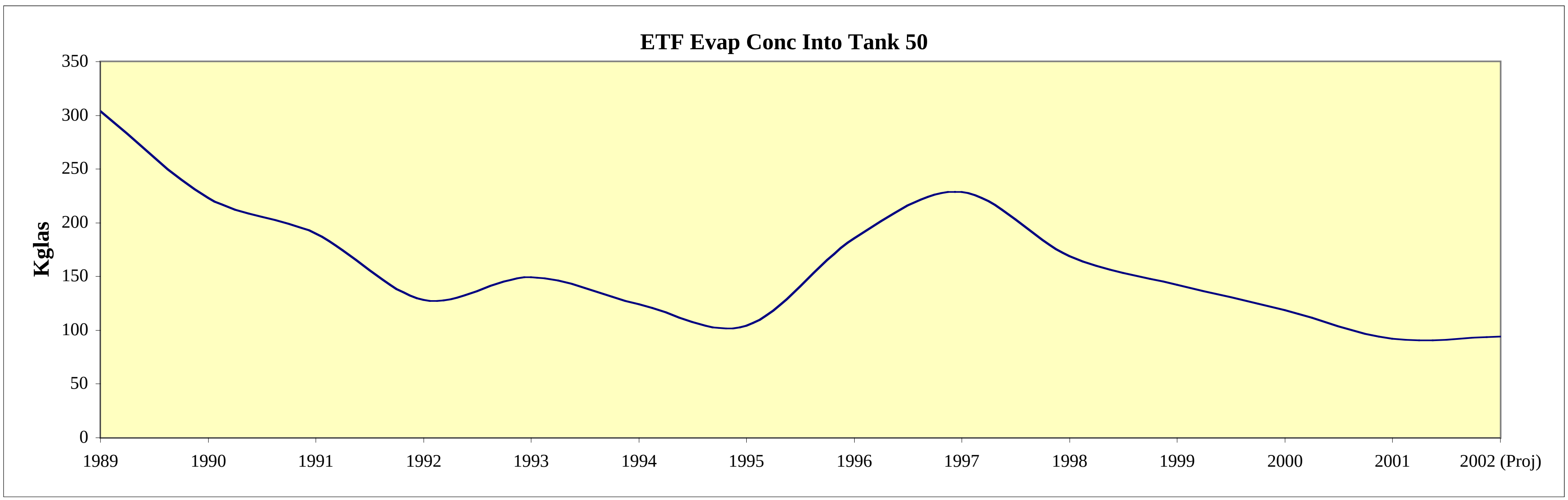
Appendix G - Historical Tank Farm Influents and Effluents





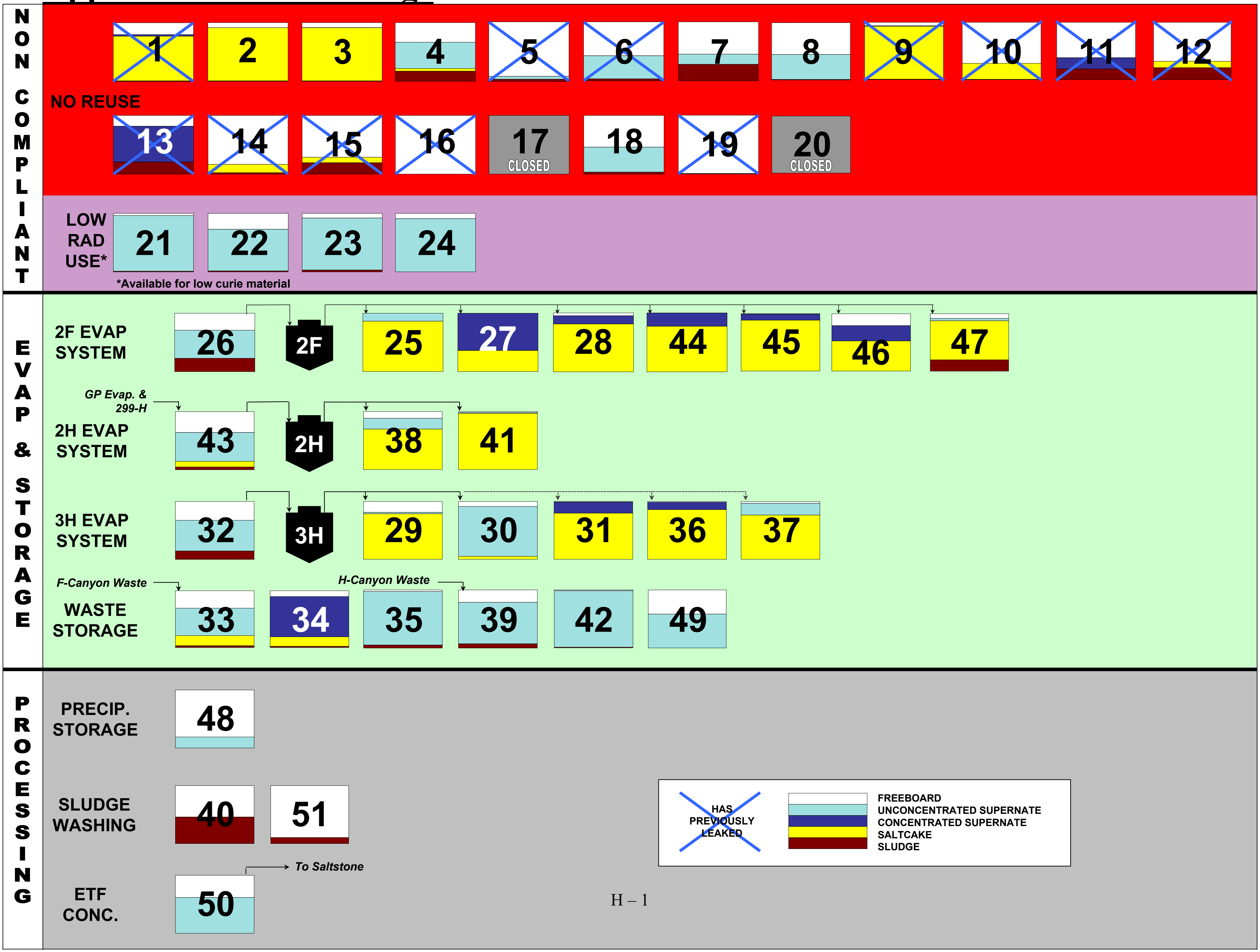
Appendix G - Historical Tank Farm Influents and Effluents





Appendix H – Tank Usage

Data Date: 1/1/02



Appendix I – Case 1

The scope and funding levels in Appendix I support **Case 1.** The Salt Disposition assumptions for Case 1 are considered to be the most pessimistic of the three cases due to the later start of the SWPF and the lack of success in any alternative salt processing. As shown in the charts above, the results of modeling reveal that of the three cases, Case 1 —

1. Provides the slowest risk reduction for waste removal from "high risk" tanks
2. Provides the slowest total Tank Farm inventory reduction
3. Meets the Site Treatment Plan (STP) regulatory commitments to have waste removed from all waste tanks by 2028
4. Meets the final Federal Facility Agreement commitment of 2022, however, it fails to meet the individual tank closure schedule
5. Provides the least contingency of the 3 cases for meeting process commitments until the start of the SWPF. That is, Type III tank space is the lowest of the 3 cases at the date of SWPF startup

Key Milestone	**Rev 13 Case 1**
Total Number of Canisters Produced	6,041
DWPF Sludge Production (in average canisters per year)	
• FY01	227(Act)
• FY02	150
• FY03	210
• FY04	220
• FY05	150
• FY06	193
• FY07	Outage
• FY08	Outage
• FY09	Outage
• FY10	200
• FY11	200
• FY12	150
• FY13 to End of Sludge Processing	230
• Salt-only Cans at End of Program	0
Salt Processing Information	
• Low Curie and Actinide Success	No
• Years Processed	n/a
• Saltcake Processed	n/a
Date Salt Waste Processing Facility Becomes Operational	FY12
• % Operational Flowrate (100% equals 6 Mgal/yr at 6.44 [Na])	10%
Date Additional Salt Waste Processing Capacity provided	FY16
• % Additional Operational Flowrate (100% equals 6 Mgal/yr at 6.44 [Na])	100%
• Max Yearly % Operational Flowrate	110%
Salt Solution Processing Rate(Kgal/yr)	
• FY08	
• FY09	
• FY10	
• FY11	
• FY12	600
• FY13	600
• FY14	600
• FY15	600
• FY16 until end of program	6,600

Appendix I – Case 1

Key Milestone	Rev 13 Case 1
Key Risk Reduction Dates	
Date when all "high risk" tanks are emptied	FY18
Date when all "non-compliant" tanks are emptied	FY18
Date when all "non-compliant" Tanks are closed	FY20
Date by which salt processing is completed	FY27
Date by which sludge processing is completed	FY27
Regulatory Commitments	
Are all STP commitments met?	Yes
Are all FFA regulatory commitments met?	No
Canister Storage Locations	
• Make additional 450 GWSB #1 locations usable	By FY04
• Begin work on additional Canister Storage locations (GWSB #2)	Module #1 FY07
• Place GWSB #2 into Radioactive Operations	Module #1 FY10
Waste Removal	
• Tank 7 ready for sludge removal	Jul-02
• Tank 11 ready for sludge removal	Apr-08
• Tank 26 ready for sludge removal	May-10
Tank Closures	
• Complete closure of Tank 19	Apr-03
• Complete closure of Tank 18	Apr-04
• Complete closure of 5th Tank	FY10
• Complete closure of 6th Tank	FY10
• Complete closure of 7th Tank	FY10
• Complete closure of 24th Tank	FY20
Key Space Management Activities	
• Return Tank 48 for waste storage/ Salt Feed tank service	FY12
• Reuse Tank 49 for waste storage	Jul-01
• Reuse Tank 50 for waste storage	Jul-02
• Tank 37 modification completed for 3H Evaporator Drop Tank	Aug-02
• Tank 37 Salt Dissolution #2	Jan-04
• Tank 37 Salt Dissolution #3	Oct-06
• Tank 37 Salt Dissolution #4	Oct-13
• Tank 31 modification completed for 3H Evaporator Drop Tank	n/a
• Tank 27 modification completed for 2F Evaporator Drop Tank	Jul-04
• Tank 42 modification completed for 2H Evaporator Drop Tank	n/a
• Tank 41 modification completed for 2H Evaporator Drop Tank	Oct-06
Repository Activities	
• Start shipping canisters to the Federal Repository	FY10
• Complete shipping canisters to Federal Repository	FY39
Facility Deactivation Complete	FY40

Appendix I – Case 1

Appendix I Contents

This appendix provides the following data:

1. Funding Requirements
2. Waste Removal and Tank Closure Schedule
3. Volume Balance
4. Salt Processing Batch makeup
5. Sludge Batch makeup
6. Canister Storage requirements
7. Useable Type III Tank Space
8. Remaining Tank Inventory
9. Non-Compliant Tank Closures with respect to the FFA
10. Level 1 Schedule.

A comparison of the Useable Tank Space; Inventory of the amount of waste in Types I, II, III, and IV tanks; Evaporator Space Recovery; and Evaporator Feed is contained in Appendix L.

Appendix I.1 – Funding (Case1)

Budget Authority in Escalated Dollars

Project Title	Actuals FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
HL-01 H Tank Farm	99,993	90,510	92,920	98,518	99,679	101,032	103,760	106,562	109,439	110,811	113,803
HL-04 H Tank Farm East & Sludge Operations	50,622	56,256	62,539	66,053	69,666	67,629	69,455	71,330	73,256	75,234	77,265
HL-02 F Tank Farm	61,742	65,240	68,267	70,122	71,269	73,735	75,726	77,771	79,870	76,120	78,175
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	3,237	3,302	805	804	985	1,043	3,185	3,271	3,360	3,450	3,543
Am/Cm	208	16,253	7,984	-							
WR: Tank Closure	-	3,059	13,840	11,232	-	-	-	-	4,170	22,267	4,714
HL-03 Total	3,445	22,614	22,628	12,037	985	1,043	3,185	3,271	7,529	25,717	8,258
HL-12 LI: Waste Removal											
LI: WR from Tanks	18,869	28,714	23,181	17,403	14,350	5,388	18,390	21,016	52,967	65,699	57,367
LI: Vit Upgrades	3,376	-	-	-	7,891	7,368	15,391	15,807	16,234	29,176	19,262
LI: Piping, Evaps & Infrastructure	-	287	6,742	15,875	11,850	-	-	-	-	-	-
HL-12 Total	22,245	29,001	29,923	33,278	34,092	12,756	33,781	36,823	69,200	94,875	76,630
HL-11 LI: Tk Fm Services Upgrade II	8,120	9,636	-	0	(0)	-	(0)	0	(0)	0	(0)
HL-05 Vitrification	106,598	123,495	126,051	126,066	131,418	138,980	129,753	136,673	141,364	154,894	153,165
HL-06 Glass Waste Storage	504	584	1,926	1,965	1,353	689	11,060	43,842	46,020	9,228	2,093
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	18,847	3,090	2,822	1,505	1,548	1,587	1,630	1,674	1,719	13,924	38,851
Low Curie	-	4,535	567	-	-	-	-	-	-	-	-
Actinide	-	17,830	16,360	16,858	-	0	0	0	0	0	0
LI: Salt Alternative	-	-	-	-	-	14,000	14,000	82,500	100,500	119,000	129,000
HL-13 Total	18,847	25,455	19,749	18,363	1,548	15,587	15,630	84,174	102,219	132,924	167,851
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**372,116**	**422,793**	**424,003**	**426,402**	**410,009**	**411,451**	**442,351**	**560,446**	**628,898**	**679,802**	**677,239**
HLW w/o Salt Total	**353,269**	**397,338**	**404,254**	**408,039**	**408,461**	**395,864**	**426,721**	**476,272**	**526,679**	**546,878**	**509,388**
Solid Waste Facilities											
ETF	14,631	14,261	17,596	18,145	19,889	20,877	22,724	21,804	22,393	22,998	23,619
SS	2,466	6,608	3,004	3,073	3,191	3,319	3,409	3,501	3,596	3,693	3,792
SW TOTAL	**17,097**	**20,870**	**20,600**	**21,218**	**23,080**	**24,196**	**26,133**	**25,306**	**25,989**	**26,691**	**27,411**
Life Cycle Cost	**389,213**	**443,662**	**444,603**	**447,620**	**433,089**	**435,647**	**468,484**	**585,752**	**654,887**	**706,493**	**704,651**

Appendix I.1 – Funding (Case1)

Budget Authority in Escalated Dollars

Project Title	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
HL-01 H Tank Farm	115,207	118,317	120,632	123,889	127,234	116,649	119,798	103,241	97,573	100,208	94,956
HL-04 H Tank Farm East & Sludge Operations	79,352	81,494	83,694	85,954	88,275	90,658	93,106	95,620	98,202	100,853	103,576
HL-02 F Tank Farm	80,285	82,453	82,919	84,254	85,600	86,351	88,683	77,131	71,767	71,969	70,217
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects Am/Cm	7,278	7,475	7,677	3,942	4,048	6,236	2,135	2,193	2,252	2,313	2,375
WR: Tank Closure	5,115	11,848	16,693	9,481	20,671	20,239	80,780	85,175	63,559	33,277	25,163
HL-03 Total	12,394	19,323	24,369	13,423	24,720	26,476	82,915	87,367	65,810	35,589	27,538
HL-12 LI: Waste Removal											
LI: WR from Tanks	53,927	49,370	60,680	64,595	97,139	77,888	90,280	72,507	64,147	85,387	71,572
LI: Vit Upgrades	13,188	20,317	20,865	21,429	14,671	15,068	-	-	-	-	-
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	67,115	69,686	81,545	86,024	111,811	92,956	90,280	72,507	64,147	85,387	71,572
HL-11 LI: Tk Fm Services Upgrade II	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0
HL-05 Vitrification	158,588	169,614	166,646	175,728	182,855	186,377	186,899	195,664	208,530	202,504	211,682
HL-06 Glass Waste Storage	2,149	2,483	2,550	2,619	2,690	2,762	2,837	2,914	2,992	3,073	3,156
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	53,200	54,636	87,636	154,754	192,183	197,372	202,701	208,174	213,794	219,567	225,495
Low Curie	-	-	-	-	-	-	-	-	-	-	-
Actinide	0	0	0	0	0	0	0	0	0	0	0
LI: Salt Alternative	84,000	150,000	385,000	440,000	165,000	-	-	-	-	-	-
HL-13 Total	137,200	204,636	472,636	594,754	357,183	197,372	202,701	208,174	213,794	219,567	225,495
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**652,291**	**748,007**	**1,034,992**	**1,166,645**	**980,366**	**799,601**	**867,219**	**842,617**	**822,816**	**819,150**	**808,192**
HLW w/o Salt Total	**515,091**	**543,371**	**562,356**	**571,891**	**623,184**	**602,229**	**664,518**	**634,443**	**609,022**	**599,584**	**582,697**
Solid Waste Facilities											
ETF	24,256	24,911	25,584	26,275	26,984	27,713	28,461	29,229	30,019	30,829	31,662
SS	6,611	8,597	12,618	54,039	41,618	58,132	52,325	58,815	45,634	47,534	60,862
SW TOTAL	**30,868**	**33,508**	**38,202**	**80,314**	**68,602**	**85,845**	**80,786**	**88,045**	**75,652**	**78,363**	**92,524**
Life Cycle Cost	**683,159**	**781,516**	**1,073,195**	**1,246,959**	**1,048,968**	**885,445**	**948,005**	**930,662**	**898,468**	**897,514**	**900,716**

Appendix I.1 – Funding (Case1)

Budget Authority in Escalated Dollars

Project Title	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33
HL-01 H Tank Farm	95,690	63,963	32,845	-	-	-	-	-	-	-	-
HL-04 H Tank Farm East & Sludge Operations	106,373	109,245	110,264	111,258	74,519	-	-	-	-	-	-
HL-02 F Tank Farm	68,452	70,300	48,373	-	-	-	-	-	-	-	-
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects Am/Cm	2,439	2,505	2,573	-	-	-	-	-	-	-	-
WR: Tank Closure	15,686	27,409	51,638	44,630	88,910	135,609	61,315	19,477	-	-	-
HL-03 Total	18,125	29,914	54,211	44,630	88,910	135,609	61,315	-	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	80,593	43,287	17,084	24,563	32,495	11,164	-	-	-	-	-
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	-	-
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	80,593	43,287	17,084	24,563	32,495	11,164	-	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	(0)	0	(0)	0	(0)	0	(0)	-	-	-	-
HL-05 Vitrification	220,098	218,595	229,611	236,108	216,922	-	-	-	-	-	-
HL-06 Glass Waste Storage	3,241	3,329	3,419	3,511	3,606	3,703	3,381	3,472	3,566	3,662	3,761
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	231,583	237,836	244,258	250,853	257,626	-	-	-	-	-	-
Low Curie	-	-	-	-	-	-	-	-	-	-	-
Actinide	0	0	0	0	0	0	0	0	-	-	-
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	-	-
HL-13 Total	231,583	237,836	244,258	250,853	257,626	0	0	-	-	-	-
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	290,375	413,093	-	-	-	-	-
HLW TOTAL	**824,155**	**776,469**	**740,064**	**670,923**	**964,452**	**563,570**	**64,695**	**3,472**	**3,566**	**3,662**	**3,761**
HLW w/o Salt Total	**592,571**	**538,633**	**495,806**	**420,070**	**706,826**	**563,570**	**64,695**	**3,472**	**3,566**	**3,662**	**3,761**
Solid Waste Facilities											
ETF	32,516	33,394	34,296	17,611	13,565	10,448	-	-	-	-	-
SS	48,702	61,596	48,815	45,140	13,817	1,563	-	-	-	-	-
SW TOTAL	**81,218**	**94,990**	**83,111**	**62,751**	**27,382**	**12,012**	**-**	**-**	**-**	**-**	**-**
Life Cycle Cost	**905,373**	**871,459**	**823,175**	**733,674**	**991,834**	**575,581**	**64,695**	**3,472**	**3,566**	**3,662**	**3,761**

Appendix I.1 – Funding (Case1)

Budget Authority in Escalated Dollars

Project Title	FY34	FY35	FY36	FY37	FY38	FY39	FY40	Cumulative FY02-FY40
HL-01 H Tank Farm	-	-	-	-	-	-	-	2,457,236
HL-04 H Tank Farm East & Sludge Operations	-	-	-	-	-	-	-	2,201,127
HL-02 F Tank Farm	-	-	-	-	-	-	-	1,805,049
HL-03 Waste Removal & Tank Closures								
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	79,189
Am/Cm								24,237
WR: Tank Closure	-	-	-	-	-	-	-	875,956
HL-03 Total	-	-	-	-	-	-	-	959,905
HL-12 LI: Waste Removal								
LI: WR from Tanks	-	-	-	-	-	-	-	1,301,154
LI: Vit Upgrades	-	-	-	-	-	-	-	216,668
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	34,754
HL-12 Total	-	-	-	-	-	-	-	1,552,576
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	9,636
HL-05 Vitrification	-	-	-	-	-	-	-	4,528,278
HL-06 Glass Waste Storage	3,862	3,966	4,074	4,184	4,297	4,413	4,532	216,963
HL-13 Salt Disposition								
Salt Disposition Ops (inc ECP)	-	-	-	-	-	-	-	3,100,017
Low Curie	-	-	-	-	-	-	-	5,102
Actinide	-	-	-	-	-	-	-	51,048
LI: Salt Alternative	-	-	-	-	-	-	-	1,683,000
HL-13 Total	-	-	-	-	-	-	-	4,858,015
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	18,707	-	722,176
HLW TOTAL	**3,862**	**3,966**	**4,074**	**4,184**	**4,297**	**23,120**	**4,532**	**19,310,960**
HLW w/o Salt Total	**3,862**	**3,966**	**4,074**	**4,184**	**4,297**	**23,120**	**4,532**	**14,452,946**
Solid Waste Facilities								
ETF	-	-	-	-	-	-	-	666,692
SS	-	-	-	-	-	-	-	706,071
SW TOTAL	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,372,763**
Life Cycle Cost	**3,862**	**3,966**	**4,074**	**4,184**	**4,297**	**23,120**	**4,532**	**20,683,723**

Appendix I.1 – Funding (Case1)

Budget Authority in Constant FY01 Year Dollars

Project Title	Actuals FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
HL-01 H Tank Farm	99,993	87,197	86,241	88,174	86,030	84,087	84,087	84,087	84,087	82,903	82,903
HL-04 H Tank Farm East & Sludge Operations	50,622	54,196	58,044	59,118	60,127	56,286	56,286	56,286	56,286	56,286	56,286
HL-02 F Tank Farm	61,742	62,852	63,360	62,760	61,510	61,368	61,368	61,368	61,368	56,949	56,949
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	3,237	3,181	747	720	850	868	2,581	2,581	2,581	2,581	2,581
Am/Cm	208	15,658	7,410	-	-	-	-	-	-	-	-
WR: Tank Closure	-	2,947	12,845	10,053	-	-	-	-	3,204	16,659	3,434
HL-03 Total	3,445	21,786	21,002	10,773	850	868	2,581	2,581	5,785	19,240	6,016
HL-12 LI: Waste Removal											
LI: WR from Tanks	18,869	27,663	21,514	15,576	12,386	4,484	14,903	16,584	40,697	49,152	41,791
LI: Vit Upgrades	3,376	-	-	-	6,811	6,132	12,473	12,473	12,473	21,828	14,032
LI: Piping, Evaps & Infrastructure	-	276	6,258	14,208	10,227	-	-	-	-	-	-
HL-12 Total	22,245	27,939	27,772	29,784	29,424	10,617	27,376	29,057	53,170	70,980	55,823
HL-11 LI: Tk Fm Services Upgrade II	8,120	9,284	-	0	(0)	-	(0)	0	(0)	0	(0)
HL-05 Vitrification	106,598	118,974	116,991	112,830	113,424	115,670	105,152	107,848	108,616	115,884	111,577
HL-06 Glass Waste Storage	504	563	1,787	1,759	1,168	574	8,963	34,595	35,360	6,904	1,525
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	18,847	2,976	2,619	1,347	1,336	1,321	1,321	1,321	1,321	10,417	28,302
Low Curie	-	4,369	526	-	-	-	-	-	-	-	-
Actinide	-	17,177	15,184	15,088	-	0	0	0	0	0	0
LI: Salt Alternative	-	-	-	-	-	11,652	11,346	65,100	77,219	89,030	93,974
HL-13 Total	18,847	24,523	18,329	16,435	1,336	12,973	12,666	66,421	78,540	99,447	122,276
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**372,116**	**407,315**	**393,527**	**381,633**	**353,868**	**342,442**	**358,480**	**442,244**	**483,212**	**508,592**	**493,354**
HLW w/o Salt Total	**353,269**	**382,792**	**375,198**	**365,198**	**352,532**	**329,470**	**345,814**	**375,823**	**404,673**	**409,146**	**371,079**
Solid Waste Facilities											
ETF	14,631	13,739	16,332	16,240	17,166	17,375	18,416	17,206	17,206	17,206	17,206
SS	2,466	6,366	2,788	2,750	2,754	2,763	2,763	2,763	2,763	2,763	2,763
SW TOTAL	**17,097**	**20,106**	**19,120**	**18,990**	**19,919**	**20,138**	**21,178**	**19,968**	**19,968**	**19,968**	**19,968**
Life Cycle Cost	**389,213**	**427,420**	**412,646**	**400,623**	**373,788**	**362,580**	**379,659**	**462,213**	**503,181**	**528,561**	**513,323**

Appendix I.1 – Funding (Case1)

Budget Authority in Constant FY01 Year Dollars

Project Title	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
HL-01 H Tank Farm	81,719	81,719	81,127	81,127	81,127	72,423	72,423	60,772	55,926	55,926	51,602
HL-04 H Tank Farm East & Sludge Operations	56,286	56,286	56,286	56,286	56,286	56,286	56,286	56,286	56,286	56,286	56,286
HL-02 F Tank Farm	56,949	56,949	55,765	55,173	54,581	53,612	53,612	45,403	41,135	40,166	38,158
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	5,163	5,163	5,163	2,581	2,581	3,872	1,291	1,291	1,291	1,291	1,291
Am/Cm	-	-	-	-	-	-	-	-	-	-	-
WR: Tank Closure	3,629	8,183	11,226	6,209	13,180	12,566	48,835	50,138	36,430	18,572	13,674
HL-03 Total	8,791	13,346	16,389	8,790	15,762	16,438	50,125	51,428	37,721	19,862	14,965
HL-12 LI: Waste Removal											
LI: WR from Tanks	38,252	34,099	40,808	42,300	61,938	48,358	54,578	42,681	36,767	47,655	38,894
LI: Vit Upgrades	9,355	14,032	14,032	14,032	9,355	9,355	-	-	-	-	-
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	47,607	48,131	54,841	56,332	71,293	57,713	54,578	42,681	36,767	47,655	38,894
HL-11 LI: Tk Fm Services Upgrade II	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0
HL-05 Vitrification	112,491	117,149	112,073	115,073	116,593	115,714	112,988	115,176	119,523	113,017	115,034
HL-06 Glass Waste Storage	1,525	1,715	1,715	1,715	1,715	1,715	1,715	1,715	1,715	1,715	1,715
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	37,736	37,736	58,937	101,339	122,540	122,540	122,540	122,540	122,540	122,540	122,540
Low Curie	-	-	-	-	-	-	-	-	-	-	-
Actinide	0	0	0	0	0	0	0	0	0	0	0
LI: Salt Alternative	59,583	103,602	258,920	288,129	105,208	-	-	-	-	-	-
HL-13 Total	97,320	141,338	317,858	389,469	227,748	122,540	122,540	122,540	122,540	122,540	122,540
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**462,687**	**516,633**	**696,053**	**763,965**	**625,105**	**496,441**	**524,267**	**496,002**	**471,613**	**457,168**	**439,194**
HLW w/o Salt Total	**365,368**	**375,295**	**378,196**	**374,497**	**397,357**	**373,900**	**401,727**	**373,462**	**349,073**	**334,628**	**316,654**
Solid Waste Facilities											
ETF	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206
SS	4,690	5,938	8,486	35,387	26,537	36,092	31,633	34,621	26,156	26,529	33,074
SW TOTAL	**21,895**	**23,143**	**25,692**	**52,593**	**43,742**	**53,297**	**48,838**	**51,827**	**43,362**	**43,735**	**50,280**
Life Cycle Cost	**484,583**	**539,776**	**721,745**	**816,558**	**668,847**	**549,738**	**573,105**	**547,829**	**514,974**	**500,903**	**489,474**

Appendix I.1 – Funding (Case1)

Budget Authority in Constant FY01 Year Dollars

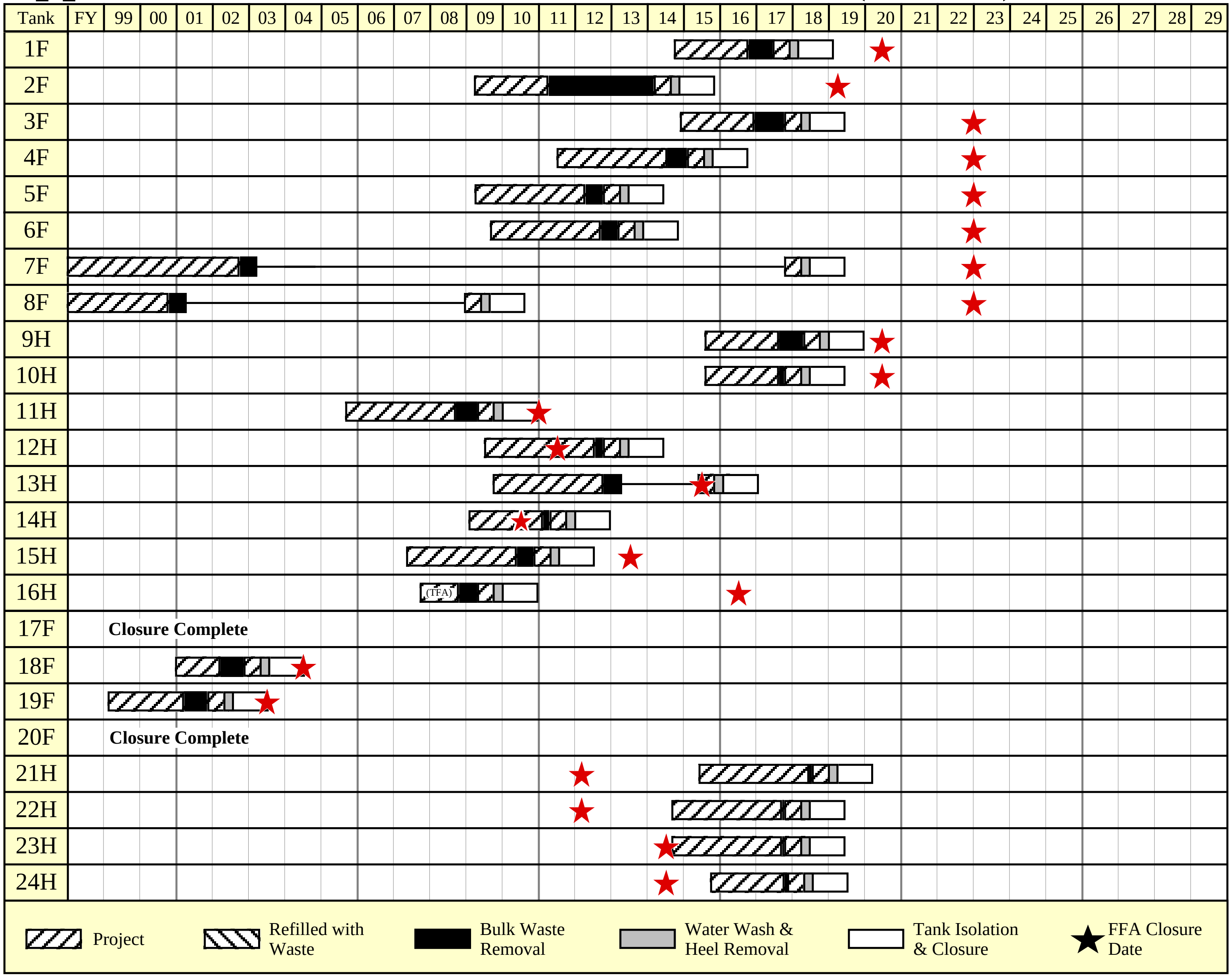
Project Title	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33
HL-01 H Tank Farm	50,633	32,956	16,478	-	-	-	-	-	-	-	-
HL-04 H Tank Farm East & Sludge Operations	56,286	56,286	55,318	54,349	35,445	-	-	-	-	-	-
HL-02 F Tank Farm	36,221	36,221	24,268	-	-	-	-	-	-	-	-
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	1,291	1,291	1,291	-	-	-	-	-	-	-	-
Am/Cm	-	-	-	-	-	-	-	-	-	-	-
WR: Tank Closure	8,300	14,122	25,906	21,802	42,290	62,807	27,651	8,553	-	-	-
HL-03 Total	9,591	15,413	27,197	21,802	42,290	62,807	27,651	8,553	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	42,645	22,303	8,571	11,999	15,456	5,171	-	-	-	-	-
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	-	-
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	42,645	22,303	8,571	11,999	15,456	5,171	-	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	(0)	0	(0)	0	(0)	0	(0)	-	-	-	-
HL-05 Vitrification	116,463	112,627	115,192	115,338	103,179	-	-	-	-	-	-
HL-06 Glass Waste Storage	1,715	1,715	1,715	1,715	1,715	1,715	1,525	1,525	1,525	1,525	1,525
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	122,540	122,540	122,540	122,540	122,540	-	-	-	-	-	-
Low Curie	-	-	-	-	-	-	-	-	-	-	-
Actinide	0	0	0	0	0	0	0	0	-	-	-
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	-	-
HL-13 Total	122,540	122,540	122,540	122,540	122,540	0	0	0	-	-	-
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	138,118	191,323	-	-	-	-	-
HLW TOTAL	**436,094**	**400,060**	**371,279**	**327,743**	**458,744**	**261,016**	**29,176**	**10,077**	**1,525**	**1,525**	**1,525**
HLW w/o Salt Total	**313,554**	**277,520**	**248,738**	**205,202**	**336,204**	**261,016**	**29,176**	**10,077**	**1,525**	**1,525**	**1,525**
Solid Waste Facilities											
ETF	17,206	17,206	17,206	8,603	6,452	4,839	-	-	-	-	-
SS	25,770	31,736	24,490	22,051	6,572	724	-	-	-	-	-
SW TOTAL	**42,976**	**48,942**	**41,695**	**30,654**	**13,024**	**5,563**	**-**	**-**	**-**	**-**	**-**
Life Cycle Cost	**479,070**	**449,002**	**412,974**	**358,396**	**471,768**	**266,579**	**29,176**	**10,077**	**1,525**	**1,525**	**1,525**

Appendix I.1 – Funding (Case1)

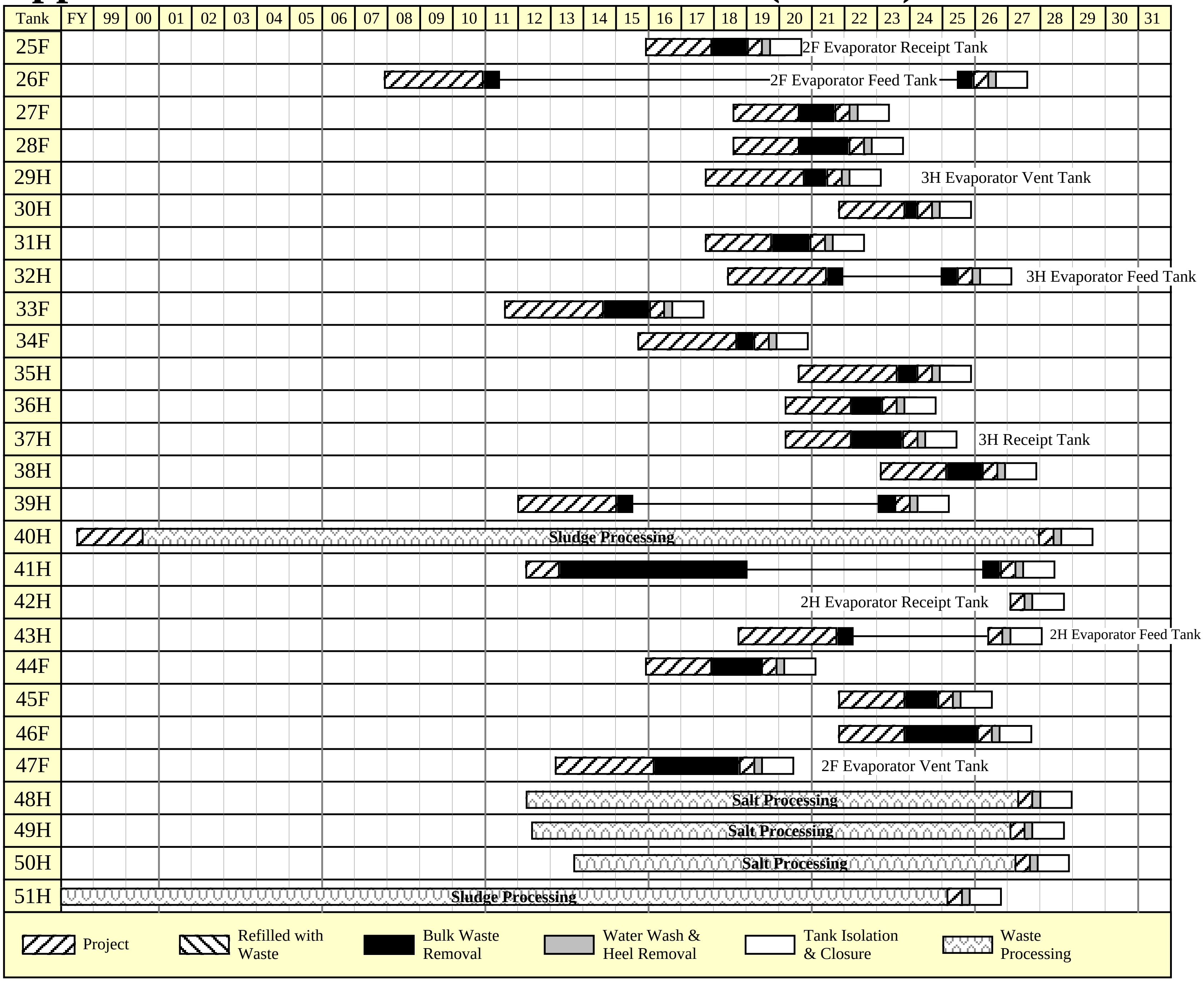
Budget Authority in Constant FY01 Year Dollars

Project Title	FY34	FY35	FY36	FY37	FY38	FY39	FY40	Cumulative FY02-FY40
HL-01 H Tank Farm	-	-	-	-	-	-	-	1,725,756
HL-04 H Tank Farm East & Sludge Operations	-	-	-	-	-	-	-	1,446,035
HL-02 F Tank Farm	-	-	-	-	-	-	-	1,258,063
HL-03 Waste Removal & Tank Closures								
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	54,121
Am/Cm	-	-	-	-	-	-	-	23,068
WR: Tank Closure	-	-	-	-	-	-	-	483,213
HL-03 Total	-	-	-	-	-	-	-	560,402
HL-12 LI: Waste Removal								
LI: WR from Tanks	-	-	-	-	-	-	-	837,224
LI: Vit Upgrades	-	-	-	-	-	-	-	156,384
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	30,970
HL-12 Total	-	-	-	-	-	-	-	1,024,577
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	9,284
HL-05 Vitrification	-	-	-	-	-	-	-	2,954,594
HL-06 Glass Waste Storage	1,525	1,525	1,525	1,525	1,525	1,525	1,525	140,458
HL-13 Salt Disposition								
Salt Disposition Ops (inc ECP)	-	-	-	-	-	-	-	1,758,514
Low Curie	-	-	-	-	-	-	-	4,895
Actinide	-	-	-	-	-	-	-	47,450
LI: Salt Alternative	-	-	-	-	-	-	-	1,163,763
HL-13 Total	-	-	-	-	-	-	-	2,993,469
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	6,463	-	335,904
HLW TOTAL	**1,525**	**1,525**	**1,525**	**1,525**	**1,525**	**7,988**	**1,525**	**12,448,540**
HLW w/o Salt Total	**1,525**	**1,525**	**1,525**	**1,525**	**1,525**	**7,988**	**1,525**	**9,455,072**
Solid Waste Facilities								
ETF	-	-	-	-	-	-	-	443,496
SS	-	-	-	-	-	-	-	414,185
SW TOTAL	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**857,681**
Life Cycle Cost	**1,525**	**1,525**	**1,525**	**1,525**	**1,525**	**7,988**	**1,525**	**13,306,221**

Appendix I.2 – Waste Removal Schedule (Case 1)



Appendix I.2 – Waste Removal Schedule (Case 1)



Appendix I.3 – Tank Farm Volume Balance (Case 1)

	Influents (gallons) (1)									Effluents (gallons) (1)								
										Space Recovery from Evaporation								
End of Fiscal Year	F-Canyon	H-Canyon	DWPF Recycle	299-H	RBOF	ETF (3)	Inhibited Water	Other	**Total In**	2F Evap	2H Evap	3H Evap	Salt Solution to Saltstone (4)	Salt Solution to Processing	Sludge to DWPF	Other	**Total Out**	**Total Inventory (gallons)**
FY01																	Beginning Volume	**38,630,957**
FY02 (2)	796,651	327,572	913,305	13,907	92,987	93,988	1,356,052	374,397	**3,968,859**	852,913	2,101,211	3,140,371	837,000	-	133,419	66,107	**7,131,021**	**35,468,796**
FY03	192,000	365,780	1,224,710	12,000	120,000	-	1,377,000	124,789	**3,416,279**	791,188	1,924,869	1,915,511	-	-	176,348	31,024	**4,838,939**	**34,046,136**
FY04	132,000	398,720	1,276,220	12,000	120,000	-	813,100	273,479	**3,025,519**	1,343,751	1,981,771	508,916	-	-	165,600	12,543	**4,012,581**	**33,059,074**
FY05	202,000	315,780	955,650	12,000	120,000	-	-	388,078	**1,993,508**	1,410,622	1,583,122	354,067	-	-	139,497	10,099	**3,497,406**	**31,555,176**
FY06	252,000	422,100	1,137,143	12,000	60,000	-	-	417,944	**2,301,187**	1,214,777	1,364,159	665,174	-	-	139,497	10,135	**3,393,741**	**30,462,622**
FY07	182,000	559,200	143,000	12,000	-	-	454,151	161,578	**1,511,928**	832,608	574,735	-	-	-	-	15,730	**1,423,072**	**30,551,478**
FY08	132,000	417,200	143,000	12,000	-	-	600,000	162,945	**1,467,145**	519,086	236,717	87,145	-	-	-	3,990	**846,937**	**31,171,686**
FY09	-	184,000	143,000	12,000	-	-	600,000	236,105	**1,175,105**	506,726	219,006	1,291,168	-	-	-	-	**2,016,901**	**30,329,890**
FY10	-	120,000	1,173,200	12,000	-	-	1,200,000	89,091	**2,594,291**	-	848,919	506,037	-	-	170,477	228,725	**1,754,157**	**31,170,024**
FY11	-	-	1,173,200	12,000	-	-	2,214,577	85,972	**3,485,749**	-	1,072,834	1,528,708	-	-	174,336	83,113	**2,858,991**	**31,796,782**
FY12	-	-	1,806,119	12,000	-	-	1,250,000	91,506	**3,159,625**	-	1,517,933	582,854	-	600,000	263,093	195,208	**3,159,087**	**31,797,320**
FY13	-	-	2,231,079	12,000	-	-	2,393,252	48,549	**4,684,880**	-	1,759,434	1,738,545	-	600,000	249,767	72,026	**4,419,772**	**32,062,428**
FY14	-	-	2,231,079	12,000	-	-	1,818,383	137,150	**4,198,611**	-	1,853,157	558,892	-	600,000	135,166	241,042	**3,388,257**	**32,872,782**
FY15	-	-	2,231,079	12,000	-	-	5,198,012	344,044	**7,785,135**	-	1,045,414	1,964,138	-	6,595,425	135,166	153,149	**9,893,291**	**30,764,626**
FY16	-	-	2,231,079	12,000	-	-	3,796,934	398,548	**6,438,560**	-	2,682,802	906,546	-	6,600,000	144,877	77,851	**10,412,076**	**26,791,110**
FY17	-	-	2,231,079	12,000	-	-	5,176,599	322,483	**7,742,161**	-	3,314,554	-	-	6,600,000	150,990	91,714	**10,157,257**	**24,376,014**
FY18	-	-	2,231,079	12,000	-	-	6,152,669	370,678	**8,766,426**	-	2,766,780	1,052,090	-	6,600,000	150,990	420,064	**10,989,924**	**22,152,516**
FY19	-	-	2,231,079	12,000	-	-	4,247,480	445,573	**6,936,132**	-	2,302,630	1,618,357	-	6,600,000	157,877	87,862	**10,766,726**	**18,321,922**
FY20	-	-	2,231,079	12,000	-	-	5,215,722	415,450	**7,874,251**	-	2,303,154	29,426	-	6,600,000	187,720	61,074	**9,181,375**	**17,014,798**
FY21	-	-	2,231,079	12,000	-	-	4,930,808	505,106	**7,678,993**	-	1,415,234	-	-	6,600,000	187,720	142,846	**8,345,800**	**16,347,991**
FY22	-	-	2,231,079	12,000	-	-	5,913,987	248,169	**8,405,235**	-	2,326,326	-	-	6,600,000	186,508	100,812	**9,213,645**	**15,539,581**
FY23	-	-	2,231,079	12,000	-	-	2,131,547	544,628	**4,919,254**	-	2,392,922	-	-	6,600,000	168,318	15,625	**9,176,865**	**11,281,970**
FY24	-	-	2,231,079	12,000	-	-	5,403,931	684,008	**8,331,018**	-	2,328,455	-	-	6,600,000	161,304	66,197	**9,155,956**	**10,457,032**
FY25	-	-	2,189,575	12,000	-	-	2,248,808	496,121	**4,946,505**	-	2,274,721	-	-	6,600,000	215,032	50,649	**9,140,401**	**6,263,136**
FY26	-	-	-	-	-	-	1,721,219	163,181	**1,884,400**	-	-	-	-	6,600,000	229,367	7,055	**6,836,422**	**1,311,113**
FY27	-	-	-	-	-	-	-	0	**0**	-	-	-	-	1,065,549	191,139	0	**1,256,688**	**54,425**

Notes:

1) Discussion of the components of the Influents and Effluents is contained in Section 5.1.3 “HLW System Material Balance”
2) FY02 includes actual values obtained from “HLW Morning Reports” for the time period between 10/1/2001 and 1/7/2002.
3) ETF evaporator effluents are assumed to be sent directly to Saltstone after FY02 and are not included in this tabulation.
4) Salt solution to Saltstone values do not include filtrate generated from the Salt Waste Processing Facility

Appendix I.4 – Salt Solution Processing (Case 1)

End of Fiscal Year	Total Salt Solution from Tank Farms (kgal)	Salt Solution processed via Low Curie and Actinide Removal (kgal)	Salt Solution processed via Salt Waste Processing Facility (kgal)	Feed Stream to Saltstone (kgal)	ETF to Saltstone (kgal)	Grout Produced (kgal)	Vault Number
FY02					837	1,481	4
FY03	0	0	0	0	180	319	4
FY04	0	0	0	0	180	319	4
FY05	0	0	0	0	180	319	4
FY06	0	0	0	0	180	319	4
FY07	0	0	0	0	180	319	4
FY08	0	0	0	0	180	319	4
FY09	0	0	0	0	180	319	4
FY10	0	0	0	0	180	319	4
FY11	0	0	0	0	180	319	4
FY12	600	0	600	768	180	1,678	4
FY13	600	0	600	768	180	1,678	4
FY14	600	0	600	768	180	1,678	1
FY15	6,595	0	6,595	8,747	180	15,801	2
FY16	6,600	0	6,600	8,753	180	15,812	3
FY17	6,600	0	6,600	8,753	180	15,812	5
FY18	6,600	0	6,600	8,753	180	15,812	7
FY19	6,600	0	6,600	8,753	180	15,812	8
FY20	6,600	0	6,600	8,753	180	15,812	10
FY21	6,600	0	6,600	8,753	180	15,812	11
FY22	6,600	0	6,600	8,753	180	15,812	13
FY23	6,600	0	6,600	8,753	180	15,812	14
FY24	6,600	0	6,600	8,753	180	15,812	16
FY25	6,600	0	6,600	8,753	180	15,812	17
FY26	6,600	0	6,600	8,753	180	15,812	19
FY27	1,066	0	1,066	1,388	180	2,775	19
FY28	0	0	0	0		0	19
Total	**82,061**	**0**	**82,061**	**108,727**	**5,337**	**201,894**	**19**

Notes:

1 FY02 ETF to Saltstone represents the recovery of Tank 50 (Saltstone Feed Tank) for use as a Salt Processing Tank by transfering the entire contents to the Saltstone Facility.

2 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.

3 Each gallon of feed, when added to the cement, flyash, and slag makes 1.77 gallons of grout. Each cell is estimated to contain 1,814 kgal of grout. Therefore each cell holds 1,025 kgal of feed solution.

Appendix I.5 – Sludge Processing (Case 1)

	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	495	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	726	2.96	12/1/01	51	25.0
	Total	**420,861**										(Included use of ~70 cans of Tank 51 heel)				
2	8	175,883			1,374	6.24	0.30	16.0	600	600	12/15/01	470	2.49	6/11/04	40	27.5
	40	261,867								-140	(Assumes DWPF outage in 4thQ FY02)					
	Total	**437,750**								460						
3	7 (70%)	291,587	4/18/03	14	1,684	6.22	0.07	16.0	473	473	6/11/04	409	2.30	9/29/06	51	28.8
	18 (70%)	16,076														
	Total	**307,663**														
4	7 (30%)	124,966	9/6/08	13	1,210	8.86	1.70	16.0	426	426	10/1/09	386	1.93	9/5/11	40	31.3
	11	124,380														
	18 (30%)	6,889														
	Total	**256,235**														
5	15	165,818	3/14/10	18	2,231	10.91	1.45	16.0	665	665	9/5/11	470	2.40	1/29/14	51	33.0
	26	154,896									(Assume coupled salt and sludge feed starts in April 2010)					
	Total	**320,714**														
6	5	57,630	8/7/12	18	3,096	7.55	2.20	16.0	450	450	1/29/14	546	2.37	6/13/16	40	35.1
	6	38,708														
	12	189,715														
	13 (30%)	125,268														
	Total	**411,321**														
7	13 (70%)	292,293	12/21/14	18	3,801	7.28	1.67	16.0	699	699	6/13/16	810	3.52	12/21/19	51	32.5
	4	65,477														
	33 (60%)	106,290														
	39 (40%)	42,522														
	Total	**506,582**														
8	21	6,393	6/29/18	18	2,925	7.14	0.94	16.0	726	726	12/21/19	641	2.79	10/3/22	40	34.8
	22	13,265														
	23	59,110														
	33 (40%)	70,860														
	34	77,119														
	39 (60%)	63,783														
	47	137,763														
	Total	**428,293**														

Appendix I.5 – Sludge Processing (Case 1)

	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 %)
9	32	214,886	5/11/21	17	2,688	8.80	3.92	16.0	502	472	10/3/22	441	1.92	9/2/24	51	35.2
	43	114,393														
	Total	**329,279**														
10	ESP Heels (Tks 40,42,51)	158,377	5/11/23	16	1,123	10.86	4.27	16.0	462	462	9/2/24	647	2.81	6/26/27	40	40.0
	35	138,956														
	Other Insoluble Solids	219,000														
	Total	**516,333**														
Totals		**3,935,031**			**20,132**	**Total Estimated Washwater**						**6,041**	**Total Estimated Cans**			

Notes:

General: Above based on the following yearly canister production values: FY02 150 cans/yr, FY03 210 cans/yr, FY04 220 cans/yr, FY05 150 cans/yr, FY06 193 cans/yr, FY07-FY09 0 cans/yr, FY10 200 cans/yr, FY11 200 cans/yr, FY12 150 cans/yr, FY13-End 230 cans/yr.

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

B) Sludge in these tanks will comprise the batch. Note: 100% of the sludge from Tanks 7 and 18 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 SpaceMan II results. This is the sludge volume plus no more than 18" of free supernate. If less supernate is shown in the model, then the total feed tank volume is reported.

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 1B and estimated for remaining batches.

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 (Case 1)

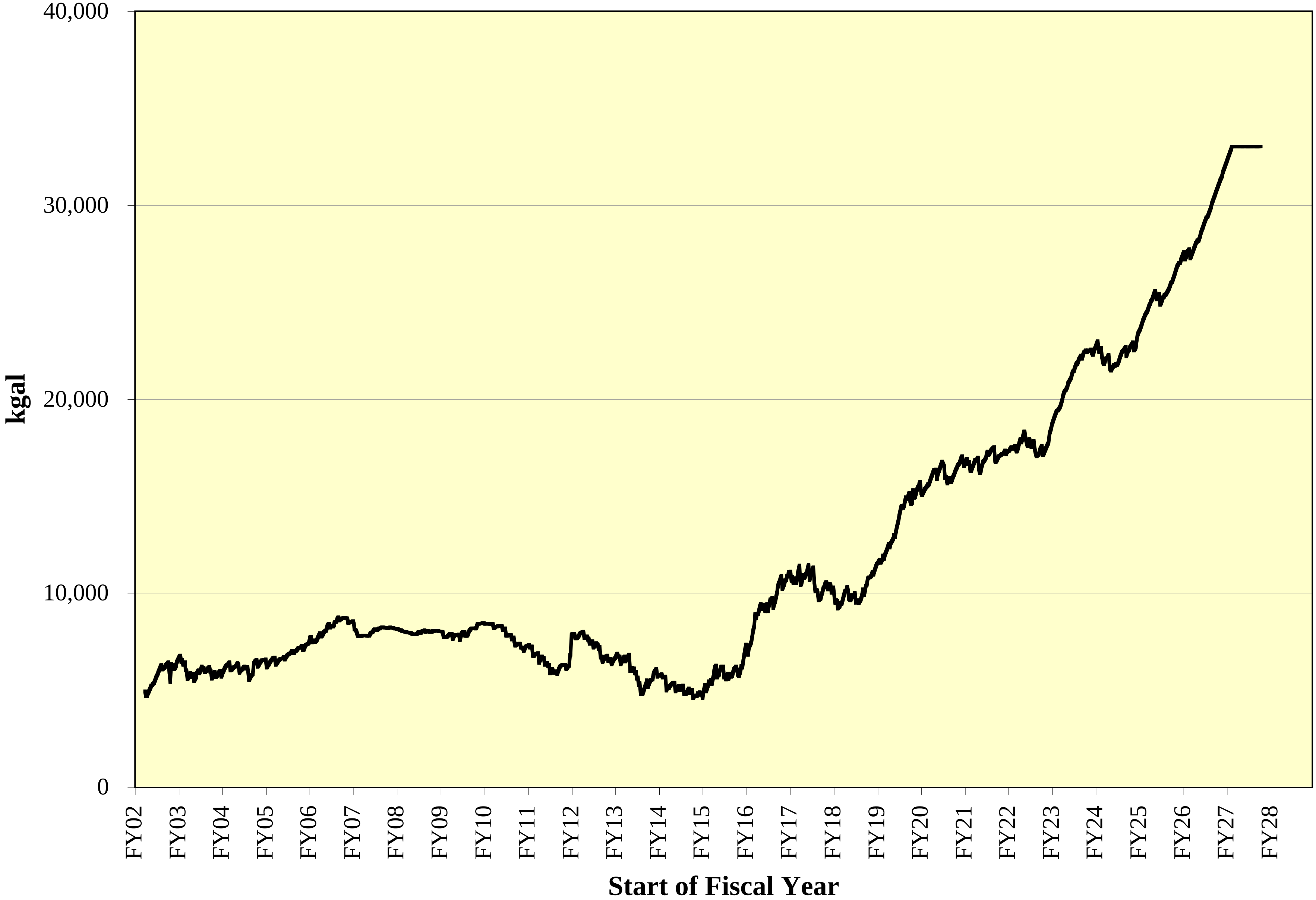
End of FY	SRS Cans Produced		SRS Cans in GWSB #1 (2,159 max)			SRS Cans in Modular Storage (1 building @ 585)			SRS Cans Shipped to Repository		Net Cans Stored At SRS
	Yearly	Cum.	Added	Shipped	Cum.	Added	Shipped	Cum.	Each Year	Cumulative	
1996	64	64	64		64						64
1997	169	233	169		233						233
1998	250	483	250		483						483
1999	236	719	236		719						719
2000	231	950	231		950						950
2001	227	1,177	227		1,177						1,177
2002	150	1,327	150		1,327						1,327
2003	210	1,537	210		1,537						1,537
2004	220	1,757	220		1,757						1,757
2005	150	1,907	150		1,907	0		0			1,907
2006	193	2,100	193		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	200	2,300	164	(105)	2,159	36		36	105	105	2,195
2011	200	2,500	0	(205)	1,954	200	0	236	205	310	2,190
2012	150	2,650	0	(205)	1,749	150	0	386	205	515	2,135
2013	230	2,880	31	(205)	1,575	199	0	585	205	720	2,160
2014	230	3,110	230	(205)	1,600	0	0	585	205	925	2,185
2015	230	3,340	230	(205)	1,625	0	0	585	205	1,130	2,210
2016	230	3,570	230	(205)	1,650	0	0	585	205	1,335	2,235
2017	230	3,800	230	(205)	1,675	0	0	585	205	1,540	2,260
2018	230	4,030	230	(205)	1,700	0	0	585	205	1,745	2,285
2019	230	4,260	230	(205)	1,725	0	0	585	205	1,950	2,310
2020	230	4,490	230	(205)	1,750	0	0	585	205	2,155	2,335
2021	230	4,720	230	(205)	1,775	0	0	585	205	2,360	2,360
2022	230	4,950	230	(205)	1,800	0	0	585	205	2,565	2,385
2023	230	5,180	230	(205)	1,825	0	0	585	205	2,770	2,410
2024	230	5,410	230	(205)	1,850	0	0	585	205	2,975	2,435
2025	230	5,640	230	(205)	1,875	0	0	585	205	3,180	2,460
2026	230	5,870	230	0	2,105	0	(205)	380	205	3,385	2,485
2027	171	6,041	4	0	2,109	167	(205)	342	205	3,590	2,451
2028	0	6,041		0	2,109	0	(205)	137	205	3,795	2,246
2029	0	6,041		(68)	2,041	0	(137)	0	205	4,000	2,041
2030	0	6,041		(205)	1,836	0	0	0	205	4,205	1,836
2031	0	6,041		(205)	1,631	0	0	0	205	4,410	1,631
2032	0	6,041		(205)	1,426	0	0	0	205	4,615	1,426
2033	0	6,041		(205)	1,221	0	0	0	205	4,820	1,221
2034	0	6,041		(205)	1,016	0	0	0	205	5,025	1,016
2035	0	6,041		(205)	811	0	0	0	205	5,230	811
2036	0	6,041		(205)	606	0	0	0	205	5,435	606
2037	0	6,041		(205)	401	0	0	0	205	5,640	401
2038	0	6,041		(205)	196	0	0	0	205	5,845	196
2039	0	6,041		(196)	0	0	0	0	196	6,041	0
2040	0	6,041			0		0	0	0	6,041	

Appendix I.6 - Canister Storage (Case 1)

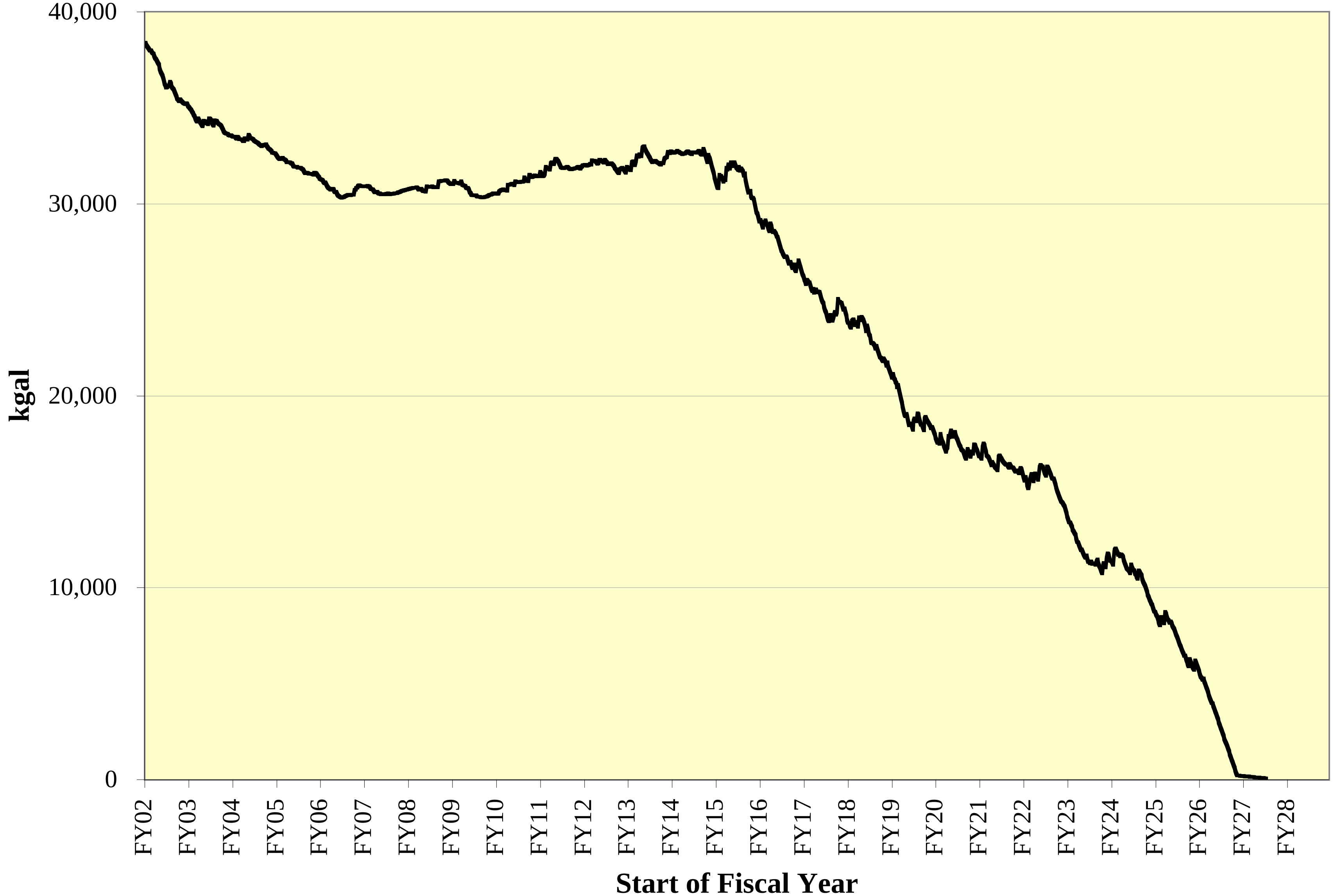
Notes:

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 modularized buildings. The first building, GWSB #2A, will be needed in FY10. 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) The Plan does not include additional locations in GWSB #2A for spent fuels materials. The addition of these materials could require additional buildings.

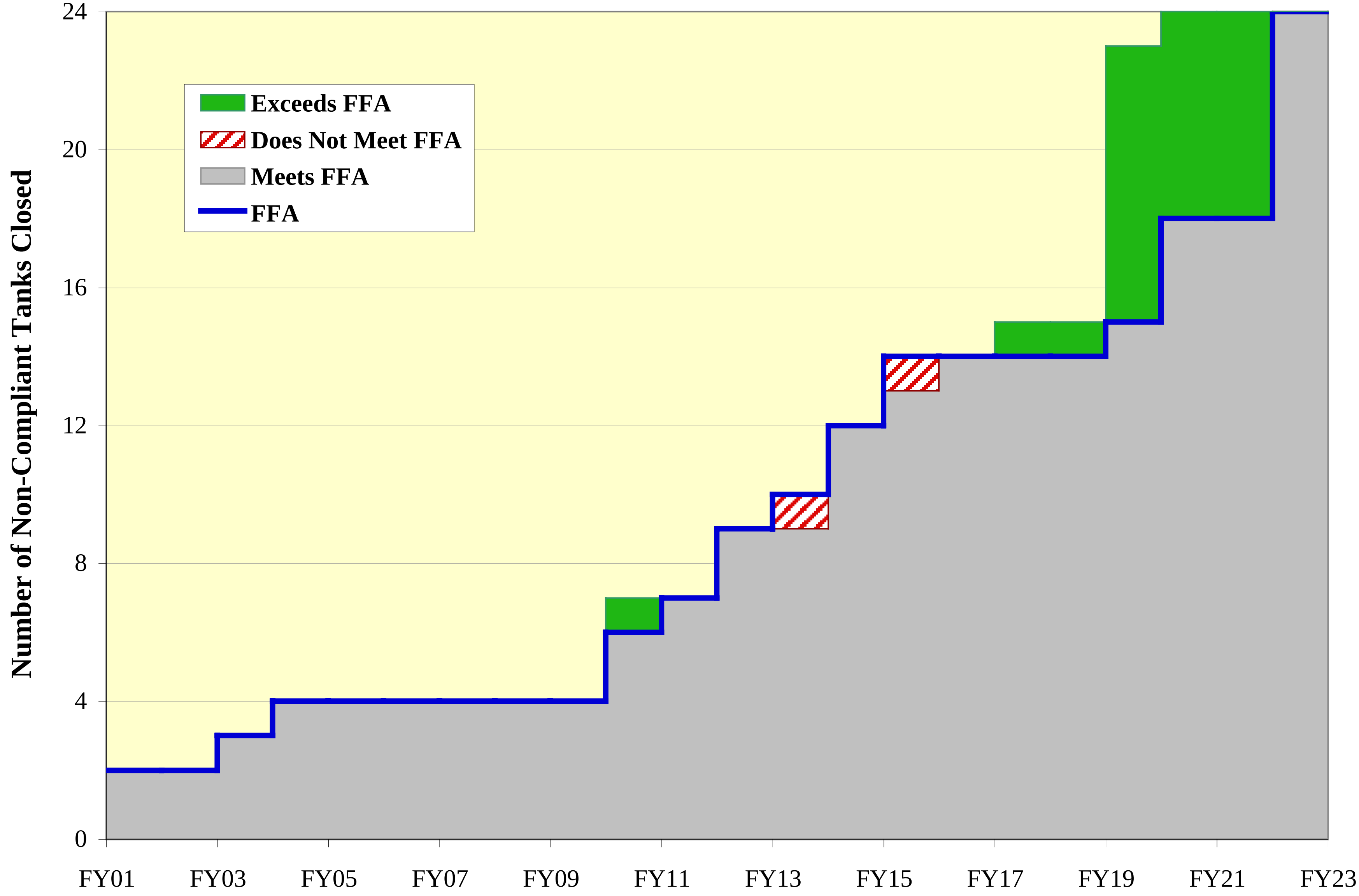
Appendix I.7 – Useable Type III Tank Space (Case 1)



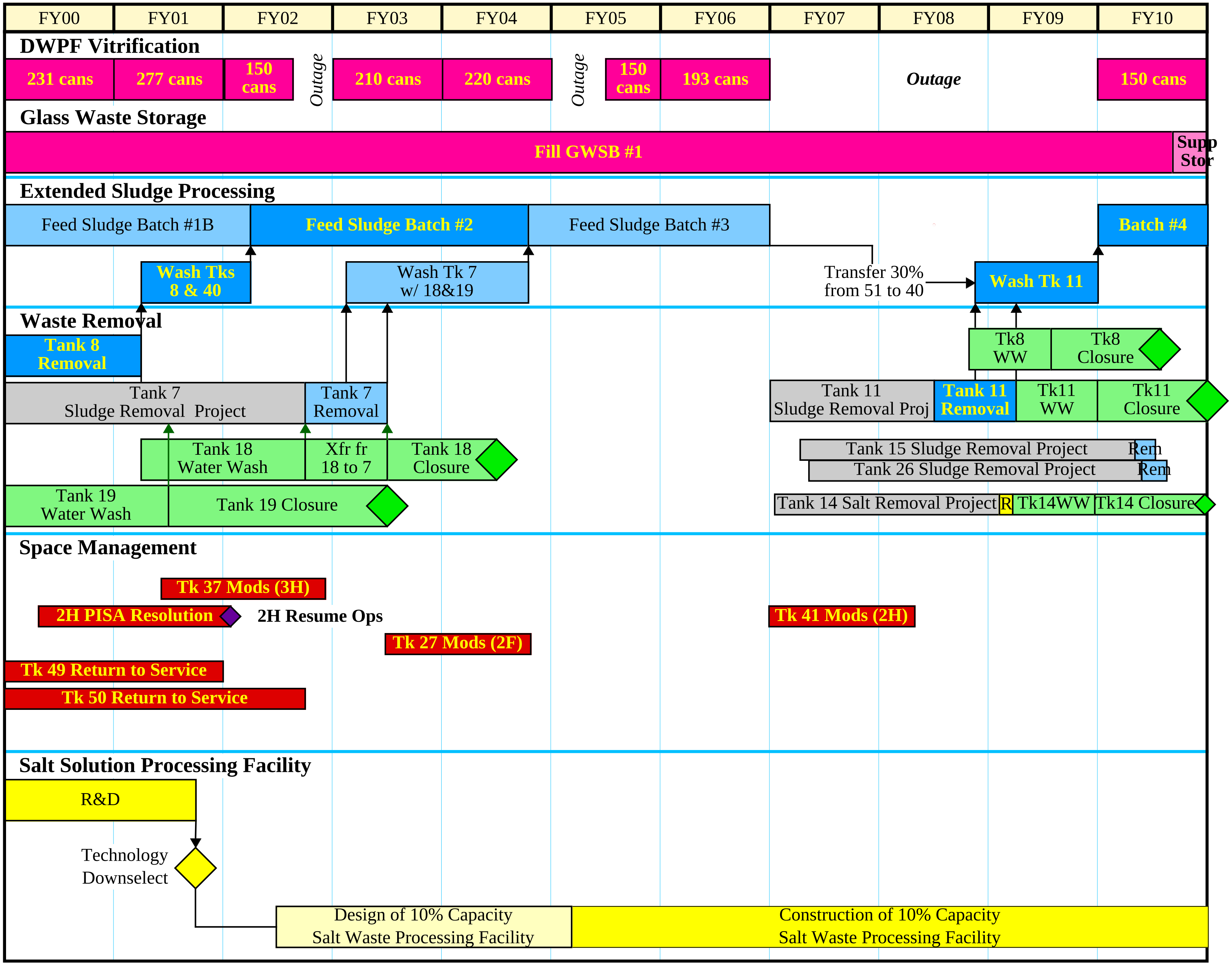
Appendix I.8 – Remaining Tank Inventory (Case 1)



Appendix I.9 – Tank Closures (Case 1)



Appendix I.10 – Level 1 Schedule (Case 1)



Appendix J – Case 2

The scope and funding levels in Appendix J support **Case 2.** The Salt Disposition assumptions for Case 2 are considered moderately optimistic due to the improved start of the SWPF and some assumed success in alternative salt processing. As shown in the charts above, the results of modeling revealed that of the three cases, Case 2 —

1. Provides improvement in risk reduction for waste removal from "high risk" tanks as compared to Case 1
2. Provides improvement in Tank Farm inventory reduction as compared to Case 1
3. Meets the Site Treatment Plan (STP) regulatory commitments to have waste removed from all waste tanks by 2028
4. Meets the final Federal Facility Agreement commitment of 2022, however, it fails to meet the individual tank closure schedule
5. Provides improved contingency over Case 1 for meeting process commitments until the start of the SWPF. That is, more Type III tank space is forecast at the date of SWPF startup

Key Milestone	Rev 13 Case 2
Total Number of Canisters Produced	6,041
DWPF Sludge Production (in average canisters per year)	
• FY01	227(Act)
• FY02	150
• FY03	210
• FY04	220
• FY05	150
• FY06	193
• FY07	Outage
• FY08	Outage
• FY09	Outage
• FY10	150
• FY11	230
• FY12	230
• FY13 to End of Sludge Processing	230
• Salt-only Cans at End of Program	0
Salt Processing Information	
• Low Curie and Actinide Success	Yes
• Years Processed	FY03-05
• Saltcake Processed	1.5 Mgal
Date Salt Waste Processing Facility Becomes Operational	FY10
• % Operational Flowrate (100% equals 6 Mgal/yr at 6.44 [Na])	15%
Date Additional Salt Waste Processing Capacity provided	FY15
• % Additional Operational Flowrate (100% equals 6 Mgal/yr at 6.44 [Na])	80%
• Max Yearly % Operational Flowrate	95%
Salt Solution Processing Rate(Kgal/yr)	
• FY08	
• FY09	
• FY10	900
• FY11	900
• FY12	900
• FY13	900
• FY14	900
• FY15	5,700
• FY16 until end of program	5,700

Appendix J – Case 2

Key Milestone	Rev 13 Case 2
Key Risk Reduction Dates	
Date when all "high risk" tanks are emptied	FY15
Date when all "non-compliant" tanks are emptied	FY18
Date when all "non-compliant" Tanks are closed	FY20
Date by which salt processing is completed	FY27
Date by which sludge processing is completed	FY27
Regulatory Commitments	
Are all STP commitments met?	Yes
Are all FFA regulatory commitments met?	No
Canister Storage Locations	
• Make additional 450 GWSB #1 locations usable	By FY04
• Begin work on additional Canister Storage locations (GWSB #2)	Module #1 FY08
• Place GWSB #2 into Radioactive Operations	Module #1 FY11
Waste Removal	
• Tank 7 ready for sludge removal	Jul-02
• Tank 11 ready for sludge removal	Apr-08
• Tank 26 ready for sludge removal	May-10
Tank Closures	
• Complete closure of Tank 19	Apr-03
• Complete closure of Tank 18	Apr-04
• Complete closure of 5th Tank	FY10
• Complete closure of 6th Tank	FY10
• Complete closure of 7th Tank	FY10
• Complete closure of 24th Tank	FY20
Key Space Management Activities	
• Return Tank 48 for waste storage/ Salt Feed tank service	FY06
• Reuse Tank 49 for waste storage	Jul-01
• Reuse Tank 50 for waste storage	Jul-02
• Tank 37 modification completed for 3H Evaporator Drop Tank	Aug-02
• Tank 37 Salt Dissolution #2	Jan-04
• Tank 37 Salt Dissolution #3	Oct-06
• Tank 37 Salt Dissolution #4	n/a
• Tank 31 modification completed for 3H Evaporator Drop Tank	n/a
• Tank 27 modification completed for 2F Evaporator Drop Tank	Jul-04
• Tank 42 modification completed for 2H Evaporator Drop Tank	n/a
• Tank 41 modification completed for 2H Evaporator Drop Tank	Oct-06
Repository Activities	
• Start shipping canisters to the Federal Repository	FY10
• Complete shipping canisters to Federal Repository	FY39
Facility Deactivation Complete	FY40

Appendix J – Case 2

Appendix J Contents

This appendix provides the following data:

1. Funding Requirements
2. Waste Removal and Tank Closure Schedule
3. Volume Balance
4. Salt Processing Batch makeup
5. Sludge Batch makeup
6. Canister Storage requirements
7. Useable Type III Tank Space
8. Remaining Tank Inventory
9. Non-Compliant Tank Closures with respect to the FFA
10. Level 1 Schedule.

A comparison of the Useable Tank Space; Inventory of the amount of waste in Types I, II, III, and IV tanks; Evaporator Space Recovery; and Evaporator Feed is contained in Appendix L.

Appendix J.1 – Funding (Case 2)

Budget Authority in Escalated Dollars

Project Title	Actuals FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
HL-01 H Tank Farm	99,993	90,510	92,920	98,518	99,679	101,032	103,760	106,562	109,439	110,020	112,991
HL-04 H Tank Farm East & Sludge Operations	50,622	56,256	62,539	66,053	69,666	67,629	69,455	71,330	73,256	75,234	77,265
HL-02 F Tank Farm	61,742	65,240	68,267	70,122	71,269	73,735	75,726	77,771	79,870	76,120	77,332
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	3,237	3,302	1,667	1,694	1,892	2,008	2,062	3,300	3,389	3,480	3,574
Am/Cm	208	16,253	7,984	-							
WR: Tank Closure	-	3,059	13,840	11,232	-	-	-	-	4,170	24,714	10,077
HL-03 Total	3,445	22,614	23,491	12,926	1,892	2,008	2,062	3,300	7,559	28,194	13,651
HL-12 LI: Waste Removal											
LI: WR from Tanks	18,869	28,714	27,968	28,222	17,513	5,388	33,649	52,957	44,058	56,629	55,113
LI: Vit Upgrades	3,376	-	-	-	7,891	7,368	15,391	15,807	16,234	29,176	19,262
LI: Piping, Evaps & Infrastructure	-	287	6,742	15,875	11,850	-	-	-	-	-	-
HL-12 Total	22,245	29,001	34,711	44,097	37,254	12,756	49,041	68,764	60,292	85,805	74,376
HL-11 LI: Tk Fm Services Upgrade II	8,120	9,636	-	0	(0)	-	(0)	0	(0)	0	(0)
HL-05 Vitrification	106,598	123,495	126,051	126,066	131,418	138,980	129,753	136,673	141,364	152,770	154,474
HL-06 Glass Waste Storage	504	584	1,926	1,965	1,353	689	5,366	20,448	52,027	33,902	2,093
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	18,847	3,090	2,822	1,505	1,548	1,587	1,630	9,457	46,759	54,264	40,977
Low Curie	-	4,535	1,134	1,176	1,219	-	-	-	-	-	-
Actinide	-	17,830	16,458	17,062	12,983	13,245	0	0	0	0	0
LI: Salt Alternative	-	-	-	14,000	14,000	82,500	122,500	157,500	157,500	55,000	50,000
HL-13 Total	18,847	25,455	20,414	33,743	29,750	97,331	124,130	166,957	204,259	109,264	90,977
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**372,116**	**422,793**	**430,318**	**453,490**	**442,281**	**494,160**	**559,292**	**651,805**	**728,065**	**671,308**	**603,158**
HLW w/o Salt Total	**353,269**	**397,338**	**409,904**	**419,747**	**412,531**	**396,829**	**435,163**	**484,848**	**523,806**	**562,044**	**512,181**
Solid Waste Facilities											
ETF	14,631	14,261	17,596	18,145	19,889	20,877	22,724	21,804	22,393	22,998	23,619
SS	2,466	6,608	8,755	8,854	9,551	4,562	4,685	5,445	6,242	8,558	8,789
SW TOTAL	**17,097**	**20,870**	**26,352**	**26,999**	**29,440**	**25,438**	**27,409**	**27,249**	**28,636**	**31,556**	**32,408**
Life Cycle Cost	**389,213**	**443,662**	**456,670**	**480,489**	**471,721**	**519,599**	**586,702**	**679,054**	**756,700**	**702,864**	**635,566**

Appendix J.1 – Funding (Case 2)

Budget Authority in Escalated Dollars

Project Title	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
HL-01 H Tank Farm	115,207	118,317	120,632	123,889	127,234	99,062	101,736	102,472	96,839	98,393	93,204
HL-04 H Tank Farm East & Sludge Operations	79,352	81,494	83,694	85,954	88,275	90,658	93,106	95,620	98,202	100,853	103,576
HL-02 F Tank Farm	79,420	81,565	82,006	84,221	85,566	72,651	74,612	73,976	70,314	70,477	70,597
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects Am/Cm	7,342	3,770	3,872	1,988	2,042	2,097	2,154	2,212	2,271	2,333	2,396
WR: Tank Closure	5,115	11,848	15,396	25,996	94,509	49,765	17,726	23,908	62,054	25,696	14,217
HL-03 Total	12,457	15,618	19,268	27,984	96,550	51,862	19,879	26,120	64,326	28,028	16,613
HL-12 LI: Waste Removal											
LI: WR from Tanks	61,261	75,897	85,594	64,947	73,446	34,752	63,862	45,104	76,086	87,580	30,603
LI: Vit Upgrades	13,188	20,317	20,865	21,429	14,671	15,068	-	-	-	-	-
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	74,449	96,214	106,459	86,375	88,117	49,819	63,862	45,104	76,086	87,580	30,603
HL-11 LI: Tk Fm Services Upgrade II	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0
HL-05 Vitrification	162,173	169,614	166,646	175,728	182,855	186,377	186,899	195,664	208,530	202,504	211,682
HL-06 Glass Waste Storage	2,149	2,483	2,550	2,619	2,690	2,762	2,837	2,914	2,992	3,073	3,156
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	42,084	68,440	122,089	151,986	156,089	160,304	164,632	169,077	173,642	178,330	183,145
Low Curie	-	-	-	-	-	-	-	-	-	-	-
Actinide	0	0	0	0	0	0	0	0	0	0	0
LI: Salt Alternative	130,000	315,000	360,000	135,000	-	-	-	-	-	-	-
HL-13 Total	172,084	383,440	482,089	286,986	156,089	160,304	164,632	169,077	173,642	178,330	183,145
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**697,291**	**948,745**	**1,063,345**	**873,755**	**827,376**	**713,495**	**707,564**	**710,945**	**790,930**	**769,238**	**712,577**
HLW w/o Salt Total	**525,207**	**565,305**	**581,256**	**586,770**	**671,287**	**553,191**	**542,932**	**541,868**	**617,288**	**590,908**	**529,432**
Solid Waste Facilities											
ETF	24,256	24,911	25,584	26,275	26,984	27,713	28,461	29,229	30,019	30,829	31,662
SS	15,391	27,551	46,518	47,250	45,638	50,006	69,095	48,802	48,583	53,605	66,735
SW TOTAL	**39,647**	**52,463**	**72,102**	**73,525**	**72,622**	**77,719**	**97,556**	**78,032**	**78,601**	**84,434**	**98,397**
Life Cycle Cost	**736,938**	**1,001,207**	**1,135,448**	**947,280**	**899,998**	**791,214**	**805,120**	**788,977**	**869,532**	**853,672**	**810,973**

Appendix J.1 – Funding (Case 2)

Budget Authority in Escalated Dollars

Project Title	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33
HL-01 H Tank Farm	93,890	96,425	89,176	41,826	42,955	-	-	-	-	-	-
HL-04 H Tank Farm East & Sludge Operations	106,373	109,245	112,194	113,241	86,929	-	-	-	-	-	-
HL-02 F Tank Farm	72,503	35,350	-	-	-	-	-	-	-	-	-
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects Am/Cm	2,460	2,527	1,346	-	-	-	-	-	-	-	-
WR: Tank Closure	12,654	42,385	67,341	51,450	63,672	137,156	76,066	-	-	-	-
HL-03 Total	15,115	44,912	68,687	51,450	63,672	137,156	76,066	-	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	57,825	62,141	29,635	24,610	22,035	32,024	-	-	-	-	-
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	-	-
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	57,825	62,141	29,635	24,610	22,035	32,024	-	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	(0)	0	(0)	0	(0)	0	(0)	-	-	-	-
HL-05 Vitrification	220,098	218,595	229,611	236,108	212,913	-	-	-	-	-	-
HL-06 Glass Waste Storage	3,241	3,329	3,419	3,511	3,606	3,703	3,381	3,472	3,566	3,662	3,761
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	188,090	193,168	198,384	203,740	209,241	-	-	-	-	-	-
Low Curie	-	-	-	-	-	-	-	-	-	-	-
Actinide	0	0	0	0	0	0	0	0	-	-	-
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	-	-
HL-13 Total	188,090	193,168	198,384	203,740	209,241	0	0	-	-	-	-
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	290,375	413,093	-	-	-	-	-
HLW TOTAL	**757,135**	**763,166**	**731,106**	**674,486**	**931,727**	**585,976**	**79,447**	**3,472**	**3,566**	**3,662**	**3,761**
HLW w/o Salt Total	**569,045**	**569,997**	**532,722**	**470,746**	**722,486**	**585,976**	**79,447**	**3,472**	**3,566**	**3,662**	**3,761**
Solid Waste Facilities											
ETF	32,516	33,394	34,296	17,611	13,565	-	-	-	-	-	-
SS	52,280	52,154	57,629	56,003	46,243	7,137	-	-	-	-	-
SW TOTAL	**84,796**	**85,548**	**91,925**	**73,614**	**59,808**	**7,137**	**-**	**-**	**-**	**-**	**-**
Life Cycle Cost	**841,931**	**848,714**	**823,031**	**748,100**	**991,535**	**593,113**	**79,447**	**3,472**	**3,566**	**3,662**	**3,761**

Appendix J.1 – Funding (Case 2)

Budget Authority in Escalated Dollars

Project Title	FY34	FY35	FY36	FY37	FY38	FY39	FY40	Cumulative FY02-FY40
HL-01 H Tank Farm	-	-	-	-	-	-	-	2,586,687
HL-04 H Tank Farm East & Sludge Operations	-	-	-	-	-	-	-	2,217,451
HL-02 F Tank Farm	-	-	-	-	-	-	-	1,688,711
HL-03 Waste Removal & Tank Closures								
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	65,176
Am/Cm								24,237
WR: Tank Closure	-	-	-	-	-	-	-	864,045
HL-03 Total	-	-	-	-	-	-	-	953,458
HL-12 LI: Waste Removal								
LI: WR from Tanks	-	-	-	-	-	-	-	1,277,613
LI: Vit Upgrades	-	-	-	-	-	-	-	216,668
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	34,754
HL-12 Total	-	-	-	-	-	-	-	1,529,035
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	9,636
HL-05 Vitrification	-	-	-	-	-	-	-	4,527,038
HL-06 Glass Waste Storage	3,862	3,966	4,074	4,184	4,297	4,413	4,532	218,555
HL-13 Salt Disposition								
Salt Disposition Ops (inc ECP)	-	-	-	-	-	-	-	2,726,079
Low Curie	-	-	-	-	-	-	-	8,064
Actinide	-	-	-	-	-	-	-	77,577
LI: Salt Alternative	-	-	-	-	-	-	-	1,593,000
HL-13 Total	-	-	-	-	-	-	-	4,423,568
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	18,707	-	722,176
HLW TOTAL	**3,862**	**3,966**	**4,074**	**4,184**	**4,297**	**23,120**	**4,532**	**18,876,315**
HLW w/o Salt Total	**3,862**	**3,966**	**4,074**	**4,184**	**4,297**	**23,120**	**4,532**	**14,452,747**
Solid Waste Facilities								
ETF	-	-	-	-	-	-	-	656,244
SS	-	-	-	-	-	-	-	865,136
SW TOTAL	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,521,380**
Life Cycle Cost	**3,862**	**3,966**	**4,074**	**4,184**	**4,297**	**23,120**	**4,532**	**20,397,695**

Appendix J.1 – Funding (Case 2)

Budget Authority in Constant FY01 Year Dollars

Project Title	Actuals FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
HL-01 H Tank Farm	99,993	87,197	86,241	88,174	86,030	84,087	84,087	84,087	84,087	82,311	82,311
HL-04 H Tank Farm East & Sludge Operations	50,622	54,196	58,044	59,118	60,127	56,286	56,286	56,286	56,286	56,286	56,286
HL-02 F Tank Farm	61,742	62,852	63,360	62,760	61,510	61,368	61,368	61,368	61,368	56,949	56,335
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	3,237	3,181	1,547	1,516	1,633	1,671	1,671	2,604	2,604	2,604	2,604
Am/Cm	208	15,658	7,410	-	-	-	-	-	-	-	-
WR: Tank Closure	-	2,947	12,845	10,053	-	-	-	-	3,204	18,490	7,341
HL-03 Total	3,445	21,786	21,802	11,569	1,633	1,671	1,671	2,604	5,808	21,094	9,944
HL-12 LI: Waste Removal											
LI: WR from Tanks	18,869	27,663	25,958	25,259	15,115	4,484	27,269	41,788	33,852	42,367	40,149
LI: Vit Upgrades	3,376	-	-	-	6,811	6,132	12,473	12,473	12,473	21,828	14,032
LI: Piping, Evaps & Infrastructure	-	276	6,258	14,208	10,227	-	-	-	-	-	-
HL-12 Total	22,245	27,939	32,216	39,467	32,153	10,617	39,743	54,261	46,325	64,195	54,181
HL-11 LI: Tk Fm Services Upgrade II	8,120	9,284	-	0	(0)	-	(0)	0	(0)	0	(0)
HL-05 Vitrification	106,598	118,974	116,991	112,830	113,424	115,670	105,152	107,848	108,616	114,294	112,531
HL-06 Glass Waste Storage	504	563	1,787	1,759	1,168	574	4,348	16,136	39,975	25,364	1,525
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	18,847	2,976	2,619	1,347	1,336	1,321	1,321	7,463	35,927	40,597	29,851
Low Curie	-	4,369	1,052	1,052	1,052	-	-	-	-	-	-
Actinide	-	17,177	15,275	15,270	11,205	11,023	0	0	0	0	0
LI: Salt Alternative	-	-	-	12,530	12,083	68,663	99,274	124,282	121,015	41,148	36,424
HL-13 Total	18,847	24,523	18,946	30,200	25,676	81,007	100,595	131,745	156,942	81,746	66,275
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**372,116**	**407,315**	**399,388**	**405,877**	**381,721**	**411,279**	**453,250**	**514,335**	**559,407**	**502,238**	**439,388**
HLW w/o Salt Total	**353,269**	**382,792**	**380,442**	**375,677**	**356,045**	**330,272**	**352,655**	**382,590**	**402,465**	**420,492**	**373,113**
Solid Waste Facilities											
ETF	14,631	13,739	16,332	16,240	17,166	17,375	18,416	17,206	17,206	17,206	17,206
SS	2,466	6,366	8,126	7,924	8,243	3,797	3,797	4,297	4,796	6,402	6,402
SW TOTAL	**17,097**	**20,106**	**24,458**	**24,164**	**25,409**	**21,172**	**22,212**	**21,502**	**22,002**	**23,608**	**23,608**
Life Cycle Cost	**389,213**	**427,420**	**423,846**	**430,041**	**407,130**	**432,451**	**475,462**	**535,837**	**581,409**	**525,846**	**462,996**

Appendix J.1 – Funding (Case 2)

Budget Authority in Constant FY01 Year Dollars

Project Title	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
HL-01 H Tank Farm	81,719	81,719	81,127	81,127	81,127	61,503	61,503	60,320	55,505	54,913	50,650
HL-04 H Tank Farm East & Sludge Operations	56,286	56,286	56,286	56,286	56,286	56,286	56,286	56,286	56,286	56,286	56,286
HL-02 F Tank Farm	56,335	56,335	55,151	55,151	54,559	45,106	45,106	43,545	40,302	39,333	38,364
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	5,208	2,604	2,604	1,302	1,302	1,302	1,302	1,302	1,302	1,302	1,302
Am/Cm	-	-	-	-	-	-	-	-	-	-	-
WR: Tank Closure	3,629	8,183	10,354	17,023	60,261	30,897	10,716	14,073	35,568	14,341	7,726
HL-03 Total	8,836	10,787	12,958	18,325	61,563	32,199	12,018	15,375	36,870	15,643	9,028
HL-12 LI: Waste Removal											
LI: WR from Tanks	43,454	52,421	57,564	42,530	46,831	21,576	38,607	26,550	43,610	48,878	16,631
LI: Vit Upgrades	9,355	14,032	14,032	14,032	9,355	9,355	-	-	-	-	-
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	52,809	66,453	71,596	56,562	56,186	30,931	38,607	26,550	43,610	48,878	16,631
HL-11 LI: Tk Fm Services Upgrade II	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0
HL-05 Vitrification	115,034	117,149	112,073	115,073	116,593	115,714	112,988	115,176	119,523	113,017	115,034
HL-06 Glass Waste Storage	1,525	1,715	1,715	1,715	1,715	1,715	1,715	1,715	1,715	1,715	1,715
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	29,851	47,270	82,107	99,526	99,526	99,526	99,526	99,526	99,526	99,526	99,526
Low Curie	-	-	-	-	-	-	-	-	-	-	-
Actinide	0	0	0	0	0	0	0	0	0	0	0
LI: Salt Alternative	92,212	217,564	242,107	88,403	-	-	-	-	-	-	-
HL-13 Total	122,064	264,834	324,215	187,930	99,526	99,526	99,526	99,526	99,526	99,526	99,526
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**494,607**	**655,278**	**715,121**	**572,170**	**527,555**	**442,981**	**427,750**	**418,494**	**453,337**	**429,312**	**387,234**
HLW w/o Salt Total	**372,544**	**390,444**	**390,907**	**384,240**	**428,029**	**343,455**	**328,223**	**318,968**	**353,811**	**329,786**	**287,708**
Solid Waste Facilities											
ETF	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206
SS	10,917	19,029	31,285	30,941	29,100	31,047	41,771	28,727	27,846	29,917	36,266
SW TOTAL	**28,123**	**36,235**	**48,490**	**48,147**	**46,306**	**48,253**	**58,976**	**45,933**	**45,052**	**47,123**	**53,471**
Life Cycle Cost	**522,730**	**691,512**	**763,612**	**620,317**	**573,861**	**491,234**	**486,726**	**464,427**	**498,389**	**476,435**	**440,705**

Appendix J.1 – Funding (Case 2)

Budget Authority in Constant FY01 Year Dollars

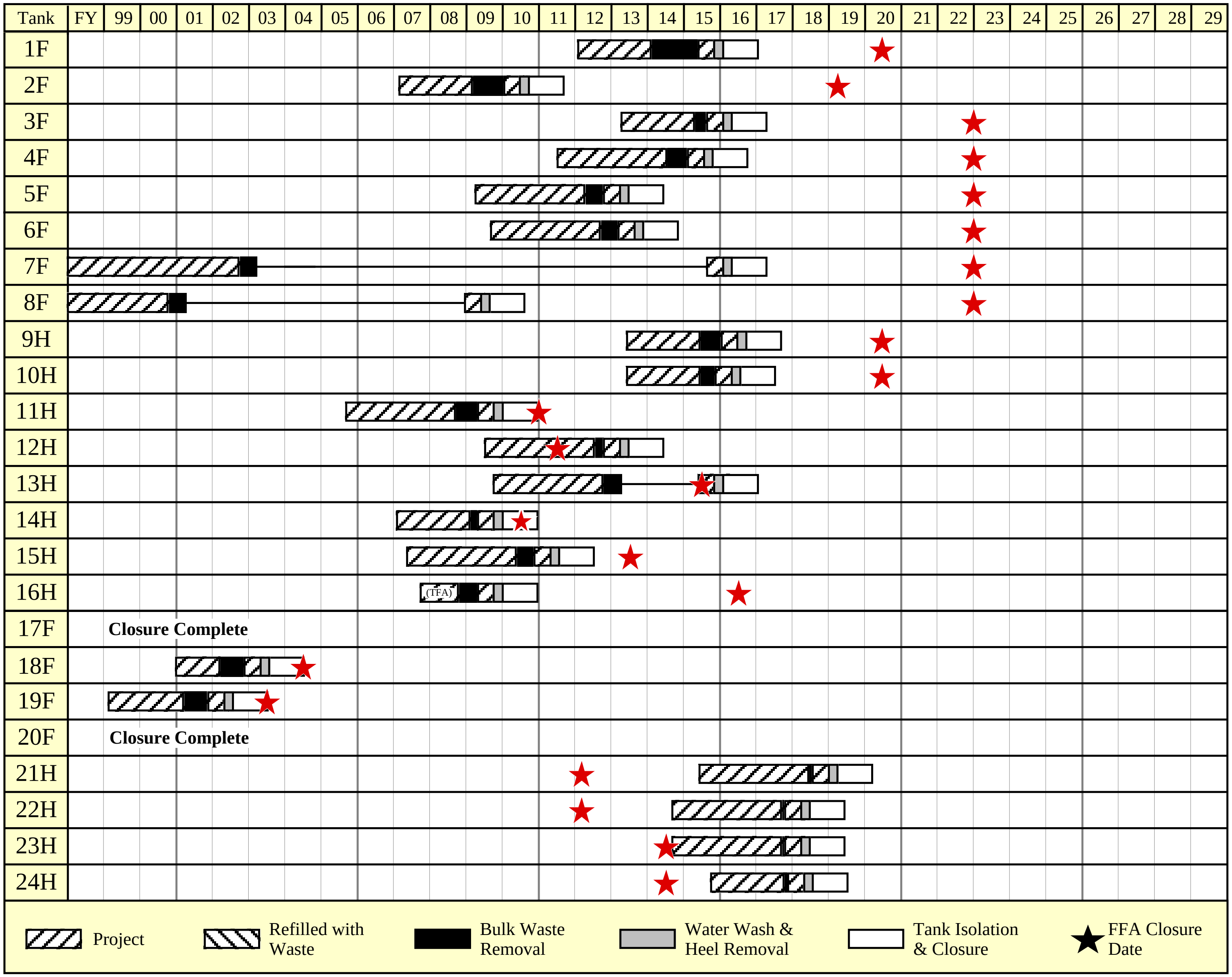
Project Title	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33
HL-01 H Tank Farm	49,681	49,681	44,738	20,432	20,432	-	-	-	-	-	-
HL-04 H Tank Farm East & Sludge Operations	56,286	56,286	56,286	55,318	41,348	-	-	-	-	-	-
HL-02 F Tank Farm	38,364	18,214	-	-	-	-	-	-	-	-	-
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	1,302	1,302	675	-	-	-	-	-	-	-	-
Am/Cm	-	-	-	-	-	-	-	-	-	-	-
WR: Tank Closure	6,696	21,838	33,784	25,133	30,286	63,523	34,304	-	-	-	-
HL-03 Total	7,998	23,140	34,459	25,133	30,286	63,523	34,304	-	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	30,597	32,017	14,867	12,022	10,481	14,832	-	-	-	-	-
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	-	-
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	30,597	32,017	14,867	12,022	10,481	14,832	-	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	(0)	0	(0)	0	(0)	0	(0)	-	-	-	-
HL-05 Vitrification	116,463	112,627	115,192	115,338	101,272	-	-	-	-	-	-
HL-06 Glass Waste Storage	1,715	1,715	1,715	1,715	1,715	1,715	1,525	1,525	1,525	1,525	1,525
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	99,526	99,526	99,526	99,526	99,526	-	-	-	-	-	-
Low Curie	-	-	-	-	-	-	-	-	-	-	-
Actinide	0	0	0	0	0	0	0	0	-	-	-
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	-	-
HL-13 Total	99,526	99,526	99,526	99,526	99,526	0	0	0	-	-	-
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	138,118	191,323	-	-	-	-	-
HLW TOTAL	**400,631**	**393,206**	**366,785**	**329,483**	**443,178**	**271,393**	**35,828**	**1,525**	**1,525**	**1,525**	**1,525**
HLW w/o Salt Total	**301,105**	**293,680**	**267,258**	**229,957**	**343,652**	**271,393**	**35,828**	**1,525**	**1,525**	**1,525**	**1,525**
Solid Waste Facilities											
ETF	17,206	17,206	17,206	8,603	6,452	-	-	-	-	-	-
SS	27,663	26,871	28,912	27,357	21,996	3,306	-	-	-	-	-
SW TOTAL	**44,869**	**44,077**	**46,117**	**35,960**	**28,448**	**3,306**	**-**	**-**	**-**	**-**	**-**
Life Cycle Cost	**445,500**	**437,283**	**412,902**	**365,443**	**471,626**	**274,699**	**35,828**	**1,525**	**1,525**	**1,525**	**1,525**

Appendix J.1 – Funding (Case 2)

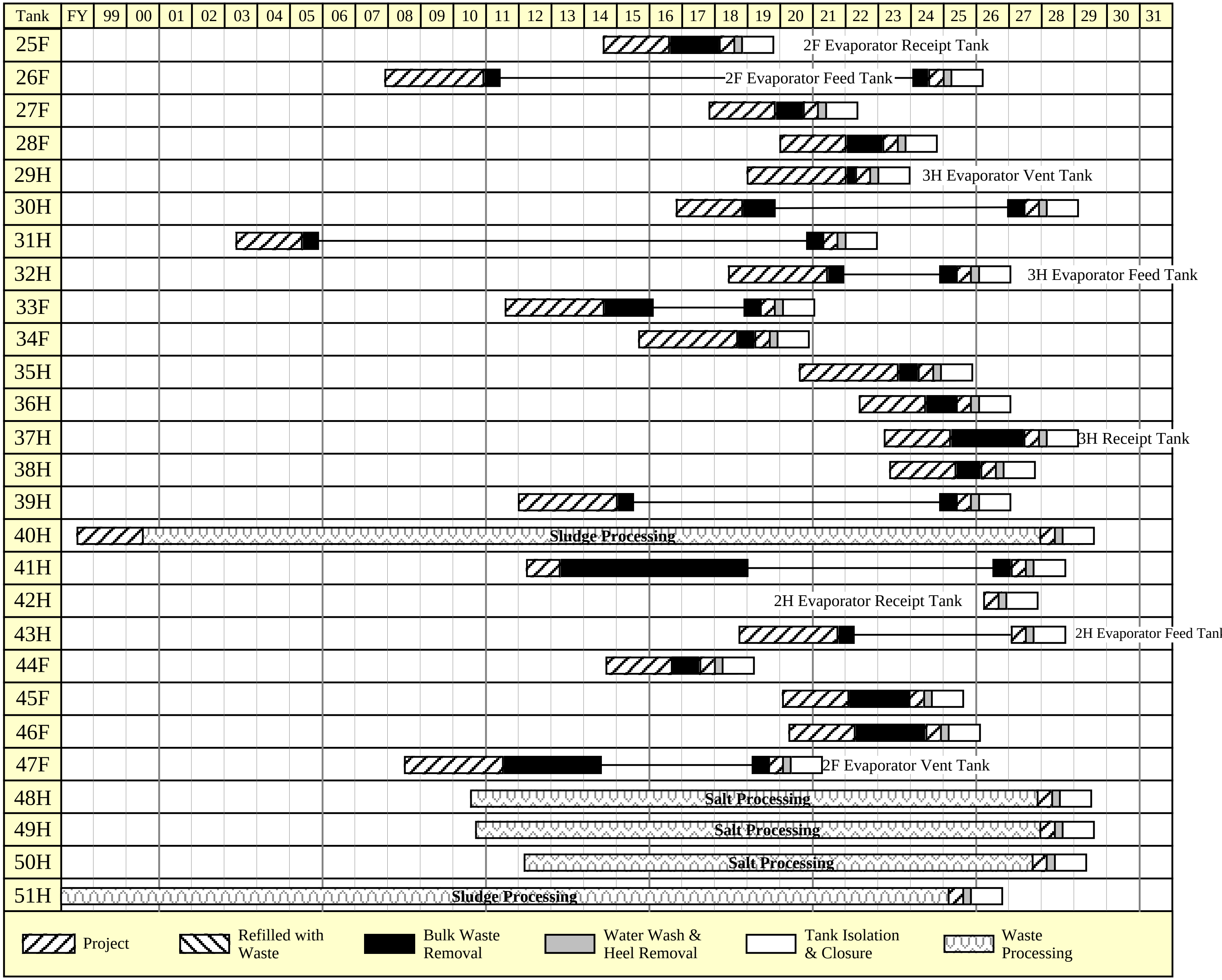
Budget Authority in Constant FY01 Year Dollars

Project Title	FY34	FY35	FY36	FY37	FY38	FY39	FY40	Cumulative FY02-FY40
HL-01 H Tank Farm	-	-	-	-	-	-	-	1,784,792
HL-04 H Tank Farm East & Sludge Operations	-	-	-	-	-	-	-	1,453,875
HL-02 F Tank Farm	-	-	-	-	-	-	-	1,195,105
HL-03 Waste Removal & Tank Closures								
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	45,744
Am/Cm	-	-	-	-	-	-	-	23,068
WR: Tank Closure	-	-	-	-	-	-	-	483,213
HL-03 Total	-	-	-	-	-	-	-	552,025
HL-12 LI: Waste Removal								
LI: WR from Tanks	-	-	-	-	-	-	-	837,371
LI: Vit Upgrades	-	-	-	-	-	-	-	156,384
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	30,970
HL-12 Total	-	-	-	-	-	-	-	1,024,725
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	9,284
HL-05 Vitrification	-	-	-	-	-	-	-	2,954,594
HL-06 Glass Waste Storage	1,525	1,525	1,525	1,525	1,525	1,525	1,525	140,458
HL-13 Salt Disposition								
Salt Disposition Ops (inc ECP)	-	-	-	-	-	-	-	1,577,827
Low Curie	-	-	-	-	-	-	-	7,526
Actinide	-	-	-	-	-	-	-	69,951
LI: Salt Alternative	-	-	-	-	-	-	-	1,155,706
HL-13 Total	-	-	-	-	-	-	-	2,829,857
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	6,463	-	335,904
HLW TOTAL	**1,525**	**1,525**	**1,525**	**1,525**	**1,525**	**7,988**	**1,525**	**12,280,618**
HLW w/o Salt Total	**1,525**	**1,525**	**1,525**	**1,525**	**1,525**	**7,988**	**1,525**	**9,450,761**
Solid Waste Facilities								
ETF	-	-	-	-	-	-	-	438,657
SS	-	-	-	-	-	-	-	515,567
SW TOTAL	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**954,224**
Life Cycle Cost	**1,525**	**1,525**	**1,525**	**1,525**	**1,525**	**7,988**	**1,525**	**13,234,843**

Appendix J.2 Waste Removal Schedule (Case 2)



Appendix J.2 Waste Removal Schedule (Case 2)



Appendix J.3 – Tank Farm Volume Balance (Case 2)

End of Fiscal Year	Influents (gallons) (1)									Effluents (gallons) (1)								Total Inventory (gallons)
										Space Recovery from Evaporation								
	F-Canyon	H-Canyon	DWPF Recycle	299-H	RBOF	ETF (3)	Inhibited Water	Other	**Total In**	2F Evap	2H Evap	3H Evap	Salt Solution to Saltstone (4)	Salt Solution to Processing	Sludge to DWPF	Other	**Total Out**	
FY01																Beginning Volume		**38,630,957**
FY02 (2)	796,651	327,572	913,305	13,907	92,987	93,988	1,376,189	302,534	**3,917,134**	852,913	2,101,211	3,140,371	837,000	-	133,419	14,378	**7,079,291**	**35,468,800**
FY03	192,000	365,780	1,224,710	12,000	120,000	-	2,495,344	170,618	**4,580,453**	791,188	1,814,632	2,086,563	2,085,457	-	176,348	32,675	**6,986,863**	**33,062,390**
FY04	132,000	398,720	1,276,220	12,000	120,000	-	1,766,051	368,845	**4,073,836**	1,338,259	1,882,627	571,672	1,383,018	-	165,600	-	**5,341,176**	**31,795,050**
FY05	202,000	315,780	955,650	12,000	120,000	-	1,283,232	454,745	**3,343,407**	1,349,835	1,729,305	1,062,137	1,750,930	-	139,497	1,034	**6,032,737**	**29,105,720**
FY06	252,000	422,100	1,137,143	12,000	60,000	-	-	280,256	**2,163,499**	977,171	1,266,161	1,186,272	-	-	139,497	7,907	**3,577,009**	**27,692,210**
FY07	182,000	559,200	143,000	12,000	-	-	1,204,629	238,419	**2,339,248**	881,387	803,101	-	-	-	-	1,960	**1,686,448**	**28,345,010**
FY08	132,000	417,200	143,000	12,000	-	-	582,702	202,973	**1,489,875**	545,311	602,992	99,913	-	-	-	20,969	**1,269,185**	**28,565,700**
FY09	-	184,000	143,000	12,000	-	-	2,609,993	295,548	**3,244,542**	518,961	371,421	1,163,180	-	-	-	-	**2,053,562**	**29,756,680**
FY10	-	120,000	1,781,969	12,000	-	-	987,883	174,500	**3,076,353**	-	1,081,652	520,497	-	900,000	170,477	53,387	**2,726,013**	**30,107,020**
FY11	-	-	2,231,079	12,000	-	-	1,796,428	201,055	**4,240,562**	-	2,066,968	1,538,863	-	899,879	174,336	12,817	**4,692,862**	**29,654,720**
FY12	-	-	2,231,079	12,000	-	-	2,314,066	181,412	**4,738,557**	-	1,957,929	606,919	-	900,000	263,093	40,956	**3,768,897**	**30,624,380**
FY13	-	-	2,231,079	12,000	-	-	1,844,138	108,397	**4,195,613**	-	2,045,190	2,269,720	-	900,000	249,767	38,066	**5,502,743**	**29,317,250**
FY14	-	-	2,231,079	12,000	-	-	1,481,862	113,819	**3,838,759**	-	2,157,168	143,108	-	875,354	135,166	7,834	**3,318,629**	**29,837,380**
FY15	-	-	2,231,079	12,000	-	-	5,679,732	315,439	**8,238,249**	-	2,200,304	1,950,094	-	5,681,400	135,166	9,466	**9,976,429**	**28,099,200**
FY16	-	-	2,231,079	12,000	-	-	3,713,273	314,937	**6,271,288**	-	1,976,107	897,684	-	5,698,318	144,877	4,452	**8,721,438**	**25,649,050**
FY17	-	-	2,231,079	12,000	-	-	3,398,322	363,664	**6,005,065**	-	2,212,984	-	-	5,700,000	150,990	1	**8,063,975**	**23,590,140**
FY18	-	-	2,231,079	12,000	-	-	2,984,371	277,322	**5,504,771**	-	1,768,229	770,566	-	5,700,000	150,990	16,987	**8,406,771**	**20,688,140**
FY19	-	-	2,231,079	12,000	-	-	4,146,770	253,288	**6,643,136**	-	2,962,766	1,630,841	-	5,700,000	157,877	27,753	**10,479,236**	**16,852,040**
FY20	-	-	2,231,079	12,000	-	-	3,528,763	409,500	**6,181,342**	-	2,257,646	-	-	5,700,000	187,720	6	**8,145,372**	**14,888,010**
FY21	-	-	2,231,079	12,000	-	-	3,941,995	225,877	**6,410,951**	-	1,607,419	-	-	5,700,000	187,720	7,834	**7,502,973**	**13,795,988**
FY22	-	-	2,231,079	12,000	-	-	3,597,762	284,958	**6,125,799**	-	-	-	-	5,480,531	186,508	5,396	**5,672,434**	**14,249,353**
FY23	-	-	2,231,079	12,000	-	-	1,549,788	359,253	**4,152,121**	-	2,122,378	-	-	5,700,000	168,318	15,098	**8,005,794**	**10,395,680**
FY24	-	-	2,231,079	12,000	-	-	3,706,004	351,672	**6,300,755**	-	2,339,058	-	-	5,700,000	161,304	11,457	**8,211,819**	**8,484,616**
FY25	-	-	2,231,079	12,000	-	-	3,519,929	281,311	**6,044,319**	-	2,256,721	-	-	5,700,000	154,655	11,551	**8,122,927**	**6,406,008**
FY26	-	-	2,045,156	9,000	-	-	3,499,696	529,697	**6,083,549**	-	1,684,610	-	-	5,696,327	164,966	3,505	**7,549,408**	**4,940,149**
FY27	-	-	-	-	-	-	1	53,974	**53,975**	-	-	-	-	4,676,232	137,471	0	**4,813,703**	**180,421**

Notes:

1) Discussion of the components of the Influents and Effluents is contained in Section 5.1.3 "HLW System Material Balance"
2) FY02 includes actual values obtained from "HLW Morning Reports" for the time period between 10/1/2001 and 1/7/2002.
3) ETF evaporator effluents are assumed to be sent directly to Saltstone after FY02 and are not included in this tabulation.
4) Salt solution to Saltstone values do not include filtrate generated from the Salt Waste Processing Facility

Appendix J.4 – Salt Solution Processing (Case 2)

End of Fiscal Year	Total Salt Solution from Tank Farms (kgal)	Salt Solution processed via Low Curie and Actinide Removal (kgal)	Salt Solution processed via Salt Waste Processing Facility (kgal)	Feed Stream to Saltstone (kgal)	ETF to Saltstone (kgal)	Grout Produced (kgal)	Vault Number
FY02					837	1,481	4
FY03	2,085	2,085	0	2,085	180	4,010	4
FY04	1,383	1,383	0	1,674	180	3,281	4
FY05	1,751	1,751	0	2,242	180	4,287	4
FY06	0	0	0	0	180	319	4
FY07	0	0	0	0	180	319	4
FY08	0	0	0	0	180	319	4
FY09	0	0	0	0	180	319	4
FY10	900	0	900	1,152	180	2,358	4
FY11	900	0	900	1,152	180	2,358	4
FY12	900	0	900	1,152	180	2,358	1
FY13	900	0	900	1,152	180	2,358	1
FY14	875	0	875	1,120	180	2,300	2
FY15	5,681	0	5,681	7,516	180	13,621	3
FY16	5,698	0	5,698	7,538	180	13,661	5
FY17	5,700	0	5,700	7,540	180	13,665	6
FY18	5,700	0	5,700	7,540	180	13,665	8
FY19	5,700	0	5,700	7,540	180	13,665	9
FY20	5,700	0	5,700	7,540	180	13,665	10
FY21	5,700	0	5,700	7,540	180	13,665	11
FY22	5,481	0	5,481	7,248	180	13,148	13
FY23	5,700	0	5,700	7,540	180	13,665	14
FY24	5,700	0	5,700	7,540	180	13,665	15
FY25	5,700	0	5,700	7,540	180	13,665	16
FY26	5,696	0	5,696	7,536	180	13,657	18
FY27	4,676	0	4,676	6,178	180	11,254	19
FY28	0	0	0	0		0	19
Total	**82,527**	**5,219**	**77,308**	**108,070**	**5,337**	**200,730**	**19**

Notes:

1 FY02 ETF to Saltstone represents the recovery of Tank 50 (Saltstone Feed Tank) for use as a Salt Processing Tank by transfering the entire contents to the Saltstone Facility.

2 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.

3 Each gallon of feed, when added to the cement, flyash, and slag makes 1.77 gallons of grout. Each cell is estimated to contain 1,814 kgal of grout. Therefore each cell holds 1,025 kgal of feed solution.

Appendix J.5 – Sludge Processing (Case 2)

	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	495	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	726	2.96	12/1/01	51	25.0
	Total	**420,861**										(Included use of ~70 cans of Tank 51 heel)				
2	8	175,883			1,374	6.24	0.30	16.0	600	600	12/15/01	470	2.49	6/11/04	40	27.5
	40	261,867								-140	(Assumes DWPF outage in 4thQ FY02)					
	Total	**437,750**								460						
3	7 (70%)	291,587	4/18/03	14	1,684	6.22	0.07	16.0	473	473	6/11/04	409	2.30	9/29/06	51	28.8
	18 (70%)	16,076														
	Total	**307,663**														
4	7 (30%)	124,966	9/6/08	13	1,210	8.86	1.70	16.0	426	426	10/1/09	386	2.03	10/10/11	40	31.3
	11	124,380														
	18 (30%)	6,889														
	Total	**256,235**														
5	15	165,818	4/18/10	18	2,231	10.91	1.45	16.0	665	665	10/10/11	470	2.04	10/25/13	51	33.0
	26	154,896									(Assume coupled salt and sludge feed starts in April 2010)					
	Total	**320,714**														
6	5	57,630	5/3/12	18	3,096	7.55	2.20	16.0	450	450	10/25/13	546	2.37	3/9/16	40	35.1
	6	38,708														
	12	189,715														
	13 (30%)	125,268														
	Total	**411,321**														
7	13 (70%)	292,293	9/16/14	18	3,801	7.28	1.67	16.0	699	699	3/9/16	810	3.52	9/16/19	51	32.5
	4	65,477														
	33 (60%)	106,290														
	39 (40%)	42,522														
	Total	**506,582**														
8	21	6,393	3/25/18	18	2,925	7.14	0.94	16.0	726	726	9/16/19	641	2.79	6/29/22	40	34.8
	22	13,265														
	23	59,110														
	33 (40%)	70,860														
	34	77,119														
	39 (60%)	63,783														
	47	137,763														
	Total	**428,293**														

Appendix J.5 – Sludge Processing (Case 2)

	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 %)
9	32	214,886	2/4/21	17	2,688	8.80	3.92	16.0	502	472	6/29/22	441	1.92	5/29/24	51	35.2
	43	114,393														
	Total	**329,279**														
10	ESP Heels (Tks 40,42,51)	158,377	2/4/23	16	1,123	10.86	4.27	16.0	462	462	5/29/24	647	2.81	3/22/27	40	40.0
	35	138,956														
	Other Insoluble Solids	219,000														
	Total	**516,333**														
Totals		**3,935,031**			**20,132**	**Total Estimated Washwater**						**6,041**	**Total Estimated Cans**			

Notes:

General) Above based on the following yearly canister production values: FY02 150 cans/yr, FY03 210 cans/yr, FY04 220 cans/yr, FY05 150 cans/yr, FY06 193 cans/yr, FY07-FY09 0 cans/yr, FY10 150 cans/yr, FY11-End 230 cans/yr.

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

B) Sludge in these tanks will comprise the batch. Note: 100% of the sludge from Tanks 7 and 18 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 SpaceMan II results. This is the sludge volume plus no more than 18" of free supernate. If less supernate is shown in the model, then the total feed tank volume is reported.

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 1B and estimated for remaining batches.

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 (Case 2)

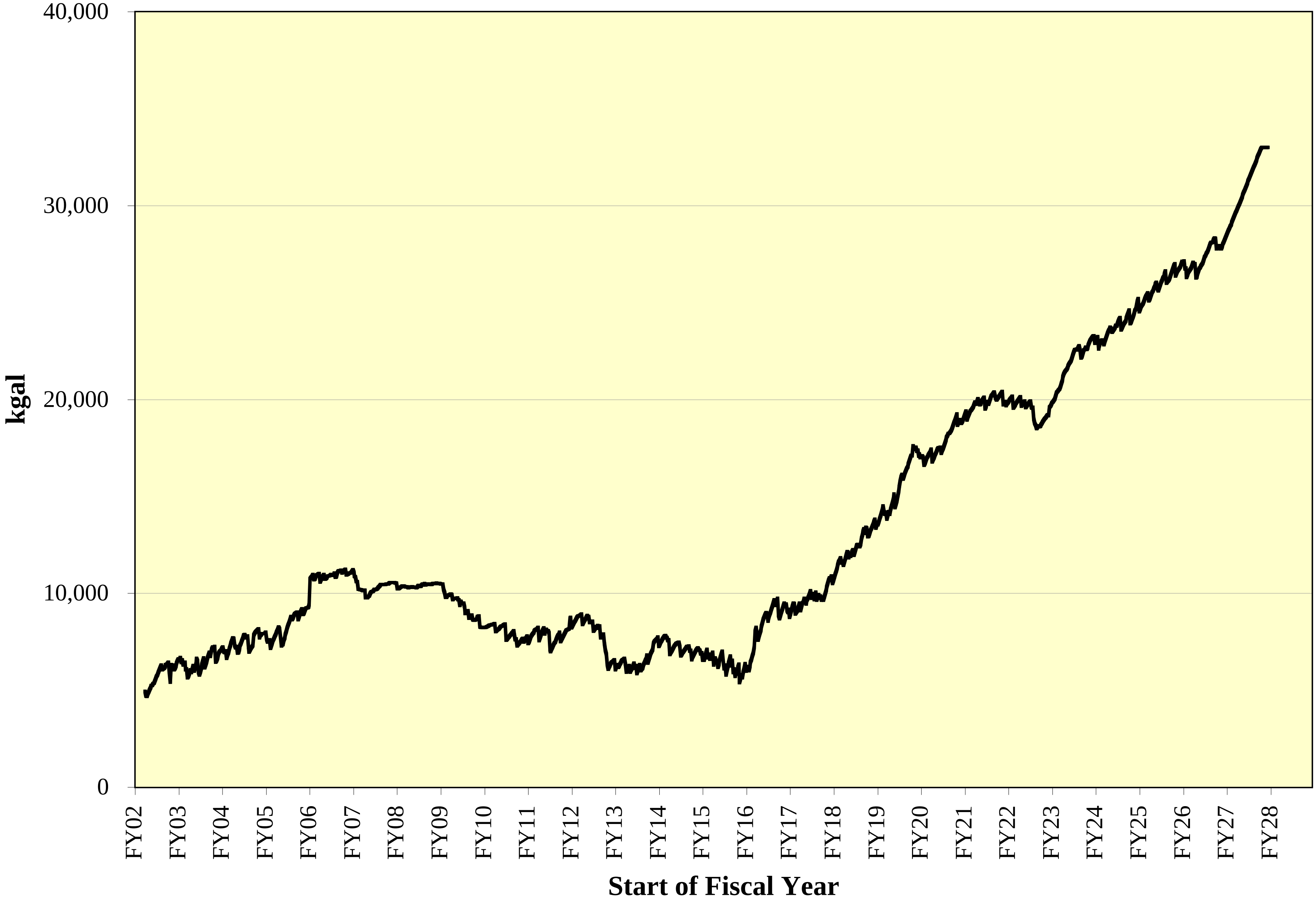
End of FY	SRS Cans Produced		SRS Cans in GWSB #1 (2,159 max)			SRS Cans in Modular Storage (1 building @ 585)			SRS Cans Shipped to Repository		Net Cans Stored At SRS
	Yearly	Cum.	Added	Shipped	Cum.	Added	Shipped	Cum.	Each Year	Cumulative	
1996	64	64	64		64						64
1997	169	233	169		233						233
1998	250	483	250		483						483
1999	236	719	236		719						719
2000	231	950	231		950						950
2001	227	1,177	227		1,177						1,177
2002	150	1,327	150		1,327						1,327
2003	210	1,537	210		1,537						1,537
2004	220	1,757	220		1,757						1,757
2005	150	1,907	150		1,907	0		0			1,907
2006	193	2,100	193		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	150	2,250	150	(105)	2,145	0		0	105	105	2,145
2011	230	2,480	219	(205)	2,159	11	0	11	205	310	2,170
2012	230	2,710	0	(205)	1,954	230	0	241	205	515	2,195
2013	230	2,940	0	(205)	1,749	230	0	471	205	720	2,220
2014	230	3,170	116	(205)	1,660	114	0	585	205	925	2,245
2015	230	3,400	230	(205)	1,685	0	0	585	205	1,130	2,270
2016	230	3,630	230	(205)	1,710	0	0	585	205	1,335	2,295
2017	230	3,860	230	(205)	1,735	0	0	585	205	1,540	2,320
2018	230	4,090	230	(205)	1,760	0	0	585	205	1,745	2,345
2019	230	4,320	230	(205)	1,785	0	0	585	205	1,950	2,370
2020	230	4,550	230	(205)	1,810	0	0	585	205	2,155	2,395
2021	230	4,780	230	(205)	1,835	0	0	585	205	2,360	2,420
2022	230	5,010	230	(205)	1,860	0	0	585	205	2,565	2,445
2023	230	5,240	230	(205)	1,885	0	0	585	205	2,770	2,470
2024	230	5,470	230	(205)	1,910	0	0	585	205	2,975	2,495
2025	230	5,700	230	(205)	1,935	0	0	585	205	3,180	2,520
2026	230	5,930	230	(10)	2,155	0	(195)	390	205	3,385	2,545
2027	111	6,041	4	0	2,159	107	(205)	292	205	3,590	2,451
2028	0	6,041		0	2,159	0	(205)	87	205	3,795	2,246
2029	0	6,041		(118)	2,041	0	(87)	0	205	4,000	2,041
2030	0	6,041		(205)	1,836	0	0	0	205	4,205	1,836
2031	0	6,041		(205)	1,631	0	0	0	205	4,410	1,631
2032	0	6,041		(205)	1,426	0	0	0	205	4,615	1,426
2033	0	6,041		(205)	1,221	0	0	0	205	4,820	1,221
2034	0	6,041		(205)	1,016	0	0	0	205	5,025	1,016
2035	0	6,041		(205)	811	0	0	0	205	5,230	811
2036	0	6,041		(205)	606	0	0	0	205	5,435	606
2037	0	6,041		(205)	401	0	0	0	205	5,640	401
2038	0	6,041		(205)	196	0	0	0	205	5,845	196
2039	0	6,041		(196)	0	0	0	0	196	6,041	0
2040	0	6,041			0		0	0	0	6,041	

Appendix J.6 - Canister Storage (Case 2)

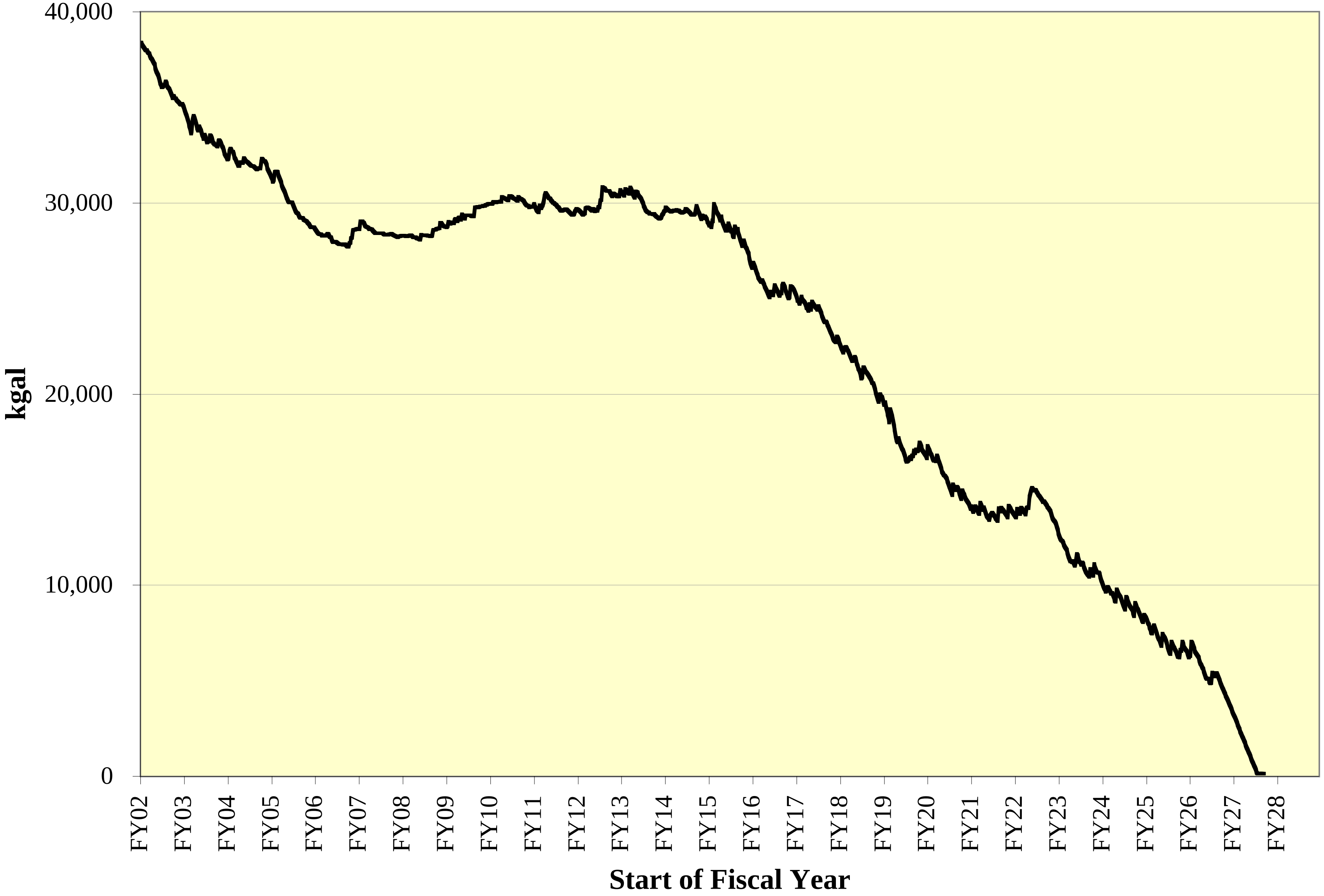
Notes:

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 FY11.
3) Additional glass waste storage locations will be built as modularized buildings. The first building, GWSB #2A, will be needed in FY11. 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) The Plan does not include additional locations in GWSB #2A for spent fuels materials. The addition of these materials could require additional buildings.

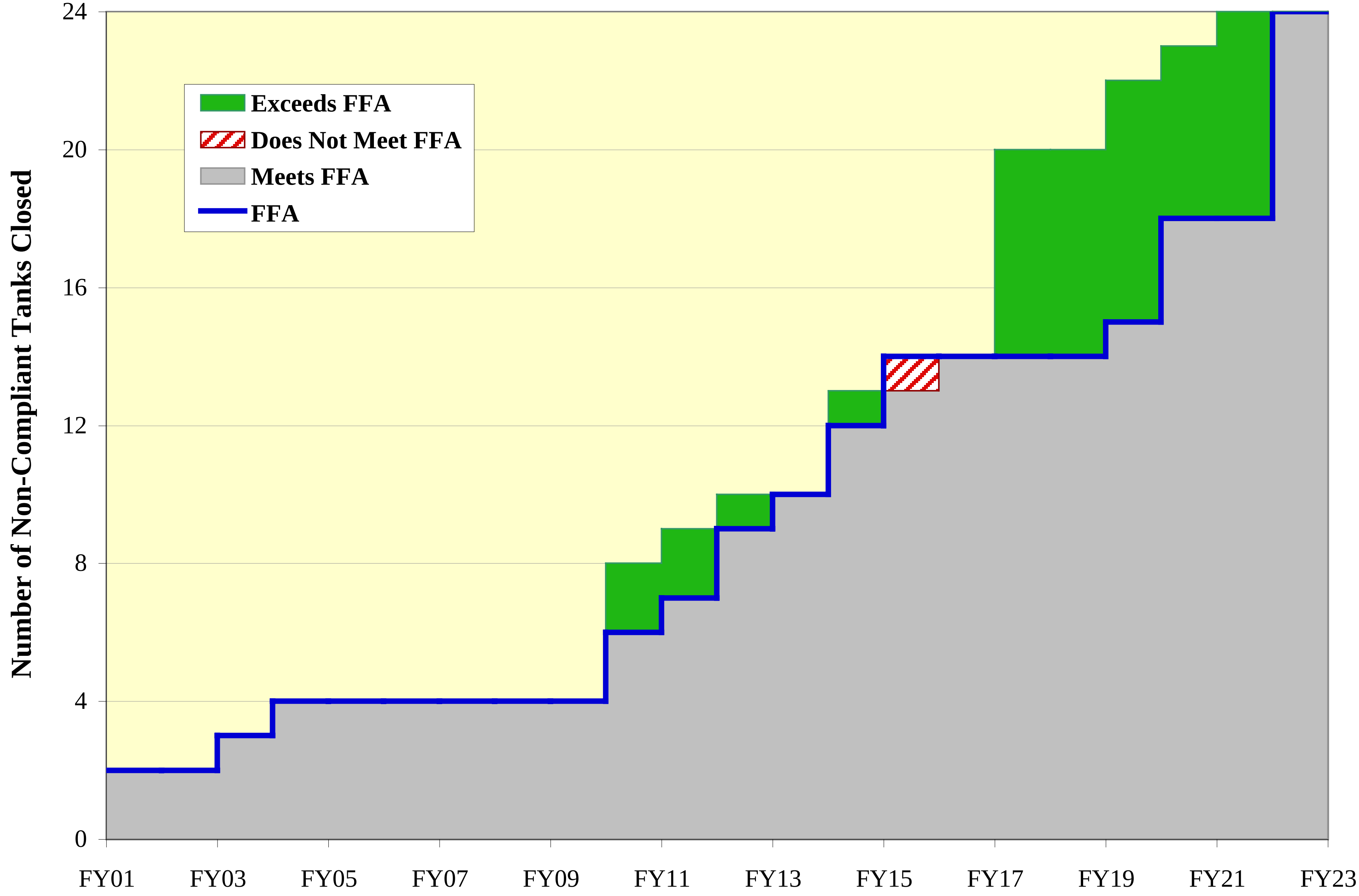
Appendix J.7 – Useable Type III Tank Space (Case 2)



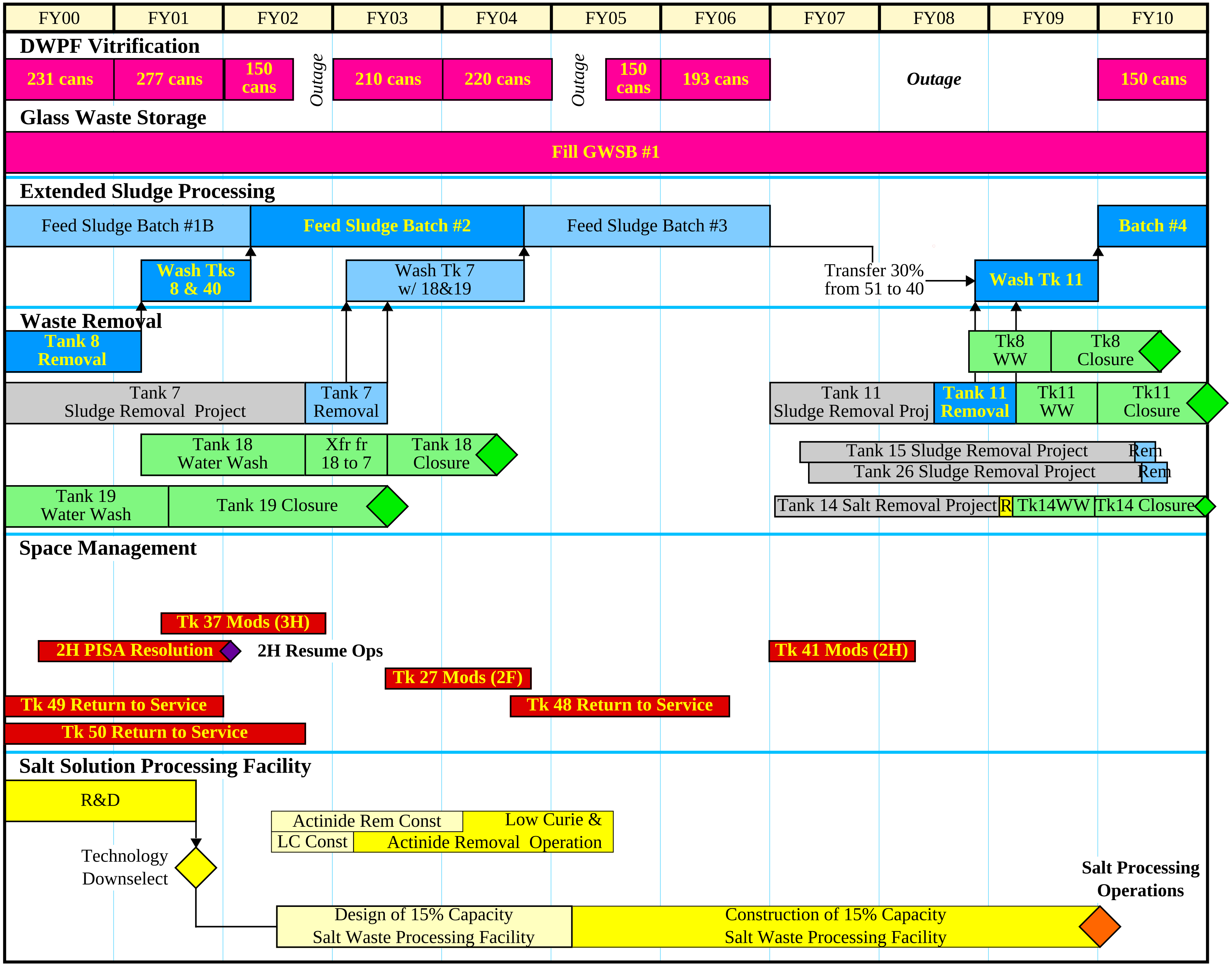
Appendix J.8 – Remaining Tank Inventory (Case 2)



Appendix J.9 – Tank Closures (Case 2)



Appendix J.10 – Level 1 Schedule (Case 2)



Appendix K – Case 3

The scope and funding levels in Appendix K support **Case 3** representing the most optimistic of the three cases. This case assumes the success of low curie salt disposition and the earliest start of the SWPF. Of the three cases, Case 3 —

1. Provides the fastest risk reduction for waste removal from "high risk" tanks
2. Provides the fastest total Tank Farm inventory reduction
3. Meets the Site Treatment Plan (STP) regulatory commitments to have waste removed from all waste tanks by 2028
4. Meets the final Federal Facility Agreement commitment of 2022 and the commitment to have a certain number of tanks closed by designated years
5. Provides the most contingency of the 3 cases for meeting process commitments until the start of the SWPF. That is, Type III tank space is the highest of the 3 cases at the date of SWPF startup

Key Milestone	Rev 13 Case 3
Total Number of Canisters Produced	6,120
DWPF Sludge Production (in average canisters per year)	
• FY01	227(Act)
• FY02	150
• FY03	240
• FY04	240
• FY05	150
• FY06	143
• FY07	200
• FY08	150
• FY09	230
• FY10	230
• FY11	230
• FY12	230
• FY13 to End of Sludge Processing	230
• Salt-only Cans at End of Program	79
Salt Processing Information	
• Low Curie and Actinide Success	Yes
• Years Processed	FY03-07
• Saltcake Processed	3.0 Mgal
Date Salt Waste Processing Facility Becomes Operational	FY08
• % Operational Flowrate (100% equals 6 Mgal/yr at 6.44 [Na])	20%
Date Additional Salt Waste Processing Capacity provided	FY13
• % Additional Operational Flowrate (100% equals 6 Mgal/yr at 6.44 [Na])	50%
• Max Yearly % Operational Flowrate	70%
Salt Solution Processing Rate(Kgal/yr)	
• FY08	1,200
• FY09	1,200
• FY10	1,200
• FY11	1,200
• FY12	1,200
• FY13	4,200
• FY14	4,200
• FY15	4,200
• FY16 until end of program	4,200

Appendix K – Case 3

Key Milestone	Rev 13 Case 3
Key Risk Reduction Dates	
Date when all "high risk" tanks are emptied	FY13
Date when all "non-compliant" tanks are emptied	FY15
Date when all "non-compliant" Tanks are closed	FY17
Date by which salt processing is completed	FY28
Date by which sludge processing is completed	FY24
Regulatory Commitments	
Are all STP commitments met?	Yes
Are all FFA regulatory commitments met?	Yes*
* Yearly closure commitments (total number of tanks/yr) are met	
Canister Storage Locations	
• Make additional 450 GWSB #1 locations usable	By FY04
• Begin work on additional Canister Storage locations (GWSB #2)	Module #1 FY04 Module #2 FY07
• Place GWSB #2 into Radioactive Operations	Module #1 FY07 Module #2 FY10
Waste Removal	
• Tank 7 ready for sludge removal	Jul-02
• Tank 11 ready for sludge removal	Apr-05
• Tank 26 ready for sludge removal	Jul-07
Tank Closures	
• Complete closure of Tank 19	Apr-03
• Complete closure of Tank 18	Apr-04
• Complete closure of 5th Tank	FY09
• Complete closure of 6th Tank	FY09
• Complete closure of 7th Tank	FY10
• Complete closure of 24th Tank	FY17
Key Space Management Activities	
• Return Tank 48 for waste storage/ Salt Feed tank service	FY06
• Reuse Tank 49 for waste storage	Jul-01
• Reuse Tank 50 for waste storage	Jul-02
• Tank 37 modification completed for 3H Evaporator Drop Tank	Aug-02
• Tank 37 Salt Dissolution #2	Jan-04
• Tank 37 Salt Dissolution #3	n/a
• Tank 37 Salt Dissolution #4	n/a
• Tank 31 modification completed for 3H Evaporator Drop Tank	Nov-06
• Tank 27 modification completed for 2F Evaporator Drop Tank	Jul-04
• Tank 42 modification completed for 2H Evaporator Drop Tank	n/a
• Tank 41 modification completed for 2H Evaporator Drop Tank	Oct-06
Repository Activities	
• Start shipping canisters to the Federal Repository	FY10
• Complete shipping canisters to Federal Repository	FY40
Facility Deactivation Complete	FY41

Appendix K – Case 3

Appendix K Contents

This appendix provides the following data:
1. Funding Requirements
2. Waste Removal and Tank Closure Schedule
3. Volume Balance
4. Salt Processing Batch makeup
5. Sludge Batch makeup
6. Canister Storage requirements
7. Useable Type III Tank Space
8. Remaining Tank Inventory
9. Non-Compliant Tank Closures with respect to the FFA
10. Level 1 Schedule.

A comparison of the Useable Tank Space; Inventory of the amount of waste in Types I, II, III, and IV tanks; Evaporator Space Recovery; and Evaporator Feed is contained in Appendix L.

Appendix K.1 – Funding (Case 3)

Budget Authority in Escalated Dollars

Project Title	Actuals FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
HL-01 H Tank Farm	99,993	90,510	92,920	98,518	99,679	101,032	103,760	106,562	107,898	109,229	110,553
HL-04 H Tank Farm East & Sludge Operations	50,622	56,256	62,539	66,053	69,666	67,629	69,455	71,330	73,256	75,234	77,265
HL-02 F Tank Farm	61,742	65,240	68,267	70,122	71,269	73,735	75,726	77,771	79,870	76,120	75,647
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	3,237	3,302	2,017	2,056	3,788	4,014	4,122	4,233	13,043	13,395	9,201
Am/Cm	208	16,253	7,984	-							
WR: Tank Closure	-	3,059	13,840	11,232	-	-	-	2,096	10,618	32,524	41,476
HL-03 Total	3,445	22,614	23,841	13,288	3,788	4,014	4,122	6,329	23,661	45,919	50,677
HL-12 LI: Waste Removal											
LI: WR from Tanks	18,869	28,714	27,968	28,407	40,619	49,428	63,033	69,066	81,076	61,251	84,173
LI: Vit Upgrades	3,376	-	-	-	7,891	7,368	15,391	15,807	16,234	29,176	19,262
LI: Piping, Evaps & Infrastructure	-	287	6,742	15,875	11,850	-	-	-	-	-	-
HL-12 Total	22,245	29,001	34,711	44,282	60,360	56,796	78,424	84,873	97,310	90,427	103,435
HL-11 LI: Tk Fm Services Upgrade II	8,120	9,636	-	0	(0)	-	(0)	0	(0)	0	(0)
HL-05 Vitrification	106,598	123,495	127,078	126,776	131,418	137,070	137,597	142,715	150,878	156,168	154,474
HL-06 Glass Waste Storage	504	584	1,926	6,762	26,226	21,324	5,366	14,600	21,995	9,228	2,093
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	18,847	3,090	2,822	1,505	1,548	6,305	19,426	26,600	27,318	28,056	44,576
Low Curie	-	4,535	1,134	1,176	1,219	1,264	1,299	-	-	-	-
Actinide	-	17,830	16,458	17,062	12,983	13,463	13,827	0	0	0	0
LI: Salt Alternative	-	14,000	14,000	82,500	144,500	196,000	196,000	66,000	50,000	100,000	210,000
HL-13 Total	18,847	39,455	34,414	102,243	160,250	217,033	230,551	92,600	77,318	128,056	254,576
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**372,116**	**436,793**	**445,696**	**528,043**	**622,655**	**678,633**	**705,001**	**596,780**	**632,186**	**690,381**	**828,720**
HLW w/o Salt Total	**353,269**	**397,338**	**411,282**	**425,801**	**462,405**	**461,600**	**474,450**	**504,180**	**554,868**	**562,325**	**574,144**
Solid Waste Facilities											
ETF	14,631	14,261	17,596	18,145	19,889	20,877	22,724	21,804	22,393	22,998	23,619
SS	2,466	6,608	8,755	8,854	7,557	13,260	21,614	11,135	13,168	19,365	16,262
SW TOTAL	**17,097**	**20,870**	**26,352**	**26,999**	**27,446**	**34,137**	**44,338**	**32,939**	**35,561**	**42,363**	**39,880**
Life Cycle Cost	**389,213**	**457,662**	**472,048**	**555,042**	**650,101**	**712,770**	**749,339**	**629,720**	**667,747**	**732,743**	**868,600**

Appendix K.1 – Funding (Case 3)

Budget Authority in Escalated Dollars

Project Title	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
HL-01 H Tank Farm	113,538	116,603	91,646	94,120	96,661	88,509	90,898	93,353	95,873	98,462	93,270
HL-04 H Tank Farm East & Sludge Operations	79,352	81,494	83,694	85,954	88,275	90,658	93,106	95,620	98,202	100,853	101,794
HL-02 F Tank Farm	76,273	76,618	76,366	78,428	80,545	69,673	71,555	70,835	69,533	69,674	35,778
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects Am/Cm	9,449	9,704	9,966	10,236	5,256	5,398	5,544	5,693	5,847	6,005	6,167
WR: Tank Closure	18,982	61,039	52,511	14,997	38,966	45,016	6,981	16,383	8,337	14,405	58,126
HL-03 Total	28,432	70,744	62,478	25,232	44,222	50,414	12,524	22,076	14,184	20,410	64,293
HL-12 LI: Waste Removal											
LI: WR from Tanks	51,651	41,871	39,548	57,647	51,421	78,291	62,024	32,636	13,666	30,444	49,529
LI: Vit Upgrades	13,188	20,317	20,865	21,429	14,671	15,068	-	-	-	-	-
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	64,839	62,187	60,413	79,076	66,092	93,359	62,024	32,636	13,666	30,444	49,529
HL-11 LI: Tk Fm Services Upgrade II	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0
HL-05 Vitrification	162,173	169,614	166,646	175,728	182,855	186,377	186,899	195,664	208,530	202,504	211,682
HL-06 Glass Waste Storage	2,149	2,483	2,550	2,619	2,690	2,762	2,837	2,914	2,992	3,073	3,156
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	78,155	96,890	99,506	102,193	104,952	107,786	110,696	113,685	116,754	119,907	123,144
Low Curie	-	-	-	-	-	-	-	-	-	-	-
Actinide	0	0	0	0	0	0	0	0	0	0	0
LI: Salt Alternative	240,000	90,000	-	-	-	-	-	-	-	-	-
HL-13 Total	318,155	186,890	99,506	102,193	104,952	107,786	110,696	113,685	116,754	119,907	123,144
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**844,910**	**766,634**	**643,300**	**643,350**	**666,293**	**689,538**	**630,540**	**626,782**	**619,734**	**645,327**	**682,646**
HLW w/o Salt Total	**526,755**	**579,744**	**543,793**	**541,157**	**561,341**	**581,752**	**519,843**	**513,097**	**502,979**	**525,420**	**559,501**
Solid Waste Facilities											
ETF	24,256	24,911	25,584	26,275	26,984	27,713	28,461	29,229	30,019	30,829	31,662
SS	19,154	42,907	41,802	43,795	43,264	44,101	50,979	46,258	47,051	47,774	50,906
SW TOTAL	**43,410**	**67,819**	**67,386**	**70,070**	**70,248**	**71,814**	**79,440**	**75,487**	**77,070**	**78,603**	**82,567**
Life Cycle Cost	**888,320**	**834,453**	**710,686**	**713,420**	**736,541**	**761,352**	**709,980**	**702,269**	**696,804**	**723,930**	**765,213**

Appendix K.1 – Funding (Case 3)

Budget Authority in Escalated Dollars

Project Title	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33
HL-01 H Tank Farm	95,789	94,615	65,104	57,547	9,852	-	-	-	-	-	-
HL-04 H Tank Farm East & Sludge Operations	102,712	103,605	106,402	107,292	110,189	113,164	-	-	-	-	-
HL-02 F Tank Farm	-	-	-	-	-	-	-	-	-	-	-
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects Am/Cm	6,334	6,505	-	-	-	-	-	-	-	-	-
WR: Tank Closure	60,327	26,329	35,845	34,402	50,039	55,188	76,199	39,578	-	-	-
HL-03 Total	66,661	32,834	35,845	34,402	50,039	55,188	76,199	-	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	46,576	38,393	15,095	3,299	12,381	16,747	21,116	-	-	-	-
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	-	-
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	46,576	38,393	15,095	3,299	12,381	16,747	21,116	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	(0)	0	(0)	0	(0)	0	(0)	-	-	-	-
HL-05 Vitrification	220,098	213,105	216,941	223,095	208,837	-	-	-	-	-	-
HL-06 Glass Waste Storage	3,241	3,329	3,419	3,511	3,606	3,703	3,381	3,472	3,566	3,662	3,761
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	126,469	129,884	133,391	136,992	140,691	72,245	-	-	-	-	-
Low Curie	-	-	-	-	-	-	-	-	-	-	-
Actinide	0	0	0	0	0	0	0	0	-	-	-
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	-	-
HL-13 Total	126,469	129,884	133,391	136,992	140,691	72,245	0	-	-	-	-
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	290,375	413,093	-	-	-	-	-
HLW TOTAL	**661,546**	**615,763**	**576,196**	**566,139**	**825,970**	**674,139**	**100,696**	**3,472**	**3,566**	**3,662**	**3,761**
HLW w/o Salt Total	**535,076**	**485,880**	**442,805**	**429,146**	**685,279**	**601,895**	**100,696**	**3,472**	**3,566**	**3,662**	**3,761**
Solid Waste Facilities											
ETF	32,516	33,394	34,296	17,611	13,565	10,448	2,090	-	-	-	-
SS	37,854	48,387	50,298	51,200	44,237	40,396	3,519	-	-	-	-
SW TOTAL	**70,370**	**81,781**	**84,594**	**68,811**	**57,802**	**50,844**	**5,609**	**-**	**-**	**-**	**-**
Life Cycle Cost	**731,916**	**697,545**	**660,791**	**634,949**	**883,772**	**724,984**	**106,305**	**3,472**	**3,566**	**3,662**	**3,761**

Appendix K.1 – Funding (Case 3)

Budget Authority in Escalated Dollars

Project Title	FY34	FY35	FY36	FY37	FY38	FY39	FY40	Cumulative FY02-FY40
HL-01 H Tank Farm	-	-	-	-	-	-	-	2,416,500
HL-04 H Tank Farm East & Sludge Operations	-	-	-	-	-	-	-	2,331,049
HL-02 F Tank Farm	-	-	-	-	-	-	-	1,509,046
HL-03 Waste Removal & Tank Closures								
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	151,274
Am/Cm								24,237
WR: Tank Closure	-	-	-	-	-	-	-	828,495
HL-03 Total	-	-	-	-	-	-	-	964,428
HL-12 LI: Waste Removal								
LI: WR from Tanks	-	-	-	-	-	-	-	1,196,069
LI: Vit Upgrades	-	-	-	-	-	-	-	216,668
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	34,754
HL-12 Total	-	-	-	-	-	-	-	1,447,491
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	9,636
HL-05 Vitrification	-	-	-	-	-	-	-	4,518,415
HL-06 Glass Waste Storage	3,862	3,966	4,074	4,184	4,297	4,413	4,532	208,306
HL-13 Salt Disposition								
Salt Disposition Ops (inc ECP)	-	-	-	-	-	-	-	2,074,587
Low Curie	-	-	-	-	-	-	-	10,627
Actinide	-	-	-	-	-	-	-	91,623
LI: Salt Alternative	-	-	-	-	-	-	-	1,403,000
HL-13 Total	-	-	-	-	-	-	-	3,598,684
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	18,707	-	722,176
HLW TOTAL	**3,862**	**3,966**	**4,074**	**4,184**	**4,297**	**23,120**	**4,532**	**17,725,731**
HLW w/o Salt Total	**3,862**	**3,966**	**4,074**	**4,184**	**4,297**	**23,120**	**4,532**	**14,127,047**
Solid Waste Facilities								
ETF	-	-	-	-	-	-	-	668,782
SS	-	-	-	-	-	-	-	882,927
SW TOTAL	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1,551,709**
Life Cycle Cost	**3,862**	**3,966**	**4,074**	**4,184**	**4,297**	**23,120**	**4,532**	**19,277,440**

Appendix K.1 – Funding (Case 3)

Budget Authority in Constant FY01 Year Dollars

Project Title	Actuals FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
HL-01 H Tank Farm	99,993	87,197	86,241	88,174	86,030	84,087	84,087	84,087	82,903	81,719	80,535
HL-04 H Tank Farm East & Sludge Operations	50,622	54,196	58,044	59,118	60,127	56,286	56,286	56,286	56,286	56,286	56,286
HL-02 F Tank Farm	61,742	62,852	63,360	62,760	61,510	61,368	61,368	61,368	61,368	56,949	55,108
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	3,237	3,181	1,872	1,840	3,269	3,340	3,340	3,340	10,021	10,021	6,703
Am/Cm	208	15,658	7,410	-	-	-	-	-	-	-	-
WR: Tank Closure	-	2,947	12,845	10,053	-	-	-	1,654	8,158	24,333	30,215
HL-03 Total	3,445	21,786	22,127	11,893	3,269	3,340	3,340	4,995	18,180	34,354	36,917
HL-12 LI: Waste Removal											
LI: WR from Tanks	18,869	27,663	25,958	25,424	35,057	41,138	51,082	54,500	62,294	45,825	61,318
LI: Vit Upgrades	3,376	-	-	-	6,811	6,132	12,473	12,473	12,473	21,828	14,032
LI: Piping, Evaps & Infrastructure	-	276	6,258	14,208	10,227	-	-	-	-	-	-
HL-12 Total	22,245	27,939	32,216	39,632	52,095	47,270	63,555	66,973	74,768	67,653	75,350
HL-11 LI: Tk Fm Services Upgrade II	8,120	9,284	-	0	(0)	-	(0)	0	(0)	0	(0)
HL-05 Vitrification	106,598	118,974	117,944	113,465	113,424	114,081	111,508	112,615	115,927	116,837	112,531
HL-06 Glass Waste Storage	504	563	1,787	6,052	22,635	17,747	4,348	11,521	16,900	6,904	1,525
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	18,847	2,976	2,619	1,347	1,336	5,247	15,742	20,990	20,990	20,990	32,472
Low Curie	-	4,369	1,052	1,052	1,052	1,052	1,052	-	-	-	-
Actinide	-	17,177	15,275	15,270	11,205	11,205	11,205	0	0	0	0
LI: Salt Alternative	-	13,487	12,994	73,838	124,714	163,127	158,838	52,080	38,417	74,815	152,981
HL-13 Total	18,847	38,011	31,940	91,508	138,308	180,632	186,838	73,070	59,407	95,805	185,453
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**372,116**	**420,802**	**413,660**	**472,603**	**537,397**	**564,812**	**571,332**	**470,915**	**485,739**	**516,507**	**603,705**
HLW w/o Salt Total	**353,269**	**382,792**	**381,720**	**381,095**	**399,090**	**384,180**	**384,494**	**397,845**	**426,331**	**420,702**	**418,252**
Solid Waste Facilities											
ETF	14,631	13,739	16,332	16,240	17,166	17,375	18,416	17,206	17,206	17,206	17,206
SS	2,466	6,366	8,126	7,924	6,522	11,036	17,516	8,787	10,118	14,488	11,846
SW TOTAL	**17,097**	**20,106**	**24,458**	**24,164**	**23,688**	**28,411**	**35,932**	**25,992**	**27,323**	**31,694**	**29,052**
Life Cycle Cost	**389,213**	**440,908**	**438,118**	**496,767**	**561,085**	**593,224**	**607,263**	**496,907**	**513,062**	**548,200**	**632,757**

Appendix K.1 – Funding (Case 3)

Budget Authority in Constant FY01 Year Dollars

Project Title	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22
HL-01 H Tank Farm	80,535	80,535	61,634	61,634	61,634	54,951	54,951	54,951	54,951	54,951	50,686
HL-04 H Tank Farm East & Sludge Operations	56,286	56,286	56,286	56,286	56,286	56,286	56,286	56,286	56,286	56,286	55,318
HL-02 F Tank Farm	54,102	52,918	51,358	51,358	51,358	43,257	43,257	41,697	39,854	38,885	19,443
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	6,703	6,703	6,703	6,703	3,351	3,351	3,351	3,351	3,351	3,351	3,351
Am/Cm	-	-	-	-	-	-	-	-	-	-	-
WR: Tank Closure	13,465	42,159	35,315	9,820	24,846	27,949	4,220	9,643	4,778	8,040	31,587
HL-03 Total	20,167	48,861	42,018	16,523	28,197	31,300	7,571	12,995	8,130	11,391	34,938
HL-12 LI: Waste Removal											
LI: WR from Tanks	36,637	28,919	26,597	37,750	32,787	48,608	37,496	19,211	7,833	16,991	26,915
LI: Vit Upgrades	9,355	14,032	14,032	14,032	9,355	9,355	-	-	-	-	-
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	45,992	42,952	40,629	51,782	42,142	57,963	37,496	19,211	7,833	16,991	26,915
HL-11 LI: Tk Fm Services Upgrade II	0	(0)	0	(0)	0	(0)	0	(0)	0	(0)	0
HL-05 Vitrification	115,034	117,149	112,073	115,073	116,593	115,714	112,988	115,176	119,523	113,017	115,034
HL-06 Glass Waste Storage	1,525	1,715	1,715	1,715	1,715	1,715	1,715	1,715	1,715	1,715	1,715
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	55,438	66,920	66,920	66,920	66,920	66,920	66,920	66,920	66,920	66,920	66,920
Low Curie	-	-	-	-	-	-	-	-	-	-	-
Actinide	0	0	0	0	0	0	0	0	0	0	0
LI: Salt Alternative	170,238	62,161	-	-	-	-	-	-	-	-	-
HL-13 Total	225,676	129,081	66,920	66,920	66,920	66,920	66,920	66,920	66,920	66,920	66,920
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	-	-	-	-	-	-
HLW TOTAL	**599,317**	**529,498**	**432,632**	**421,291**	**424,844**	**428,107**	**381,185**	**368,952**	**355,212**	**360,157**	**370,969**
HLW w/o Salt Total	**373,641**	**400,416**	**365,712**	**354,371**	**357,924**	**361,187**	**314,265**	**302,032**	**288,292**	**293,237**	**304,049**
Solid Waste Facilities											
ETF	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206	17,206
SS	13,586	29,635	28,113	28,679	27,586	27,381	30,819	27,229	26,968	26,663	27,664
SW TOTAL	**30,792**	**46,841**	**45,319**	**45,885**	**44,792**	**44,587**	**48,025**	**44,435**	**44,174**	**43,868**	**44,869**
Life Cycle Cost	**630,109**	**576,339**	**477,951**	**467,176**	**469,636**	**472,694**	**429,210**	**413,387**	**399,386**	**404,026**	**415,838**

Appendix K.1 – Funding (Case 3)

Budget Authority in Constant FY01 Year Dollars

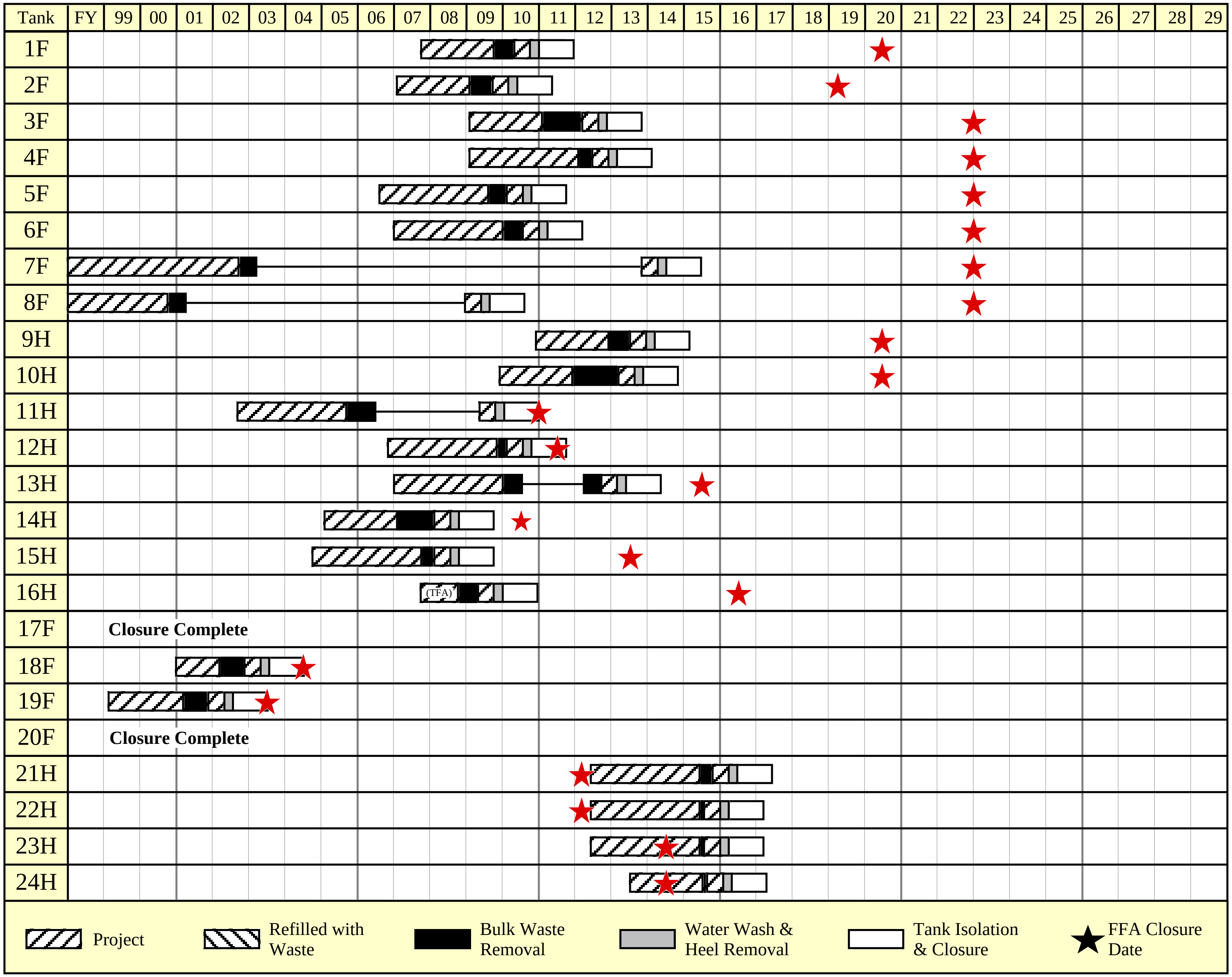
Project Title	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31	FY32	FY33
HL-01 H Tank Farm	50,686	48,748	32,661	28,111	4,686	-	-	-	-	-	-
HL-04 H Tank Farm East & Sludge Operations	54,349	53,380	53,380	52,412	52,412	52,412	-	-	-	-	-
HL-02 F Tank Farm	-	-	-	-	-	-	-	-	-	-	-
HL-03 Waste Removal & Tank Closures											
WR Ops w/ Demo Projects	3,351	3,351	-	-	-	-	-	-	-	-	-
Am/Cm	-	-	-	-	-	-	-	-	-	-	-
WR: Tank Closure	31,922	13,566	17,983	16,805	23,801	25,560	34,364	17,379	-	-	-
HL-03 Total	35,273	16,917	17,983	16,805	23,801	25,560	34,364	17,379	-	-	-
HL-12 LI: Waste Removal											
LI: WR from Tanks	24,645	19,781	7,573	1,612	5,889	7,756	9,523	-	-	-	-
LI: Vit Upgrades	-	-	-	-	-	-	-	-	-	-	-
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	-	-	-	-
HL-12 Total	24,645	19,781	7,573	1,612	5,889	7,756	9,523	-	-	-	-
HL-11 LI: Tk Fm Services Upgrade II	(0)	0	(0)	0	(0)	0	(0)	-	-	-	-
HL-05 Vitrification	116,463	109,798	108,836	108,981	99,334	-	-	-	-	-	-
HL-06 Glass Waste Storage	1,715	1,715	1,715	1,715	1,715	1,715	1,525	1,525	1,525	1,525	1,525
HL-13 Salt Disposition											
Salt Disposition Ops (inc ECP)	66,920	66,920	66,920	66,920	66,920	33,460	-	-	-	-	-
Low Curie	-	-	-	-	-	-	-	-	-	-	-
Actinide	0	0	0	0	0	0	0	0	-	-	-
LI: Salt Alternative	-	-	-	-	-	-	-	-	-	-	-
HL-13 Total	66,920	66,920	66,920	66,920	66,920	33,460	0	0	-	-	-
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	138,118	191,323	-	-	-	-	-
HLW TOTAL	**350,051**	**317,260**	**289,069**	**276,556**	**392,875**	**312,226**	**45,411**	**18,904**	**1,525**	**1,525**	**1,525**
HLW w/o Salt Total	**283,131**	**250,340**	**222,149**	**209,636**	**325,955**	**278,766**	**45,411**	**18,904**	**1,525**	**1,525**	**1,525**
Solid Waste Facilities											
ETF	17,206	17,206	17,206	8,603	6,452	4,839	942	-	-	-	-
SS	20,030	24,930	25,234	25,011	21,042	18,709	1,587	-	-	-	-
SW TOTAL	**37,236**	**42,136**	**42,440**	**33,614**	**27,494**	**23,548**	**2,529**	**-**	**-**	**-**	**-**
Life Cycle Cost	**387,287**	**359,396**	**331,508**	**310,170**	**420,368**	**335,774**	**47,940**	**18,904**	**1,525**	**1,525**	**1,525**

Appendix K.1 – Funding (Case 3)

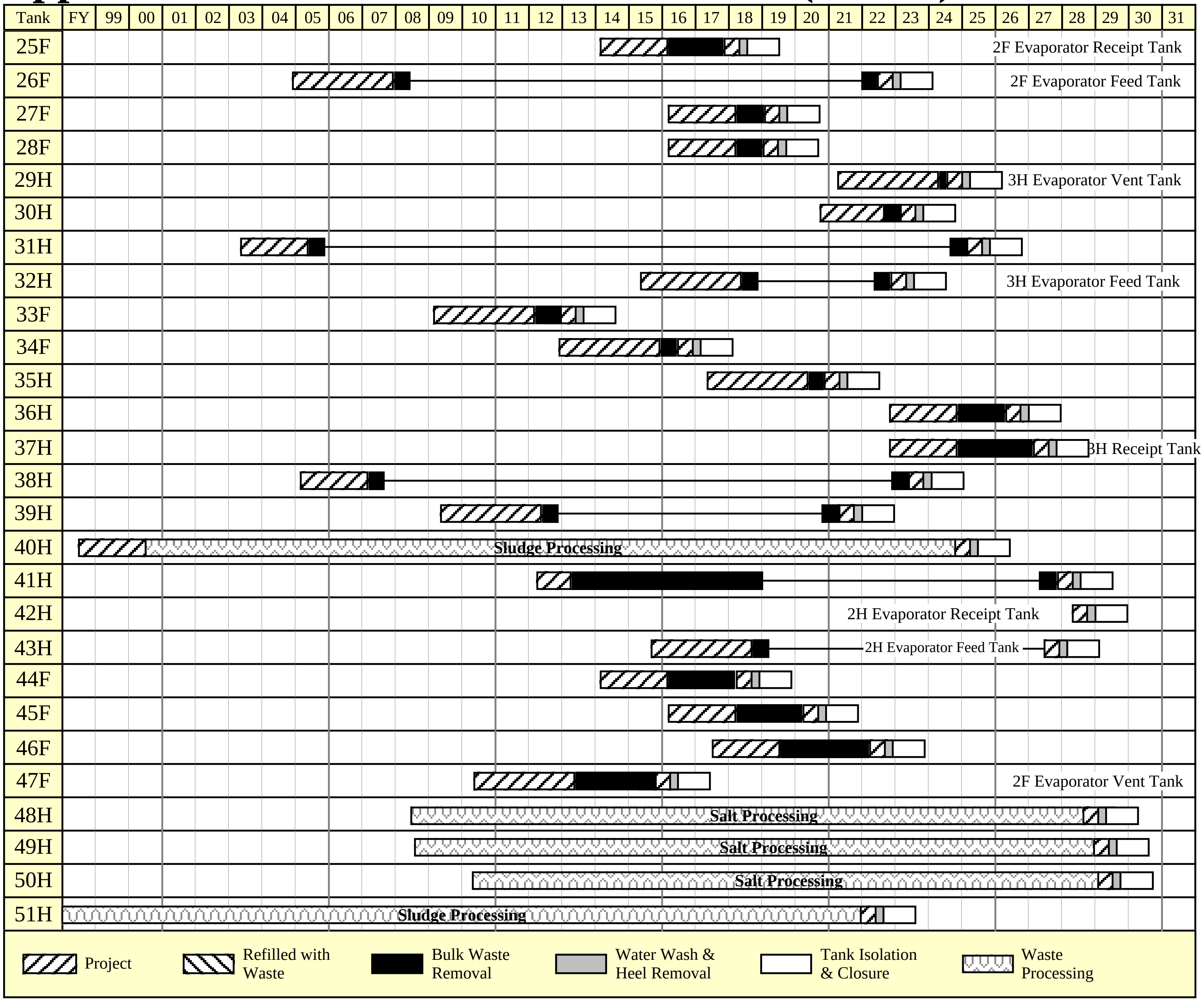
Budget Authority in Constant FY01 Year Dollars

Project Title	FY34	FY35	FY36	FY37	FY38	FY39	FY40	Cumulative FY02-FY40
HL-01 H Tank Farm	-	-	-	-	-	-	-	1,681,369
HL-04 H Tank Farm East & Sludge Operations	-	-	-	-	-	-	-	1,505,726
HL-02 F Tank Farm	-	-	-	-	-	-	-	1,095,499
HL-03 Waste Removal & Tank Closures								
WR Ops w/ Demo Projects	-	-	-	-	-	-	-	103,902
Am/Cm	-	-	-	-	-	-	-	23,068
WR: Tank Closure	-	-	-	-	-	-	-	483,405
HL-03 Total	-	-	-	-	-	-	-	610,376
HL-12 LI: Waste Removal								
LI: WR from Tanks	-	-	-	-	-	-	-	826,782
LI: Vit Upgrades	-	-	-	-	-	-	-	156,384
LI: Piping, Evaps & Infrastructure	-	-	-	-	-	-	-	30,970
HL-12 Total	-	-	-	-	-	-	-	1,014,136
HL-11 LI: Tk Fm Services Upgrade II	-	-	-	-	-	-	-	9,284
HL-05 Vitrification	-	-	-	-	-	-	-	2,958,090
HL-06 Glass Waste Storage	1,525	1,525	1,525	1,525	1,525	1,525	1,525	137,243
HL-13 Salt Disposition								
Salt Disposition Ops (inc ECP)	-	-	-	-	-	-	-	1,217,409
Low Curie	-	-	-	-	-	-	-	9,631
Actinide	-	-	-	-	-	-	-	81,339
LI: Salt Alternative	-	-	-	-	-	-	-	1,097,690
HL-13 Total	-	-	-	-	-	-	-	2,424,916
FA-24 Facility Decontamination/ Decommissioning	-	-	-	-	-	6,463	-	335,904
HLW TOTAL	**1,525**	**1,525**	**1,525**	**1,525**	**1,525**	**7,988**	**1,525**	**11,772,542**
HLW w/o Salt Total	**1,525**	**1,525**	**1,525**	**1,525**	**1,525**	**7,988**	**1,525**	**9,347,626**
Solid Waste Facilities								
ETF	-	-	-	-	-	-	-	444,439
SS	-	-	-	-	-	-	-	536,061
SW TOTAL	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**980,500**
Life Cycle Cost	**1,525**	**1,525**	**1,525**	**1,525**	**1,525**	**7,988**	**1,525**	**12,753,042**

Appendix K.2 – Waste Removal Schedule (Case 3)



Appendix K.2 – Waste Removal Schedule (Case 3)



Appendix K.3 – Tank Farm Volume Balance (Case 3)

End of Fiscal Year	Influents (gallons) (1)									Effluents (gallons) (1)								Total Inventory (gallons)
	F-Canyon	H-Canyon	DWPF Recycle	299-H	RBOF	ETF (3)	Inhibited Water	Other	**Total In**	Space Recovery from Evaporation: 2F Evap	Space Recovery from Evaporation: 2H Evap	Space Recovery from Evaporation: 3H Evap	Salt Solution to Saltstone (4)	Salt Solution to Processing	Sludge to DWPF	Other	**Total Out**	
FY01																	Beginning Volume	**38,630,957**
FY02 (2)	796,651	327,572	913,305	13,907	92,987	93,988	1,356,052	371,078	**3,965,540**	852,913	2,101,211	3,140,371	837,000	-	133,419	62,788	**7,127,701**	**35,468,796**
FY03	192,000	365,780	1,379,240	12,000	120,000	-	2,626,674	184,933	**4,880,628**	791,188	1,871,029	2,086,563	2,085,457	-	176,348	181,963	**7,192,548**	**33,156,876**
FY04	132,000	398,720	1,379,240	12,000	120,000	-	1,940,276	204,125	**4,186,361**	1,340,150	1,895,304	571,672	1,383,018	-	165,600	10,569	**5,366,313**	**31,976,924**
FY05	202,000	315,780	955,650	12,000	120,000	-	2,024,735	359,875	**3,990,040**	1,344,677	1,704,378	606,609	1,750,945	-	139,497	49,362	**5,595,468**	**30,371,496**
FY06	252,000	422,100	879,593	12,000	60,000	-	2,633,357	221,269	**4,480,319**	807,001	1,139,595	1,737,084	2,498,337	-	116,247	128,795	**6,427,059**	**28,424,756**
FY07	182,000	559,200	1,173,200	12,000	-	-	3,681,448	139,843	**5,747,691**	315,125	1,210,415	1,153,845	2,430,000	-	99,593	332,369	**5,541,347**	**28,631,100**
FY08	132,000	417,200	1,806,119	12,000	-	-	1,885,216	115,586	**4,368,121**	259,189	1,561,484	1,812,303	270,000	1,200,000	99,593	64,296	**5,266,865**	**27,732,356**
FY09	-	184,000	2,231,079	12,000	-	-	3,016,631	50,144	**5,493,853**	557,565	2,155,066	355,464	-	1,200,000	220,331	216,896	**4,705,321**	**28,520,888**
FY10	-	120,000	2,231,079	12,000	-	-	2,806,888	71,448	**5,241,415**	-	2,144,096	2,298,474	-	1,200,000	240,944	62,499	**5,946,013**	**27,816,290**
FY11	-	-	2,231,079	12,000	-	-	1,926,752	46,410	**4,216,241**	-	2,104,448	710,673	-	1,200,000	139,769	302,951	**4,457,841**	**27,574,690**
FY12	-	-	2,231,079	12,000	-	-	1,777,781	225,042	**4,245,902**	-	2,011,626	1,263,482	-	1,200,000	116,421	79,394	**4,670,922**	**27,149,670**
FY13	-	-	2,231,079	12,000	-	-	5,894,481	72,937	**8,210,497**	-	1,868,005	2,294,542	-	4,200,000	127,583	248,539	**8,738,669**	**26,621,498**
FY14	-	-	2,231,079	12,000	-	-	974,357	147,514	**3,364,950**	-	2,260,081	-	-	4,200,000	141,935	71,021	**6,673,036**	**23,313,412**
FY15	-	-	2,231,079	12,000	-	-	2,901,199	214,453	**5,358,731**	-	2,548,716	890,966	-	4,200,000	141,935	266,871	**8,048,487**	**20,623,656**
FY16	-	-	2,231,079	12,000	-	-	5,539,173	178,949	**7,961,201**	-	2,294,286	1,975,359	-	4,104,476	141,935	162,376	**8,678,431**	**19,906,426**
FY17	-	-	2,231,079	12,000	-	-	2,230,867	490,887	**4,964,834**	-	2,253,117	224,223	-	4,198,978	194,787	134,275	**7,005,380**	**17,865,880**
FY18	-	-	2,231,079	12,000	-	-	4,095,141	199,542	**6,537,762**	-	1,578,531	76,380	-	4,199,688	199,592	76,314	**6,130,504**	**18,273,138**
FY19	-	-	2,231,079	12,000	-	-	5,184,441	368,683	**7,796,203**	-	2,650,813	1,897,430	-	4,200,000	198,014	217,186	**9,163,443**	**16,905,898**
FY20	-	-	2,231,079	12,000	-	-	3,877,893	367,889	**6,488,861**	-	2,662,214	1,114,499	-	4,200,000	188,775	17,193	**8,182,681**	**15,212,078**
FY21	-	-	2,231,079	12,000	-	-	2,083,397	309,620	**4,636,095**	-	2,311,849	739,957	-	4,200,000	174,076	47,459	**7,473,341**	**12,374,832**
FY22	-	-	2,231,079	12,000	-	-	2,970,662	187,567	**5,401,308**	-	2,311,318	-	-	4,200,000	124,634	42,196	**6,678,148**	**11,097,992**
FY23	-	-	2,231,079	12,000	-	-	3,756,338	317,897	**6,317,315**	-	2,253,027	-	-	4,200,000	124,634	77,113	**6,654,774**	**10,760,533**
FY24	-	-	2,231,079	12,000	-	-	1,861,885	514,512	**4,619,477**	-	2,349,633	-	-	4,200,000	75,300	30,970	**6,655,903**	**8,724,107**
FY25	-	-	2,231,079	12,000	-	-	4,043,267	319,544	**6,605,890**	-	2,329,220	-	-	4,200,000	-	154,696	**6,683,916**	**8,646,081**
FY26	-	-	1,786,192	10,000	-	-	1,615,333	419,064	**3,830,588**	-	1,860,391	-	-	4,200,000	-	-	**6,060,391**	**6,416,279**
FY27	-	-	-	-	-	-	1,171,777	145,630	**1,317,408**	-	-	-	-	4,200,000	-	14,317	**4,214,317**	**3,519,369**
FY28	-	-	-	-	-	-	99,918	3,187	**103,105**	-	-	-	-	3,547,221	-	0	**3,547,222**	**75,252**

Notes:

1) Discussion of the components of the Influents and Effluents is contained in Section 5.1.3 "HLW System Material Balance"
2) FY02 includes actual values obtained from "HLW Morning Reports" for the time period between 10/1/2001 and 1/7/2002.
3) ETF evaporator effluents are assumed to be sent directly to Saltstone after FY02 and are not included in this tabulation.
4) Salt solution to Saltstone values do not include filtrate generated from the Salt Waste Processing Facility

Appendix K.4 – Salt Solution Processing (Case 3)

End of Fiscal Year	Total Salt Solution from Tank Farms (kgal)	Salt Solution processed via Low Curie and Actinide Removal (kgal)	Salt Solution processed via Salt Waste Processing Facility (kgal)	Feed Stream to Saltstone (kgal)	ETF to Saltstone (kgal)	Grout Produced (kgal)	Vault Number
FY02					837	1,481	4
FY03	2,085	2,085	0	2,085	180	4,010	4
FY04	1,383	1,383	0	1,674	180	3,281	4
FY05	1,751	1,751	0	2,242	180	4,287	4
FY06	2,498	2,498	0	3,199	180	5,981	1
FY07	2,430	2,430	0	3,111	180	5,826	2
FY08	1,470	270	1,200	1,546	180	3,055	2
FY09	1,200	0	1,200	1,536	180	3,038	2
FY10	1,200	0	1,200	1,536	180	3,038	2
FY11	1,200	0	1,200	1,536	180	3,038	3
FY12	1,200	0	1,200	1,536	180	3,038	3
FY13	4,200	0	4,200	5,529	180	10,105	5
FY14	4,200	0	4,200	5,529	180	10,105	6
FY15	4,200	0	4,200	5,529	180	10,105	7
FY16	4,104	0	4,104	5,402	180	9,880	8
FY17	4,199	0	4,199	5,528	180	10,103	9
FY18	4,200	0	4,200	5,529	180	10,104	9
FY19	4,200	0	4,200	5,529	180	10,105	10
FY20	4,200	0	4,200	5,529	180	10,105	11
FY21	4,200	0	4,200	5,529	180	10,105	12
FY22	4,200	0	4,200	5,529	180	10,105	13
FY23	4,200	0	4,200	5,529	180	10,105	14
FY24	4,200	0	4,200	5,529	180	10,105	15
FY25	4,200	0	4,200	5,529	180	10,105	16
FY26	4,200	0	4,200	5,529	180	10,105	17
FY27	4,200	0	4,200	5,529	180	10,105	18
FY28	3,547	0	3,547	4,660	180	8,567	19
Total	**82,868**	**10,418**	**72,450**	**107,471**	**5,517**	**199,988**	**19**

Notes:

1 FY02 ETF to Saltstone represents the recovery of Tank 50 (Saltstone Feed Tank) for use as a Salt Processing Tank by transfering the entire contents to the Saltstone Facility.

2 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.

3 Each gallon of feed, when added to the cement, flyash, and slag makes 1.77 gallons of grout. Each cell is estimated to contain 1,814 kgal of grout. Therefore each cell holds 1,025 kgal of feed solution.

Appendix K.5 – Sludge Processing (Case 3)

	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	495	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	726	2.96	12/1/01	51	25.0
	Total	**420,861**										(Included use of ~70 cans of Tank 51 heel)				
2	8	175,883			1,374	6.24	0.30	16.0	600	600	12/15/01	470	2.31	4/5/04	40	27.5
	40	261,867								-140	(Assumes DWPF outage in 4thQ FY02)					
	Total	**437,750**								460						
3	7 (70%)	291,587	2/10/03	14	1,684	6.22	0.07	16.0	473	473	4/5/04	409	2.47	9/24/06	51	28.8
	18 (70%)	16,076														
	Total	**307,663**														
4	7 (30%)	124,966	9/6/05	13	1,210	8.86	1.70	16.0	426	426	10/1/06	386	2.16	11/26/08	40	31.3
	11	124,380														
	18 (30%)	6,889														
	Total	**256,235**														
5	15	165,818	6/5/07	18	2,231	10.91	1.45	16.0	665	665	11/26/08	470	2.04	12/12/10	51	33.0
	26	154,896									(Assume coupled salt and sludge feed starts in April 2010)					
	Total	**320,714**														
6	5	57,630	6/20/09	18	3,096	7.55	2.20	16.0	450	450	12/12/10	546	2.37	4/26/13	40	35.1
	6	38,708														
	12	189,715														
	13 (30%)	125,268														
	Total	**411,321**														
7	13 (70%)	292,293	11/3/11	18	3,801	7.28	1.67	16.0	699	699	4/26/13	810	3.52	11/1/16	51	32.5
	4	65,477														
	33 (60%)	106,290														
	39 (40%)	42,522														
	Total	**506,582**														
8	21	6,393	5/11/15	18	2,925	7.14	0.94	16.0	726	726	11/1/16	641	2.79	8/16/19	40	34.8
	22	13,265														
	23	59,110														
	33 (40%)	70,860														
	34	77,119														
	39 (60%)	63,783														
	47	137,763														
	Total	**428,293**														

Appendix K.5 – Sludge Processing (Case 3)

	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 %)
9	32	214,886	3/24/18	17	2,688	8.80	3.92	16.0	502	472	8/16/19	441	1.92	7/16/21	51	35.2
	43	114,393														
	Total	**329,279**														
10	ESP Heels (Tks 40,42,51)	158,377	3/23/20	16	1,123	10.86	4.27	16.0	462	462	7/16/21	647	2.81	5/7/24	40	40.0
	35	138,956														
	Other Insoluble Solids	219,000														
	Total	**516,333**														
Totals		**3,935,031**			**20,132**	**Total Estimated Washwater**						**6,041**	**Total Estimated Cans**			

Notes:

General) Above based on the following yearly canister production values: FY02 150 cans/yr, FY03 240 cans/yr, FY04 240 cans/yr, FY05 150 cans/yr, FY06 143 cans/yr, FY07 200 cans/yr, FY08 150 cans/yr, FY09-End 230 cans/yr.

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

B) Sludge in these tanks will comprise the batch. Note: 100% of the sludge from Tanks 7 and 18 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 SpaceMan II results. This is the sludge volume plus no more than 18" of free supernate. If less supernate is shown in the model, then the total feed tank volume is reported.

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 1B and estimated for remaining batches.

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.6 - Canister Storage (Case 3)

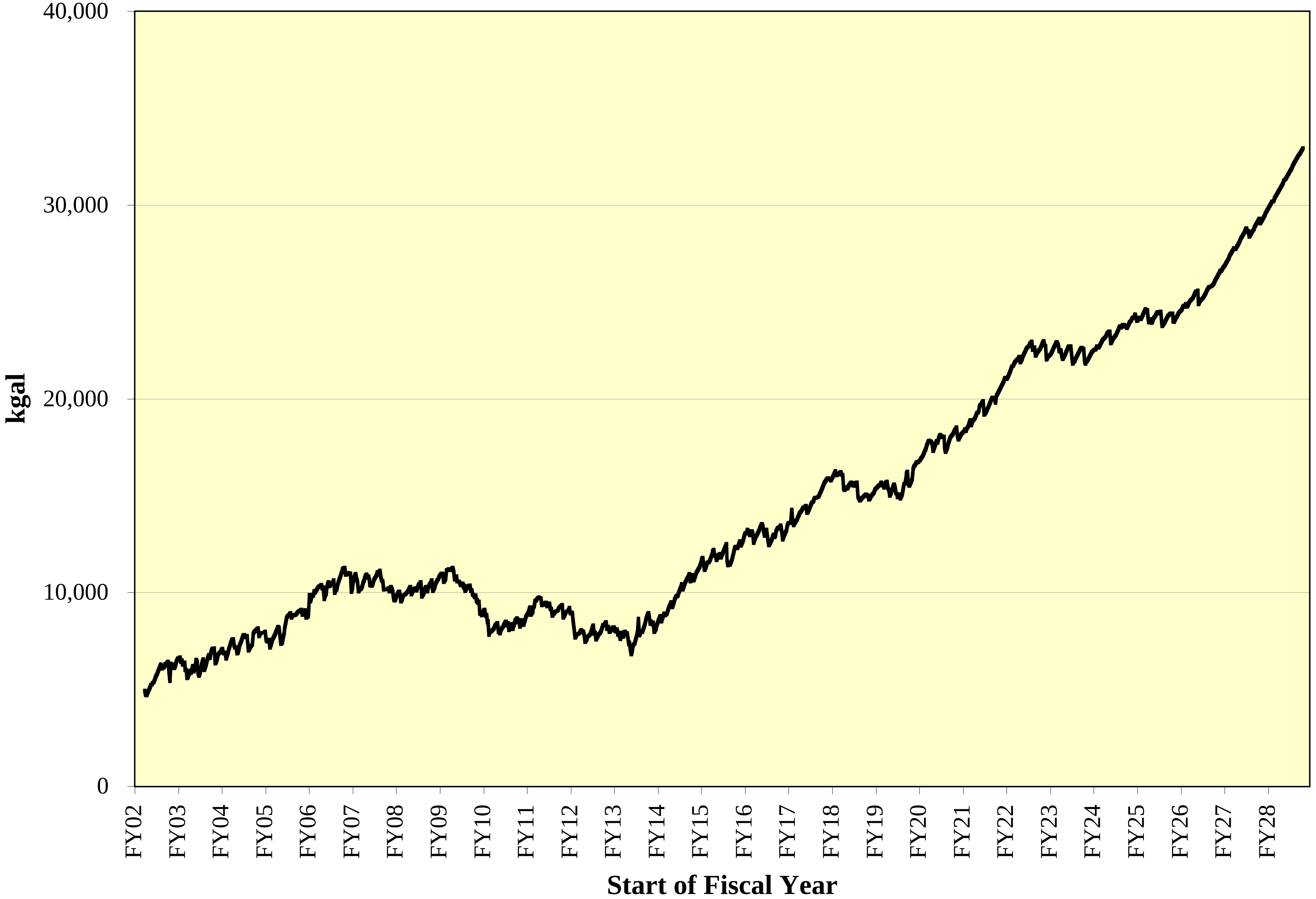
End of FY	SRS Cans Produced		SRS Cans in GWSB #1 (2,159 max)			SRS Cans in Modular Storage (2 buildings @ 585 each)			SRS Cans Shipped to Repository		Net Cans Stored At SRS
	Yearly	Cum.	Added	Shipped	Cum.	Added	Shipped	Cum.	Each Year	Cumulative	
1996	64	64	64		64						64
1997	169	233	169		233						233
1998	250	483	250		483						483
1999	236	719	236		719						719
2000	231	950	231		950						950
2001	227	1,177	227		1,177						1,177
2002	150	1,327	150		1,327						1,327
2003	240	1,567	240		1,567						1,567
2004	240	1,807	240		1,807						1,807
2005	150	1,957	150		1,957	0		0			1,957
2006	143	2,100	143		2,100	0		0			2,100
2007	200	2,300	59		2,159	141		141			2,300
2008	150	2,450	0		2,159	150		291			2,450
2009	230	2,680	0		2,159	230		521			2,680
2010	230	2,910	0	(105)	2,054	230		751	105	105	2,805
2011	230	3,140	0	(205)	1,849	230	0	981	205	310	2,830
2012	230	3,370	41	(205)	1,685	189	0	1,170	205	515	2,855
2013	230	3,600	230	(205)	1,710	0	0	1,170	205	720	2,880
2014	230	3,830	230	(205)	1,735	0	0	1,170	205	925	2,905
2015	230	4,060	230	(205)	1,760	0	0	1,170	205	1,130	2,930
2016	230	4,290	230	(205)	1,785	0	0	1,170	205	1,335	2,955
2017	230	4,520	230	(205)	1,810	0	0	1,170	205	1,540	2,980
2018	230	4,750	230	(205)	1,835	0	0	1,170	205	1,745	3,005
2019	230	4,980	230	(205)	1,860	0	0	1,170	205	1,950	3,030
2020	230	5,210	230	(205)	1,885	0	0	1,170	205	2,155	3,055
2021	230	5,440	230	(205)	1,910	0	0	1,170	205	2,360	3,080
2022	230	5,670	230	(205)	1,935	0	0	1,170	205	2,565	3,105
2023	230	5,900	230	(205)	1,960	0	0	1,170	205	2,770	3,130
2024	141	6,041	141	(205)	1,896	0	0	1,170	205	2,975	3,066
2025	30	6,071	30	(205)	1,721	0	0	1,170	205	3,180	2,891
2026	30	6,101	30	(205)	1,546	0	0	1,170	205	3,385	2,716
2027	19	6,120	19	(205)	1,360	0	0	1,170	205	3,590	2,530
2028	0	6,120		(205)	1,155	0	0	1,170	205	3,795	2,325
2029	0	6,120		(205)	950	0	0	1,170	205	4,000	2,120
2030	0	6,120		(205)	745	0	0	1,170	205	4,205	1,915
2031	0	6,120		(205)	540	0	0	1,170	205	4,410	1,710
2032	0	6,120		(205)	335	0	0	1,170	205	4,615	1,505
2033	0	6,120		(205)	130	0	0	1,170	205	4,820	1,300
2034	0	6,120		(130)	0	0	(75)	1,095	205	5,025	1,095
2035	0	6,120		0	0	0	(205)	890	205	5,230	890
2036	0	6,120		0	0	0	(205)	685	205	5,435	685
2037	0	6,120		0	0	0	(205)	480	205	5,640	480
2038	0	6,120		0	0	0	(205)	275	205	5,845	275
2039	0	6,120		0	0	0	(205)	70	205	6,050	70
2040	0	6,120			0		(70)	0	70	6,120	

Appendix K.6 - Canister Storage (Case 3)

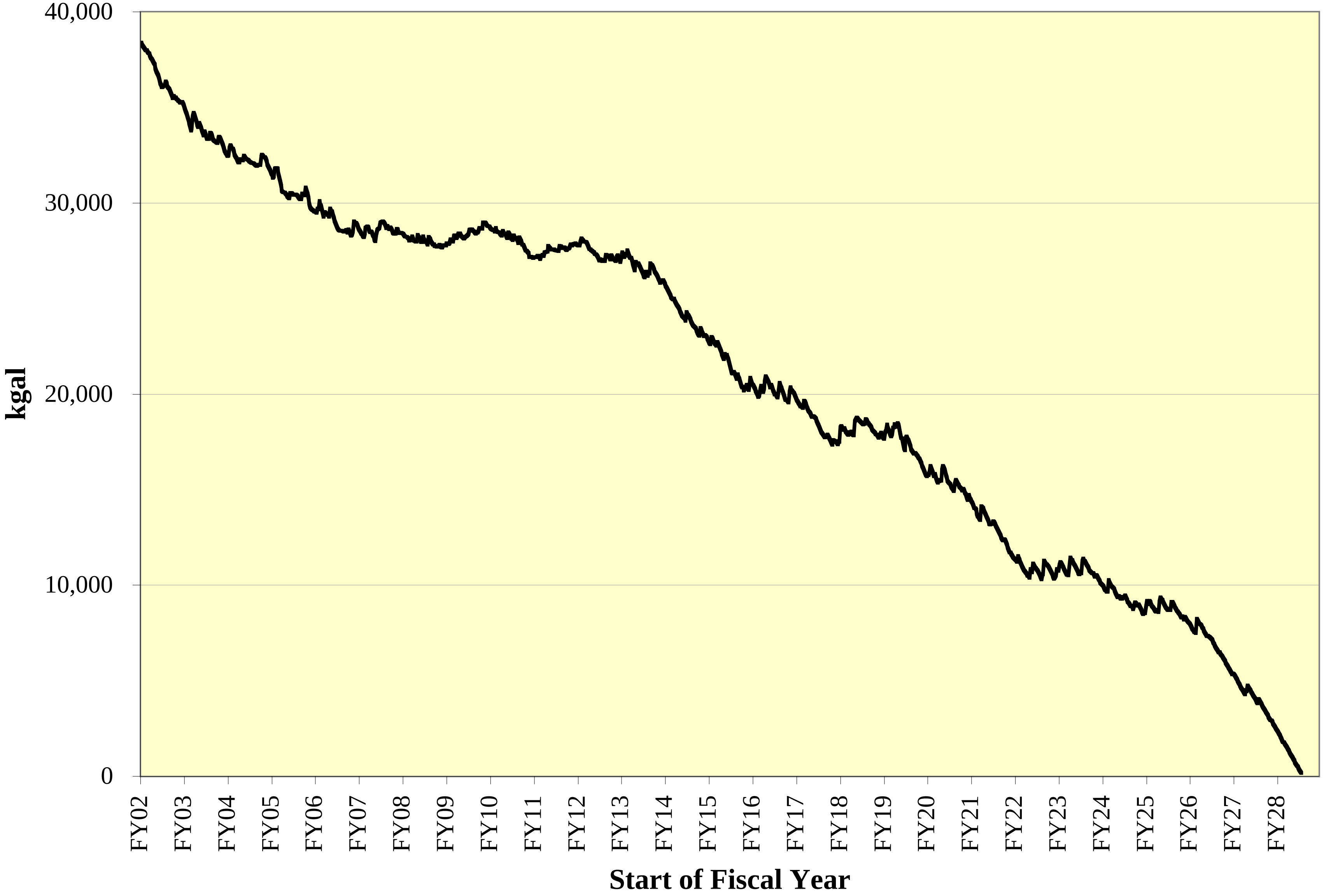
Notes:

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 modularized buildings. The first building, GWSB #2A, will be needed in FY07. 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 FY34
7) GWSB #2A will be emptied and available for D&D in FY40.
8) The Plan does not include additional locations in GWSB #2A for spent fuels materials. The addition of these materials could require additional buildings.

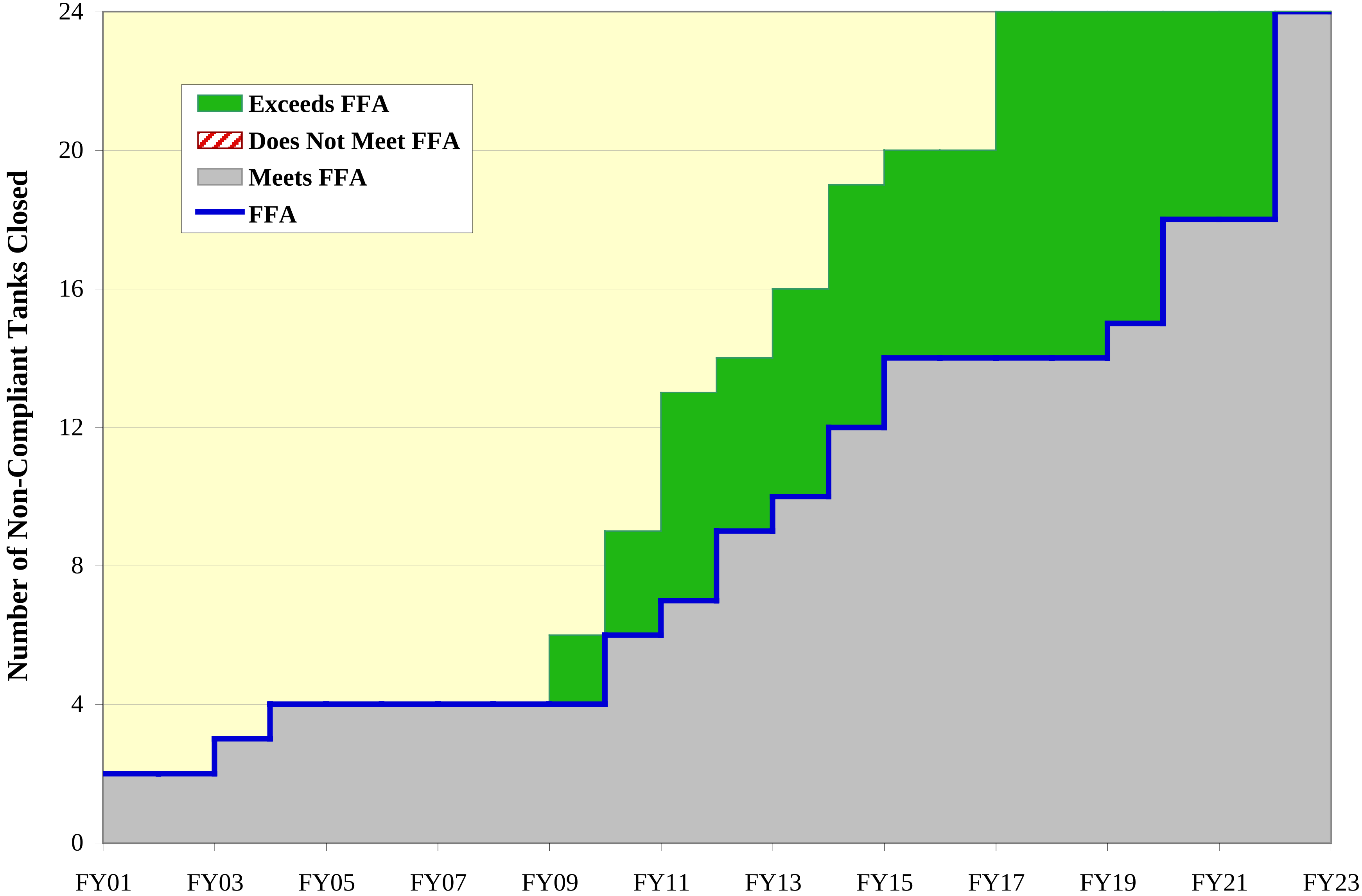
Appendix K.7 – Useable Type III Tank Space (Case 3)



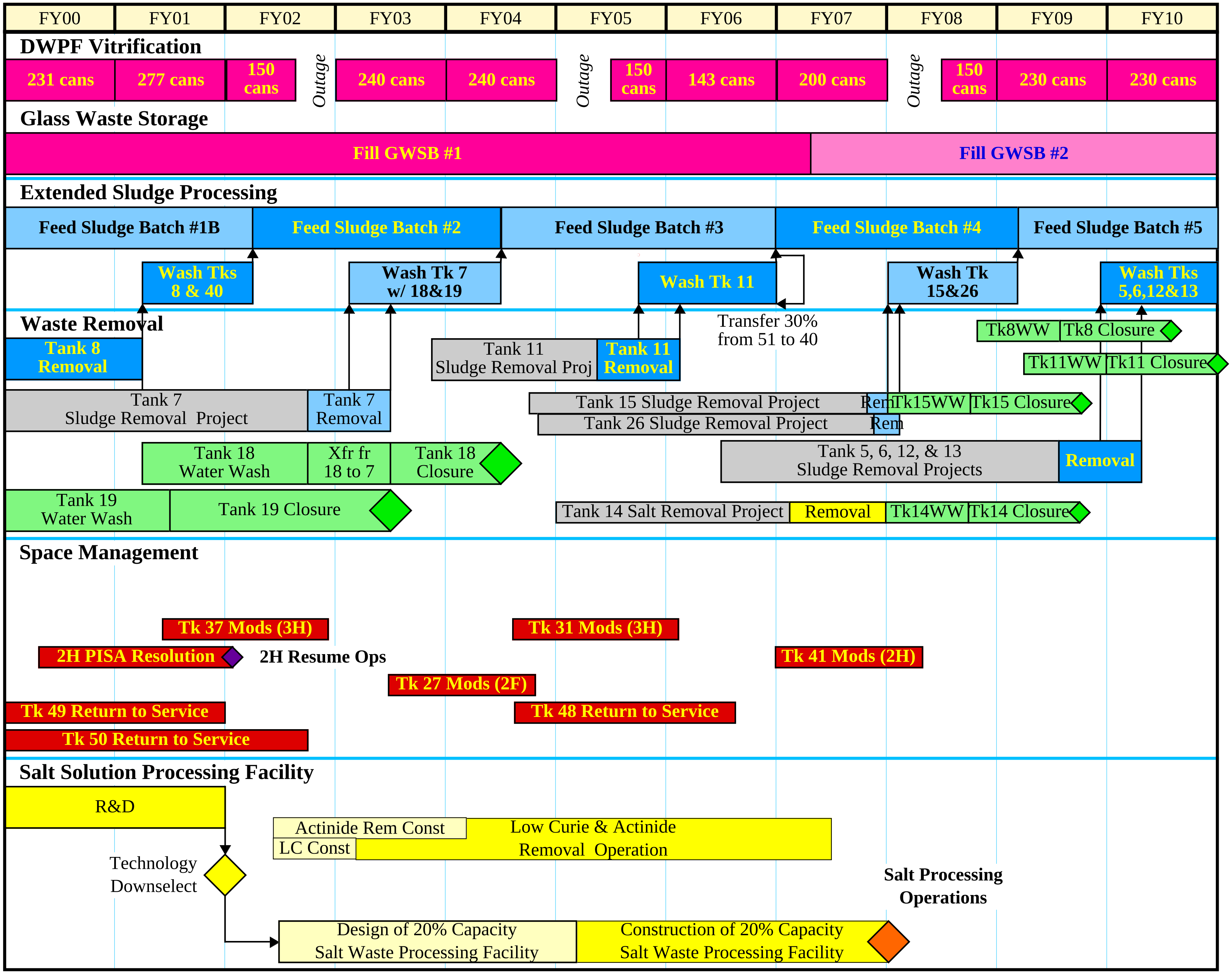
Appendix K.8 – Remaining Tank Inventory (Case 3)



Appendix K.9 – Tank Closures (Case 3)



Appendix K.10 – Level 1 Schedule (Case 3)



Appendix L – Case Comparisons

This appendix contains several charts that offer comparisons of the three cases and, in most instances, with Revision 12.

Key Milestone	Rev 12 Base Case	Rev 12 Stretch Case	Rev 12 Super Stretch Case	Rev 13 Case 1	Rev 13 Case 2	Rev 13 Case 3
Total Number of Canisters Produced	5,914	5,914	5,871	6,041	6,041	6,120
DWPF Sludge Production (in average canisters per year)						
• FY01	163	220	255	227(Act)	227(Act)	227(Act)
• FY02	111	150	150	150	150	150
• FY03	155	210	240	210	210	240
• FY04	163	220	240	220	220	240
• FY05	111	150	150	150	150	150
• FY06	147	200	115	193	193	143
• FY07	200	Outage	200	Outage	Outage	200
• FY08	107	Outage	200	Outage	Outage	150
• FY09	Outage	Outage	200	Outage	Outage	230
• FY10	150	100	150	200	150	230
• FY11	200	230	250	200	230	230
• FY12	200	230	250	150	230	230
• FY13 to End of Sludge Processing	200	230	250	230	230	230
• Salt-only Cans at End of Program	0	0	0	0	0	79
Salt Processing Information						
• Low Curie and Actinide Success				No	Yes	Yes
• Years Processed				n/a	FY03-05	FY03-07
• Saltcake Processed				n/a	1.5 Mgal	3.0 Mgal
Date Salt Waste Processing Facility Becomes Operational	FY10	FY10	FY10	FY12	FY10	FY08
• % Operational Flowrate (100% equals 6 Mgal/yr at 6.44 [Na])	100%	100%	100%	10%	15%	20%
Date Additional Salt Waste Processing Capacity provided				FY16	FY15	FY13
• % Additional Operational Flowrate (100% equals 6 Mgal/yr at 6.44 [Na])	n/a	n/a	n/a	100%	80%	50%
• Max Yearly % Operational Flowrate	100%	100%	100%	110%	95%	70%
Salt Solution Processing Rate(Kgal/yr)						
• FY08						1,200
• FY09						1,200
• FY10	3,000	3,000	3,000		900	1,200
• FY11	6,000	6,000	6,000		900	1,200
• FY12	6,000	6,000	6,000	600	900	1,200
• FY13	6,000	6,000	6,000	600	900	4,200
• FY14	6,000	6,000	6,000	600	900	4,200
• FY15	6,000	6,000	6,000	600	5,700	4,200
• FY16 until end of program	6,000	6,000	6,000	6,600	5,700	4,200

Appendix L – Case Comparisons

Key Milestone	Rev 12 Base Case	Rev 12 Stretch Case	Rev 12 Super Stretch Case	Rev 13 Case 1	Rev 13 Case 2	Rev 13 Case 3
Key Risk Reduction Dates						
Date when all "high risk" tanks are emptied	FY16	FY16	FY14	FY18	FY15	FY13
Date when all "non-compliant" tanks are emptied	FY19	FY17	FY15	FY18	FY18	FY15
Date when all "non-compliant" Tanks are closed	FY21	FY20	FY18	FY20	FY20	FY17
Date by which salt processing is completed	FY24	FY22	FY22	FY27	FY27	FY28
Date by which sludge processing is completed	FY29	FY27	FY23	FY27	FY27	FY24
Regulatory Commitments						
Are all STP commitments met?	No	Yes	Yes	Yes	Yes	Yes
Are all FFA regulatory commitments met?	No	No	Yes*	No	No	Yes*
	* Yearly closure commitments (total number of tanks/yr) are met					
Canister Storage Locations						
• Make additional 450 GWSB #1 locations usable	FY05-07	FY03-05	FY03-05	By FY04	By FY04	By FY04
• Begin work on additional Canister Storage locations (GWSB #2 or Privatized Modules)	Module #1 FY07	Module #1 FY10	Module #1 FY04 Module #2 FY07	Module #1 FY07	Module #1 FY08	Module #1 FY04 Module #2 FY07
• Place GWSB #2 or Privatized Modules into Radioactive Operations	Module #1 FY10	Module #1 FY13	Module #1 FY07 Module #2 FY10	Module #1 FY10	Module #1 FY11	Module #1 FY07 Module #2 FY10
Waste Removal						
• Tank 7 ready for sludge removal	Oct-03	Jul-02	Jul-02	Jul-02	Jul-02	Jul-02
• Tank 11 ready for sludge removal	Apr-08	Apr-08	Apr-05	Apr-08	Apr-08	Apr-05
• Tank 26 ready for sludge removal	Dec-10	Jan-11	Sep-07	May-10	May-10	Jul-07
Tank Closures						
• Complete closure of Tank 19	Apr-03	Apr-03	Apr-03	Apr-03	Apr-03	Apr-03
• Complete closure of Tank 18	Apr-04	Apr-04	Apr-04	Apr-04	Apr-04	Apr-04
• Complete closure of 5th Tank	FY10	FY10	FY08	FY10	FY10	FY09
• Complete closure of 6th Tank	FY11	FY11	FY09	FY10	FY10	FY09
• Complete closure of 7th Tank	FY13	FY13	FY10	FY10	FY10	FY10
• Complete closure of 24th Tank	FY21	FY20	FY19	FY20	FY20	FY17

Appendix L – Case Comparisons

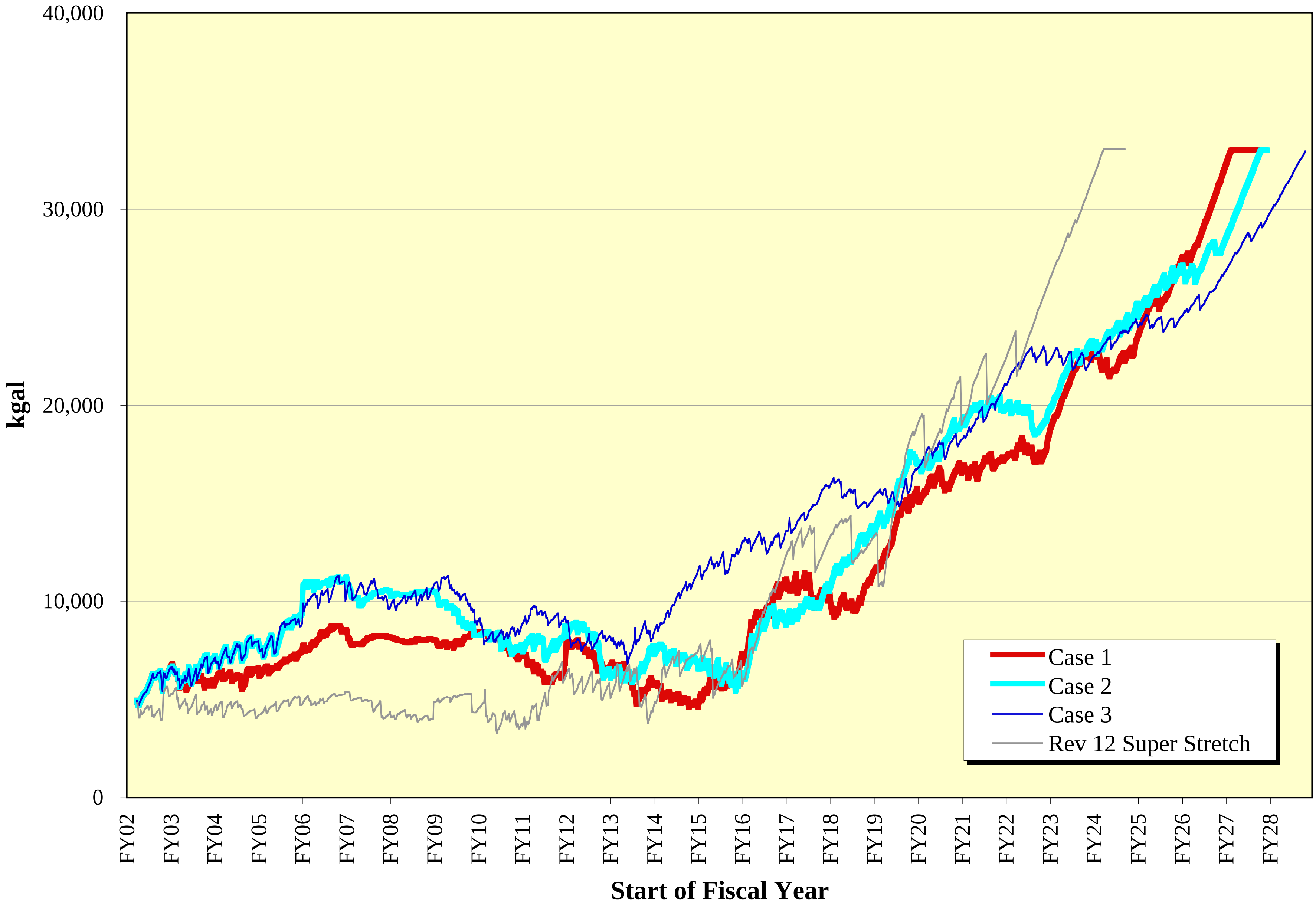
Key Milestone	Rev 12 Base Case	Rev 12 Stretch Case	Rev 12 Super Stretch Case	Rev 13 Case 1	Rev 13 Case 2	Rev 13 Case 3
Key Space Management Activities						
• Return Tank 48 for waste storage/ Salt Feed tank service	FY10	FY10	FY10	FY12	FY06	FY06
• Reuse Tank 49 for waste storage	Jul-01	Jul-01	Jul-01	Jul-01	Jul-01	Jul-01
• Reuse Tank 50 for waste storage	Sep-02	Sep-02	Sep-02	Jul-02	Jul-02	Jul-02
• Tank 37 modification completed for 3H Evaporator Drop Tank	Sep-02	Sep-02	Sep-02	Aug-02	Aug-02	Aug-02
• Tank 37 Salt Dissolution #2	n/a	Mar-05	Mar-04	Jan-04	Jan-04	Jan-04
• Tank 37 Salt Dissolution #3	n/a	n/a	n/a	Oct-06	Oct-06	n/a
• Tank 37 Salt Dissolution #4	n/a	n/a	n/a	Oct-13	n/a	n/a
• Tank 31 modification completed for 3H Evaporator Drop Tank	n/a	n/a	n/a	n/a	n/a	Nov-06
• Tank 27 modification completed for 2F Evaporator Drop Tank	Mar-06	May-06	Feb-05	Jul-04	Jul-04	Jul-04
• Tank 42 modification completed for 2H Evaporator Drop Tank	Feb-12	Feb-11	Feb-10	n/a	n/a	n/a
• Tank 41 modification completed for 2H Evaporator Drop Tank	n/a	n/a	n/a	Oct-06	Oct-06	Oct-06
Repository Activities						
• Start shipping canisters to the Federal Repository	FY10	FY10	FY10	FY10	FY10	FY10
• Complete shipping canisters to Federal Repository	FY39	FY39	FY39	FY39	FY39	FY40
Facility Deactivation Complete	FY40	FY40	FY40	FY40	FY40	FY41

Appendix L Contents

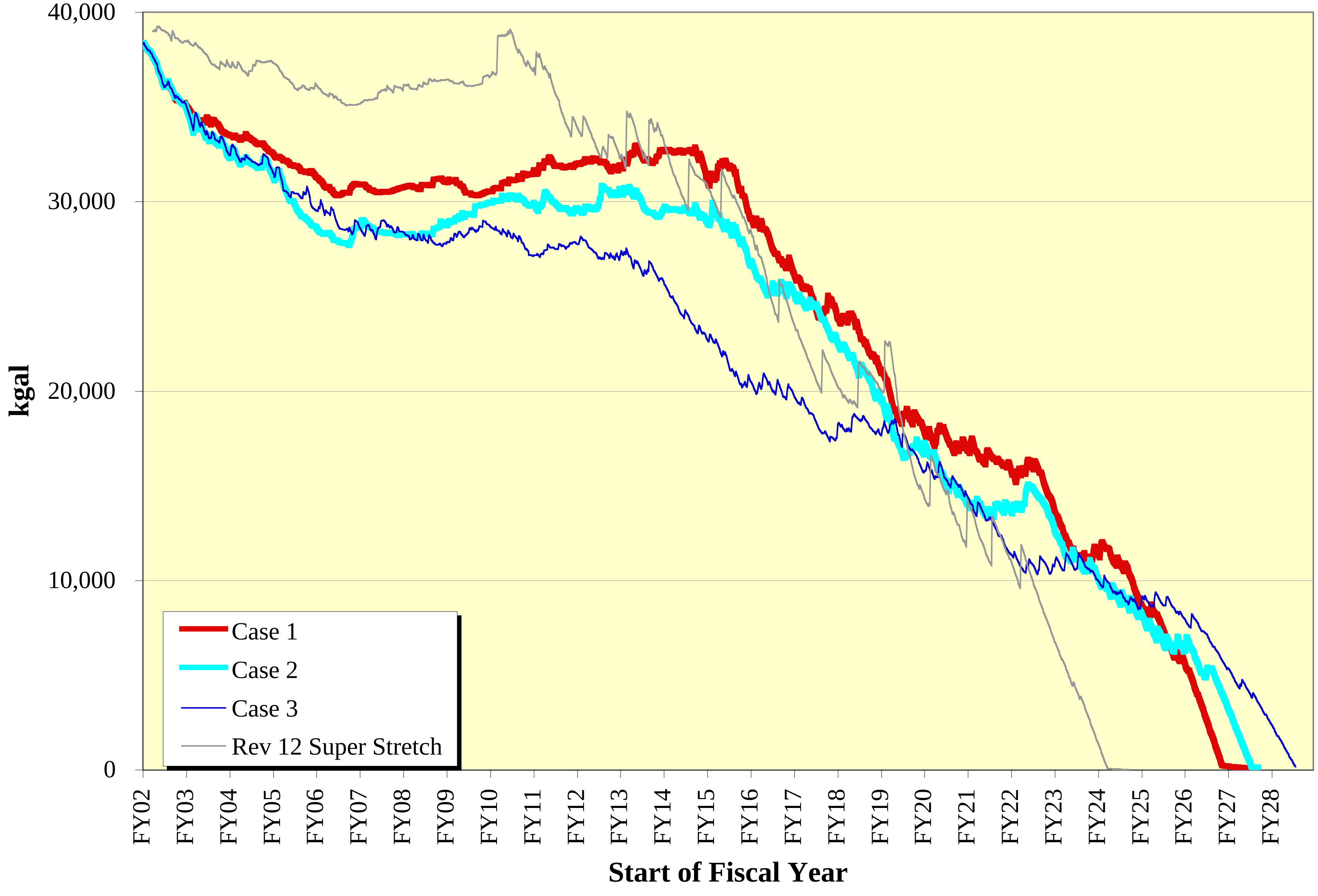
This appendix provides a comparison of:

- Useable Tank Space
- Remaining Tank Inventory
- Remaining Inventory in Non-Compliant Tanks
- Inventory of the amount of waste in Types I, II, III, and IV tanks
- Evaporator Feed
- Evaporator Space Recovery

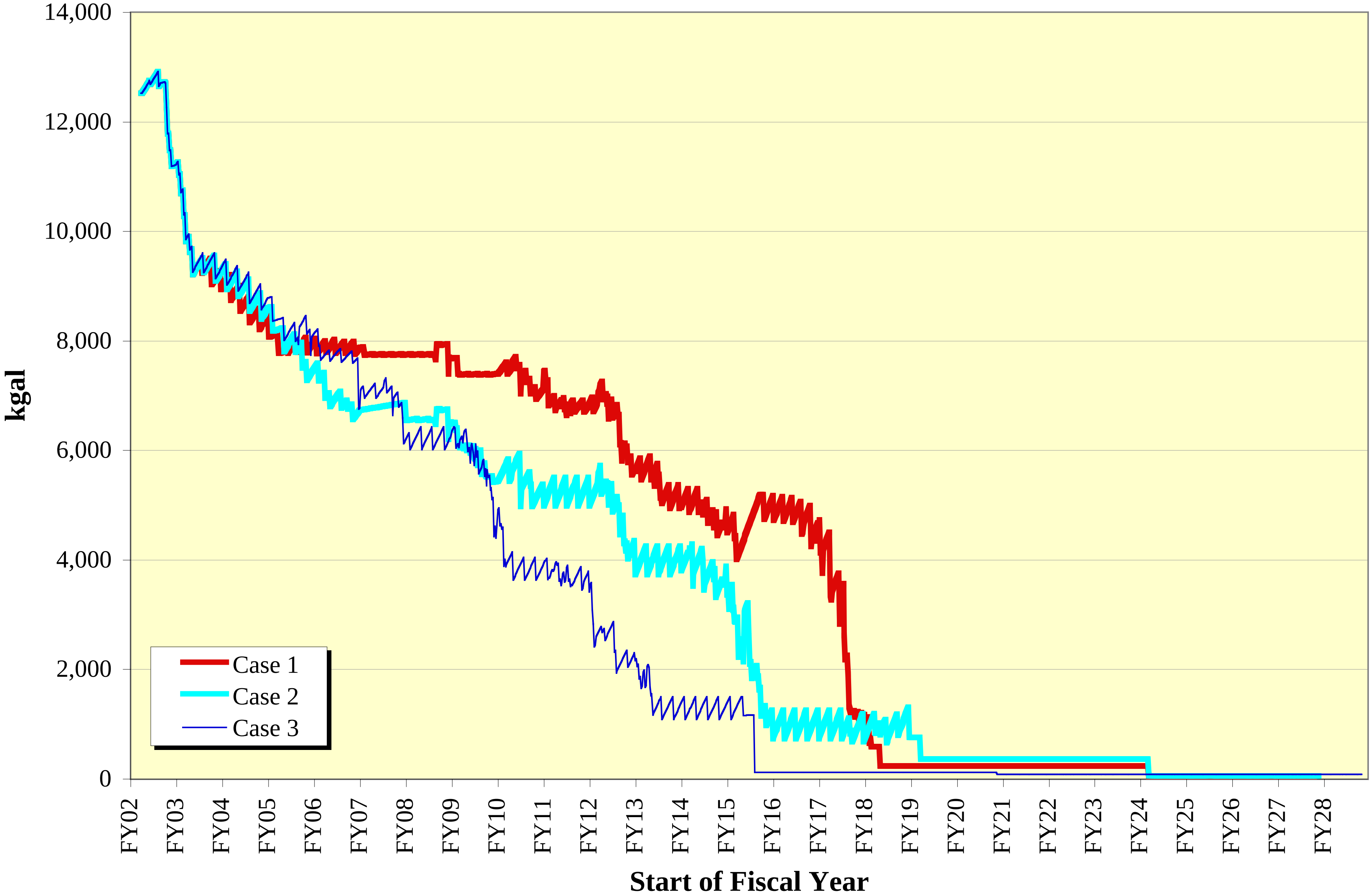
Appendix L.1 – Useable Type III Tank Space



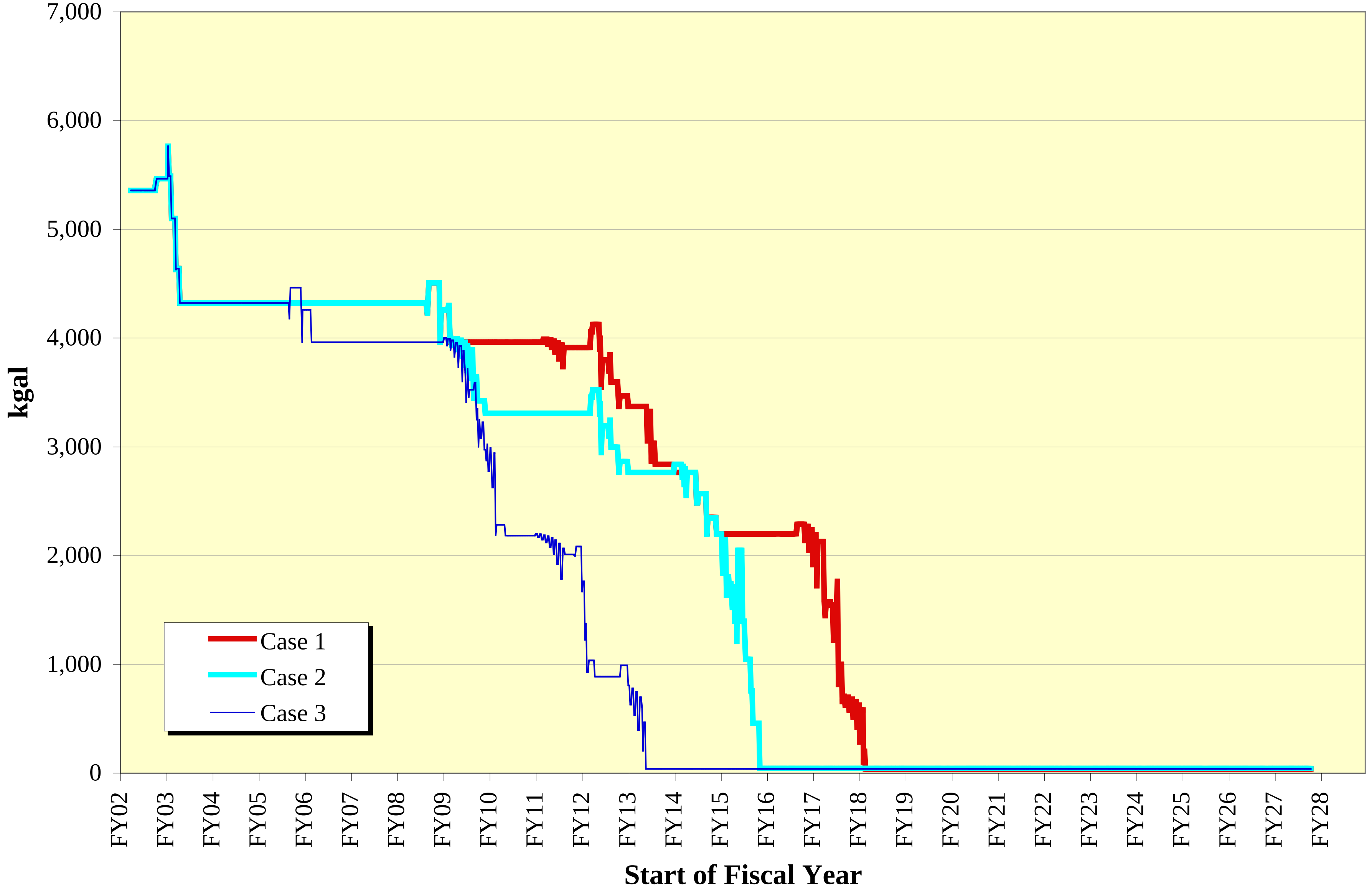
Appendix L.2 – Remaining Tank Inventory



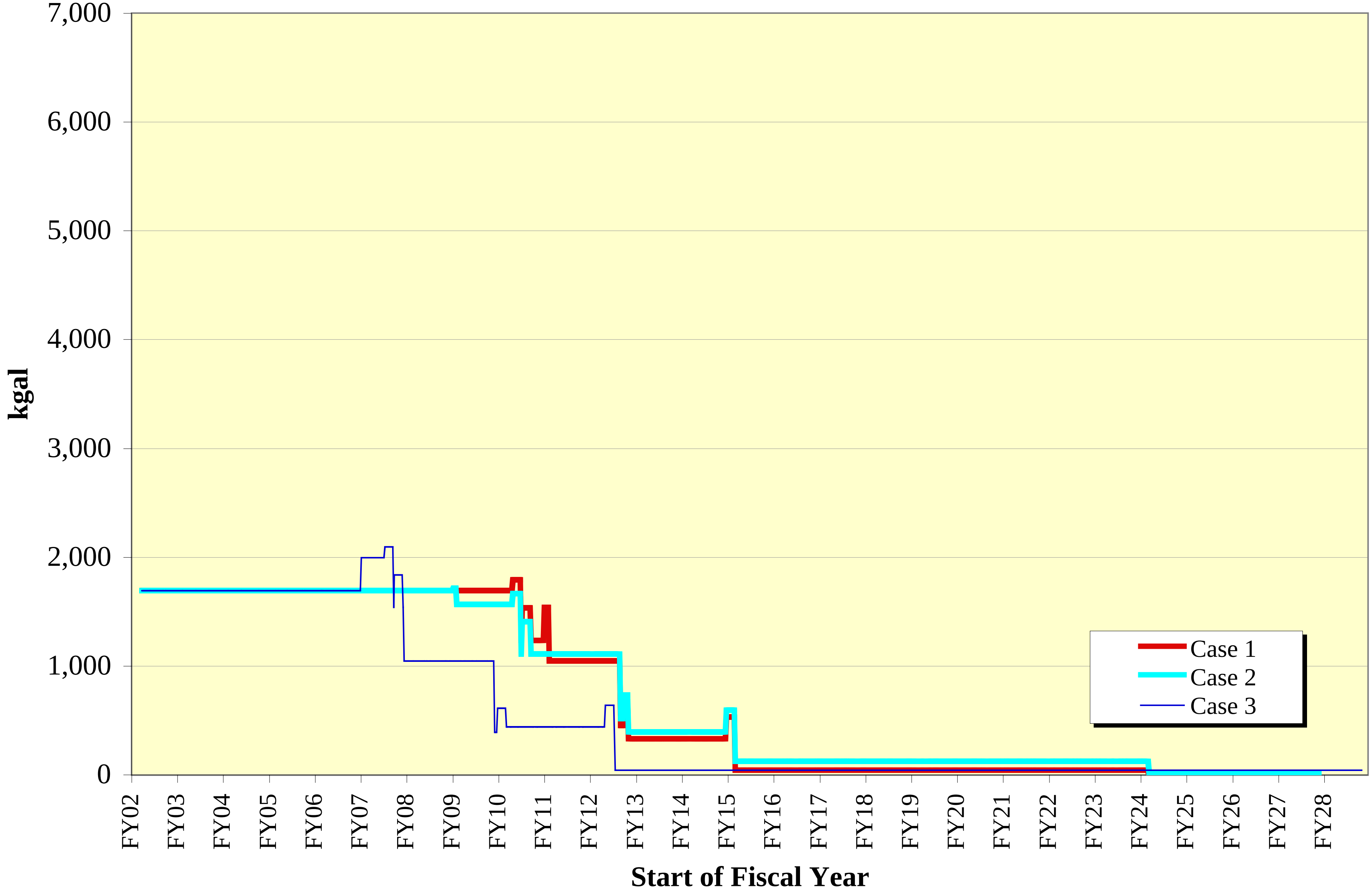
Appendix L.3 – Remaining Inventory in Non-Compliant Tanks



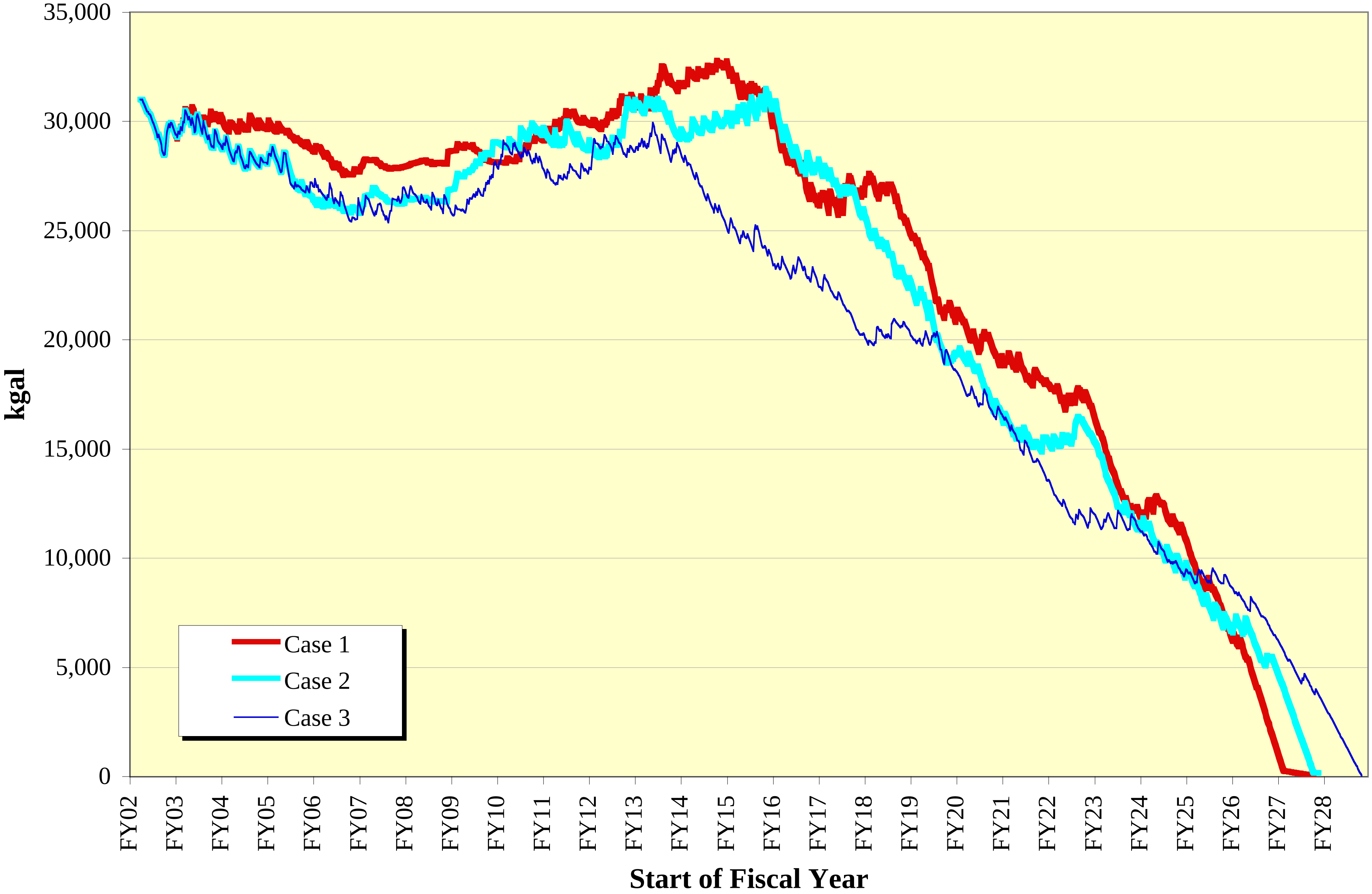
Appendix L.4 – Remaining Inventory in Type I Tanks



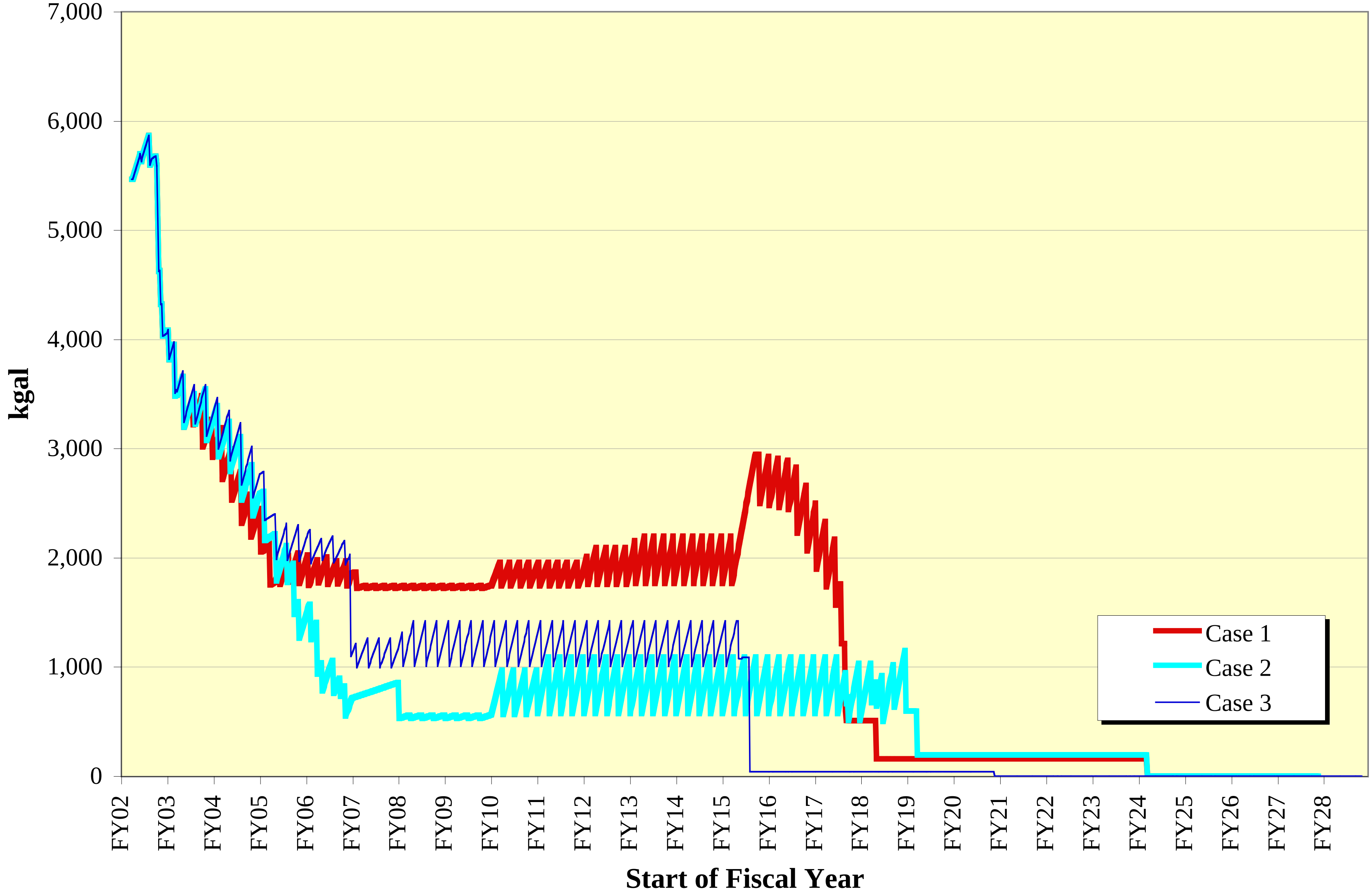
Appendix L.5 – Remaining Inventory in Type II Tanks



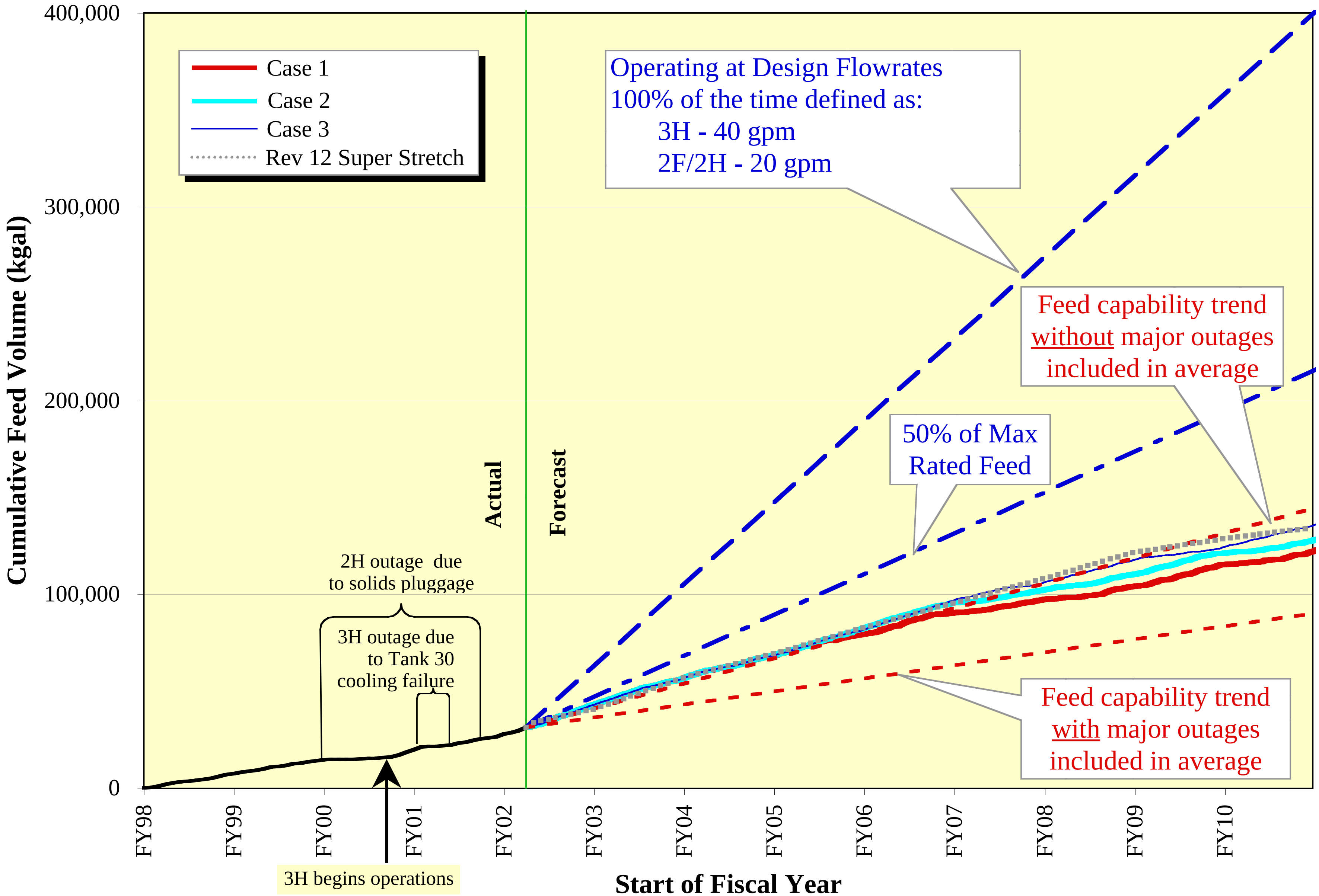
Appendix L.6 – Remaining Inventory in Type III Tanks



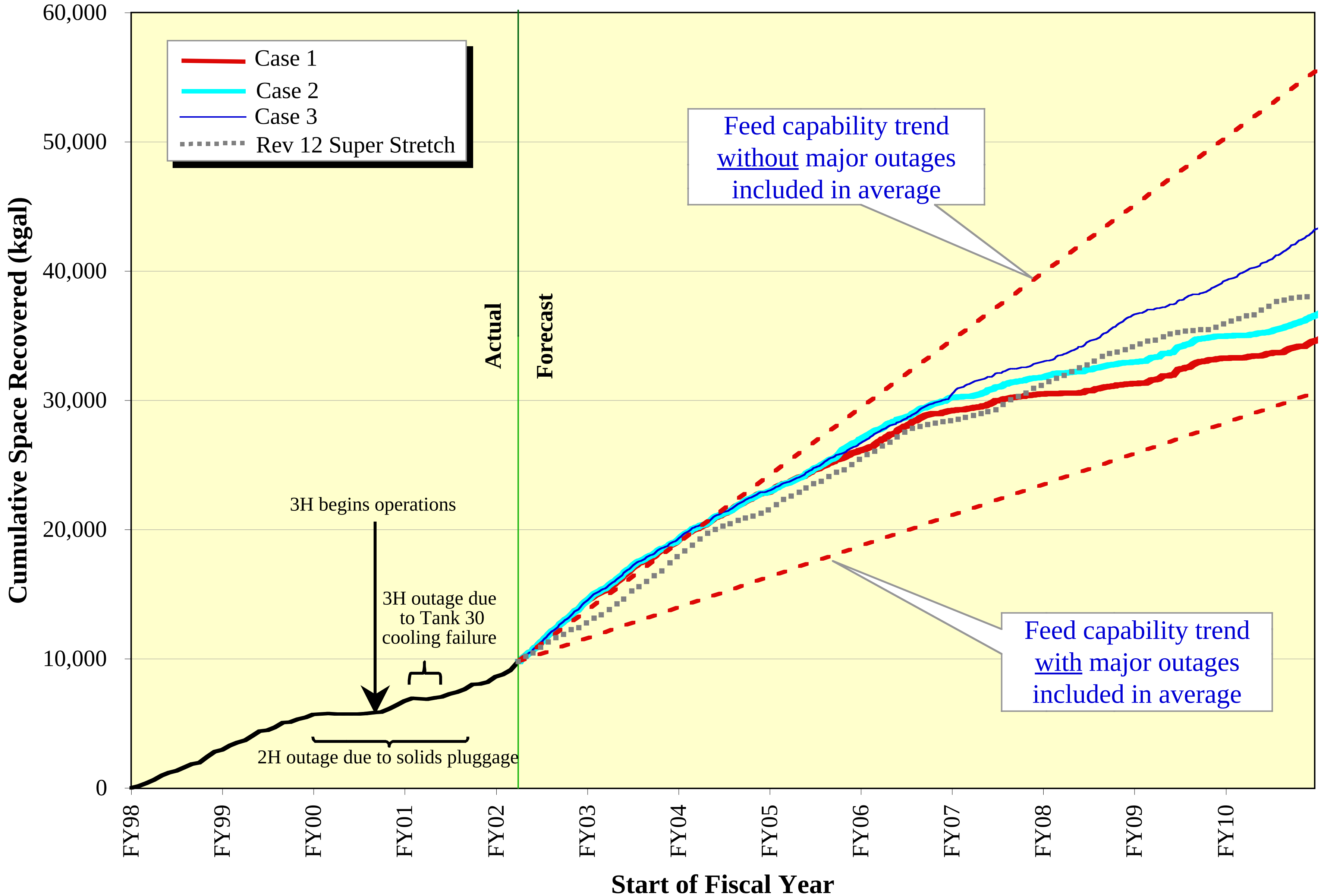
Appendix L.7 – Remaining Inventory in Type IV Tanks



Appendix L.8 – Tank Farm Evaporator Cumulative Feed Volume



Appendix L.9 – Tank Farm Evaporator Space Recovery Forecast



Appendix M – Revision 12 Restatement

Appendix M provides a restatement of the detailed production planning information as it was presented in Revision 12 of the HLW System Plan.

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.

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**.

Also 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 authorized as of the publication of Revision 13 of the HLW System Plan. 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**.

The scope for these three cases provided:

1. Risk Reduction
   Base Case Provides the slowest risk reduction for waste removal from "high risk" tanks
   Stretch Case Provides acceptable risk reduction for waste removal from "high risk" tanks
   Super Stretch Provides excellent risk reduction by expediting waste removal from "high risk" tanks
2. Regulatory Commitments
   Base Case Does not meet the FFA or STP regulatory commitments
   Stretch Case Meets the Site Treatment Plan regulatory commitments
   Comes Close to meeting the Federal Facility Agreement regulatory commitments
   Super Stretch Meets all regulatory commitments
3. Salt Processing
   Base Case Starts salt processing activities by mid 2010
   Stretch Case Starts salt processing activities by mid 2010
   Super Stretch Starts salt processing activities by mid 2010
4. Canister Production
   Base Case Process an average of 200 cans per year after salt processing becomes operational
   Stretch Case Process an average of 225 cans per year after salt processing becomes operational
   Super Stretch Process an average of 250 cans per year after salt processing becomes operational

Revision 12 Status

The charts in Appendix M will provide a short analysis of the status of the forecasts provided in Revision 12 of the Plan.

Key Milestones

Several key milestones were planned for FY01 in Revision 12 of the plan.

- DWPF produced 227 cans, exceeding the forecast of the Base and Stretch case.
- The conversion of 89 canister locations in GWSB #1 is ahead of schedule for making 450 of the unusable locations useable by FY05.
- Tank 49 was return to waste storage use in late 2001.

Appendix M – Revision 12 Restatement

Key Milestone	Actuals	Rev 12 Base Case	Rev 12 Stretch Case	Rev 12 Super Stretch Case
Total Number of Canisters Produced		5,914	5,914	5,871
DWPF Sludge Production (in average canisters per year)				
• FY01	227	163	220	255
• FY02		111	150	150
• FY03		155	210	240
• FY04		163	220	240
• FY05		111	150	150
• FY06		147	200	115
• FY07		200	Outage	200
• FY08		107	Outage	200
• FY09		Outage	Outage	200
• FY10		150	100	150
• FY11		200	230	250
• FY12		200	230	250
• FY13 to End of Sludge Processing		200	230	250
• Salt-only Cans at End of Program		0	0	0
Salt Processing Information				
Date Salt Waste Processing Facility Becomes Operational		FY10	FY10	FY10
• % Operational Flowrate (100% equals 6 Mgal/yr at 6.44 [Na])		100%	100%	100%
Salt Solution Processing Rate(Kgal/yr)				
• FY10		3,000	3,000	3,000
• FY11		6,000	6,000	6,000
• FY12		6,000	6,000	6,000
• FY13		6,000	6,000	6,000
• FY14		6,000	6,000	6,000
• FY15		6,000	6,000	6,000
• FY16 until end of program		6,000	6,000	6,000
Key Risk Reduction Dates				
Date when all “high risk” tanks are emptied		FY16	FY16	FY14
Date when all “non-compliant” tanks are emptied		FY19	FY17	FY15
Date when all “non-compliant” Tanks are closed		FY21	FY20	FY18
Date by which salt processing is completed		FY24	FY22	FY22
Date by which sludge processing is completed		FY29	FY27	FY23
Regulatory Commitments				
Are all STP commitments met?		No	Yes	Yes
Are all FFA regulatory commitments met?		No	No	Yes*
Canister Storage Locations				
• Make additional 450 GWSB #1 locations usable	89	FY05-07	FY03-05	FY03-05
• Begin work on additional Canister Storage locations (GWSB #2 or Privatized Modules)		Module #1 FY07	Module #1 FY10	Module #1 FY04 Module #2 FY07
• Place GWSB #2 or Privatized Modules into Radioactive Operations		Module #1 FY10	Module #1 FY13	Module #1 FY07 Module #2 FY10

Appendix M – Revision 12 Restatement

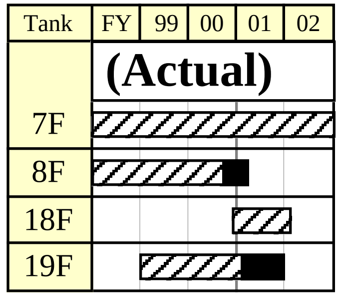
Key Milestone	Actuals	Rev 12 Base Case	Rev 12 Stretch Case	Rev 12 Super Stretch Case
Waste Removal				
• Tank 7 ready for sludge removal		Oct-03	Jul-02	Jul-02
• Tank 11 ready for sludge removal		Apr-08	Apr-08	Apr-05
• Tank 26 ready for sludge removal		Dec-10	Jan-11	Sep-07
Tank Closures				
• Complete closure of Tank 19		Apr-03	Apr-03	Apr-03
• Complete closure of Tank 18		Apr-04	Apr-04	Apr-04
• Complete closure of 5th Tank		FY10	FY10	FY08
• Complete closure of 6th Tank		FY11	FY11	FY09
• Complete closure of 7th Tank		FY13	FY13	FY10
• Complete closure of 24th Tank		FY21	FY20	FY19
Key Space Management Activities				
• Return Tank 48 for waste storage/ Salt Feed tank service		FY10	FY10	FY10
• Reuse Tank 49 for waste storage	Oct-01	Jul-01	Jul-01	Jul-01
• Reuse Tank 50 for waste storage		Sep-02	Sep-02	Sep-02
• Tank 37 modification completed for 3H Evaporator Drop Tank		Sep-02	Sep-02	Sep-02
• Tank 37 Salt Dissolution #2		n/a	Mar-05	Mar-04
• Tank 27 modification completed for 2F Evaporator Drop Tank		Mar-06	May-06	Feb-05
• Tank 42 modification completed for 2H Evaporator Drop Tank		Feb-12	Feb-11	Feb-10
• Tank 41 modification completed for 2H Evaporator Drop Tank		n/a	n/a	n/a
Repository Activities				
• Start shipping canisters to the Federal Repository		FY10	FY10	FY10
• Complete shipping canisters to Federal Repository		FY39	FY39	FY39
Facility Deactivation Complete		FY40	FY40	FY40

Appendix M.1 – Funding (Revision 12 Restate)

Budget Authority in Escalated Dollars

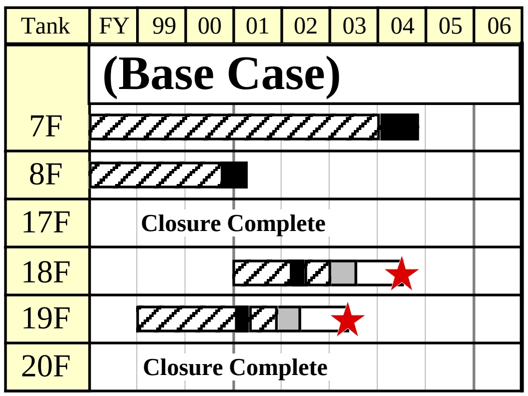
			Rev 12 - Base Case					Rev 12 - Stretch Case					Rev 12 - SuperStretch Case				
Project Title	**FY01**	**FY01 Actuals**	**FY02**	**FY03**	**FY04**	**FY05**	**FY06**	**FY02**	**FY03**	**FY04**	**FY05**	**FY06**	**FY02**	**FY03**	**FY04**	**FY05**	**FY06**
HL-01 H Tank Farm																	
H Tank Farm Operations	95,078	101,781	93,420	100,337	106,546	108,122	110,347	93,420	100,337	106,546	108,122	110,347	93,420	100,337	106,546	108,122	110,347
LI: Replacement Evaporator	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HL-01 Total	**95,078**	**101,781**	**93,420**	**100,337**	**106,546**	**108,122**	**110,347**	**93,420**	**100,337**	**106,546**	**108,122**	**110,347**	**93,420**	**100,337**	**106,546**	**108,122**	**110,347**
HL-02 F Tank Farm	**59,966**	**62,755**	**63,928**	**68,328**	**70,446**	**71,438**	**74,157**	**63,928**	**68,328**	**70,471**	**71,464**	**74,184**	**63,928**	**68,328**	**70,471**	**71,464**	**74,184**
HL-03 Waste Removal & Tank Closures																	
WR Ops w/ Demo Projects	3,169		3,311	3,252	3,362	1,733	-	3,311	3,552	3,673	-	-	3,311	3,552	3,673	3,786	3,931
WR: Tank Closure	16		3,113	4,745	1,653	-	-	3,113	4,745	1,653	-	-	3,113	4,745	1,653	-	-
HL-03 Total	**3,185**	**3,503**	**6,424**	**7,996**	**5,015**	**1,733**	**-**	**6,424**	**8,297**	**5,326**	**-**	**-**	**6,424**	**8,297**	**5,326**	**3,786**	**3,931**
HL-04 Feed Preparations & Sludge Operations	**50,722**	**51,437**	**56,097**	**62,734**	**66,549**	**70,173**	**69,739**	**56,097**	**62,734**	**66,549**	**70,173**	**69,739**	**56,097**	**62,734**	**66,549**	**70,173**	**69,739**
HL-05 Vitrification																	
Vitrification Ops	111,727	108,310	125,108	130,313	131,338	139,751	144,990	126,400	132,185	133,344	141,166	146,986	126,400	132,185	133,344	141,166	146,986
Failed Equip. Storage Vaults	1,143		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HL-05 Total	**112,870**	**108,310**	**125,108**	**130,313**	**131,338**	**139,751**	**144,990**	**126,400**	**132,185**	**133,344**	**141,166**	**146,986**	**126,400**	**132,185**	**133,344**	**141,166**	**146,986**
HL-06 Glass Waste Storage	**684**	**511**	**712**	**1,426**	**784**	**1,472**	**839**	**712**	**2,056**	**2,078**	**1,472**	**839**	**712**	**2,056**	**2,078**	**1,472**	**839**
HL-13 Salt Disposition																	
Salt Disposition Ops	17,543	19,086	4,982	-	-	-	-	4,982	-	-	-	-	4,982	-	-	-	-
LI: Salt Alternative	-		29,465	84,345	135,123	150,278	150,768	29,465	84,345	135,123	150,278	150,768	29,465	84,345	135,123	150,278	150,768
HL-13 Total	**17,543**	**19,086**	**34,447**	**84,345**	**135,123**	**150,278**	**150,768**	**34,447**	**84,345**	**135,123**	**150,278**	**150,768**	**34,447**	**84,345**	**135,123**	**150,278**	**150,768**
HL-10 LI: Storm Water Upgrades	**138**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HL-11 LI: Tk Fm Services Upgrade II	**10,455**	**8,136**	**6,303**	**-**	**-**	**-**	**-**	**6,303**	**-**	**-**	**-**	**-**	**6,303**	**-**	**-**	**-**	**-**
HL-12 LI: Waste Removal																	
LI: WR from Tanks	23,046	22,353	19,244	10,113	533	-	-	25,458	3,688	11,196	12,300	1,827	28,690	11,082	25,192	28,897	38,905
LI: Vit Upgrades	616		-	-	-	7,063	7,276	-	-	-	7,063	7,276	-	-	-	7,063	7,276
LI: Pipe, Evaps & Infrastructure	-		993	5,995	15,870	12,536	-	993	5,995	15,870	12,536	-	993	5,995	15,870	12,536	-
HL-12 Total	**23,662**	**22,353**	**20,238**	**16,108**	**16,403**	**19,598**	**7,276**	**26,452**	**9,683**	**27,066**	**31,899**	**9,103**	**29,683**	**17,077**	**41,063**	**48,496**	**46,181**
FA-24 Facility Decontamination / Decommissioning			**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
HLW TOTAL	**374,304**	**377,872**	**406,675**	**471,588**	**532,204**	**562,566**	**558,117**	**414,182**	**467,965**	**546,502**	**574,574**	**561,967**	**417,413**	**475,359**	**560,499**	**594,957**	**602,976**
HLW w/o Salt Total	**356,760**	**358,786**	**372,228**	**387,243**	**397,081**	**412,288**	**407,349**	**379,735**	**383,619**	**411,379**	**424,296**	**411,199**	**382,966**	**391,013**	**425,375**	**444,678**	**452,208**
Solid Waste Facilities																	
ETF	16,115	14,631	17,302	18,705	20,455	22,088	23,838	17,302	18,705	20,455	22,088	23,838	17,302	18,705	20,455	22,088	23,838
Saltstone	1,099	2,466	2,055	4,454	2,317	2,229	2,314	2,055	4,454	2,317	2,229	2,314	2,055	4,454	2,317	2,229	2,314
SW TOTAL	**17,214**	**17,097**	**19,356**	**23,159**	**22,772**	**24,317**	**26,152**	**19,356**	**23,159**	**22,772**	**24,317**	**26,152**	**19,356**	**23,159**	**22,772**	**24,317**	**26,152**
Life Cycle Cost	**391,518**	**394,969**	**426,032**	**494,747**	**554,976**	**586,883**	**584,269**	**433,538**	**491,123**	**569,274**	**598,891**	**588,119**	**436,769**	**498,517**	**583,271**	**619,274**	**629,128**

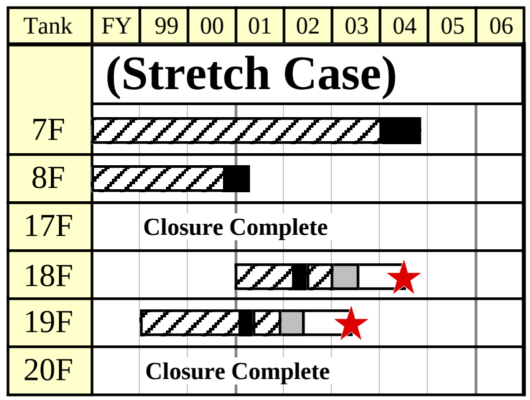
Appendix M.2 – Waste Removal Schedule (Revision 12 Restate)

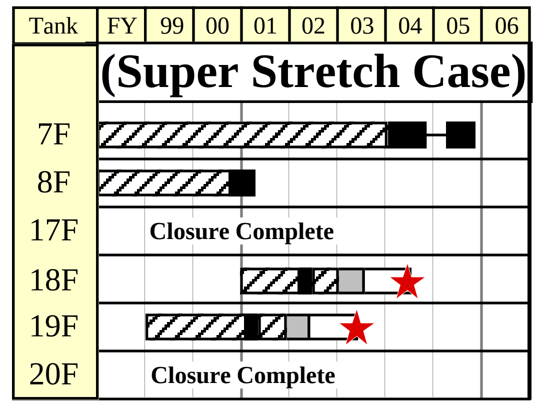


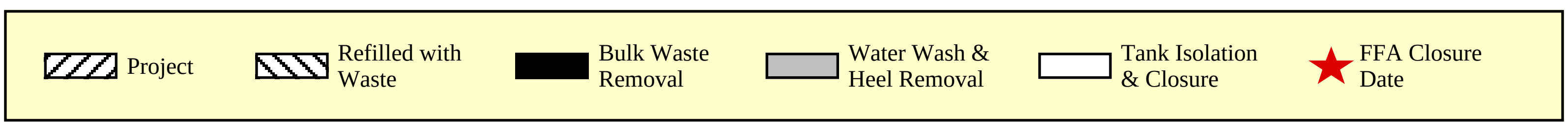
FY01 Analysis

- Construction of waste removal equipment continues on Tank 7
- Construction of waste removal equipment is complete on Tanks 8 and 19
- Construction of waste removal equipment was initiated on Tank 18
- Heel removal on Tank 19 was completed









Appendix M.3 – Material Balance (Revision 12 Restate)

End of Month/Year	Influents (gallons)							Effluents (gallons)							Net-Out
	F-Can Total	H-Can Total	DWPF Recycle	Other	Inhibited Water	Jet Dilution	**Total In**	Space Recovery from Evaporation				Salt Solution to Processing	Sludge to ESP/DWPF	**Tot-Out**	
								2F Evaps	2H Evaps	3H Evaps	**Total**				
FY01 Actuals	421,024	236,047	1,173,925	312,627	849,000	614,000	**3,606,623**	686,106	-	1,185,968	**1,872,074**	-	150,501	**2,022,575**	**(1,584,048)**
Base Case															
FY01	544,423	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)**
FY02	366,500	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**
FY03	132,000	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**
FY04	132,000	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**
FY05	157,200	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	136,800	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**
Stretch Case															
FY01	544,423	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)**
FY02	366,500	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**
FY03	132,000	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**
FY04	132,000	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**
FY05	157,200	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	136,800	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**
Super Stretch Case															
FY01	445,125	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)**
FY02	366,500	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**
FY03	132,000	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**
FY04	132,000	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)**
FY05	157,200	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	136,800	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**

FY01 Analysis

F&H Canyon:	The tank farms received 82% of the forecasted volume from the canyons.
DWPF Recycle:	The tank farms received 156% of the forecasted Base Case or 110% of the Stretch Case recycle from DWPF. This is due to the greater number of canisters produced (227 actual vs. 163 – Base, 220 – Stretch)
Other:	The tank farms received 108% of the forecasted volume of 299-H, RBOF, and miscellaneous flushes – within the normal variation of this type of material.
Inhibited Water:	The tank farms used 62% of the forecasted inhibited water additions. This was the result of optimization efforts of Sludge Batch #2 washing to reduce tank farm volume impacts.
Evaporation:	2F Evaporator Space Recovery was 61% of the FY01 forecast due to an unforecast transfer of poor feed material and outages related to the response to Tank 5 leakage. 3H Evaporator Space Recovery was 195% of forecast as a result of the success of leak stoppage material added to the cooling coils of the receipt tank (Tank 30). This allowed continuous operation of the evaporator for the last half of the year as opposed to the intermittent operation forecast in Revision 12 of the Plan
Sludge to DWPF:	The sludge volume varied from the forecasts because the weight percent of the sludge in the ESP feed tank was higher than forecast. This allowed the sludge to be transferred to DWPF with a smaller volume.

Appendix M.4 – Salt Solution Processing (Revision 12 Restatement)

No Salt Batches were planned for any of the Revision 12 cases in the FY01 to FY06 time frame covered by this Restatement.

Appendix M.5 – Sludge Processing (Revision 12 Restate)

	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 %)
Base Case																
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														
Stretch Case																
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														
Super Stretch Case																
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														

FY01 Analysis

Sludge Batch #1B finished feeding to DWPF in Dec. 01 with a total canister yield of 726 canisters. The canister yeild was greater than forecast in the Base and Stretch Cases due to greater use of the Tank 51 heel. As there was no DWPF outage, Sludge Batch #2 began feeding in Dec. 01. Actual ESP washwater generated to prepare Sludge Batch #2 was 1,374 kgal vs. the forecast of 1,977 kgal due to lower sodium content in the sludge feed tank requiring less washing to meet the DWPF Waste Acceptance Criteria.

Appendix M.5 – Sludge Processing (Revision 12 Restate)

Notes:

General) Above based on the following yearly canister production values: **Base:** FY01 163 cans/yr, FY02 111 cans/yr, FY03 155 cans/yr, FY04 163 cans/yr, FY05 111 cans/yr, FY06 147 cans/yr; **Stretch:** FY01 220 cans/yr, FY02 150 cans/yr, FY03 210 cans/yr, FY04 220 cans/yr, FY05 150 cans/yr, FY06 200 cans/yr; **SuperStretch:** 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

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 M.6 – Canister Storage (Revision 12 Restate)

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	
Base Case											
1996-1999		719	719		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
Stretch Case											
1996-1999		719	719		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
Super Stretch Case											
1996-1999		719	719		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

FY01 Analysis:

In 2001, 227 canisters were added for a total of 1,177. In addition, 89 of the 450 unuseable location were modified and are now useable.

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.

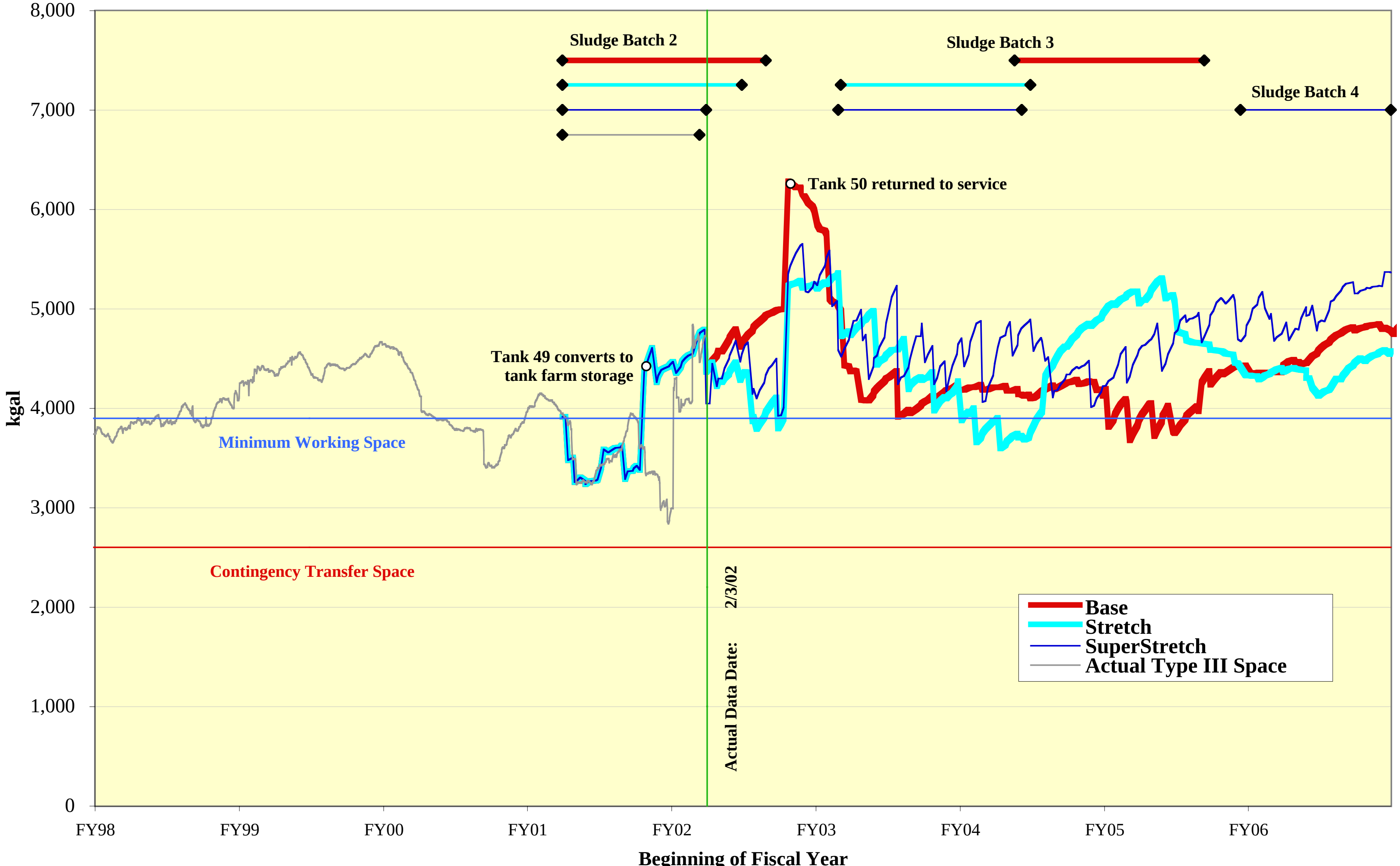
Appendix M.7 – Near Term Saltstone Operations (Revision 12 Restate)

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:
Base, Stretch, and Super Stretch Case								
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.

FY01 Analysis:

The Saltstone Facility remained in a lay-up state as planned in FY01.

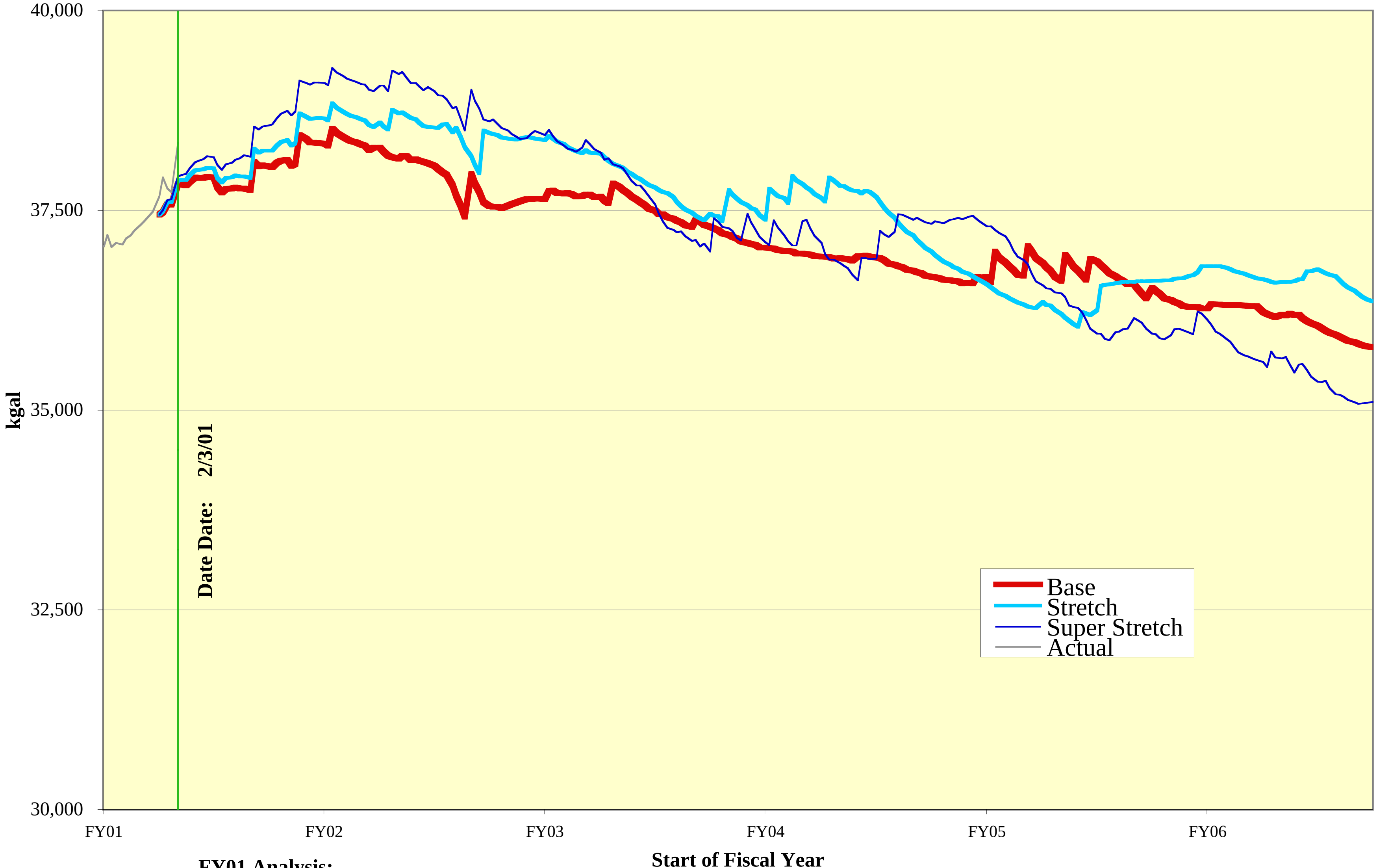
Appendix M.8 – Useable Space (Revision 12 Restate)



FY01 Analysis:

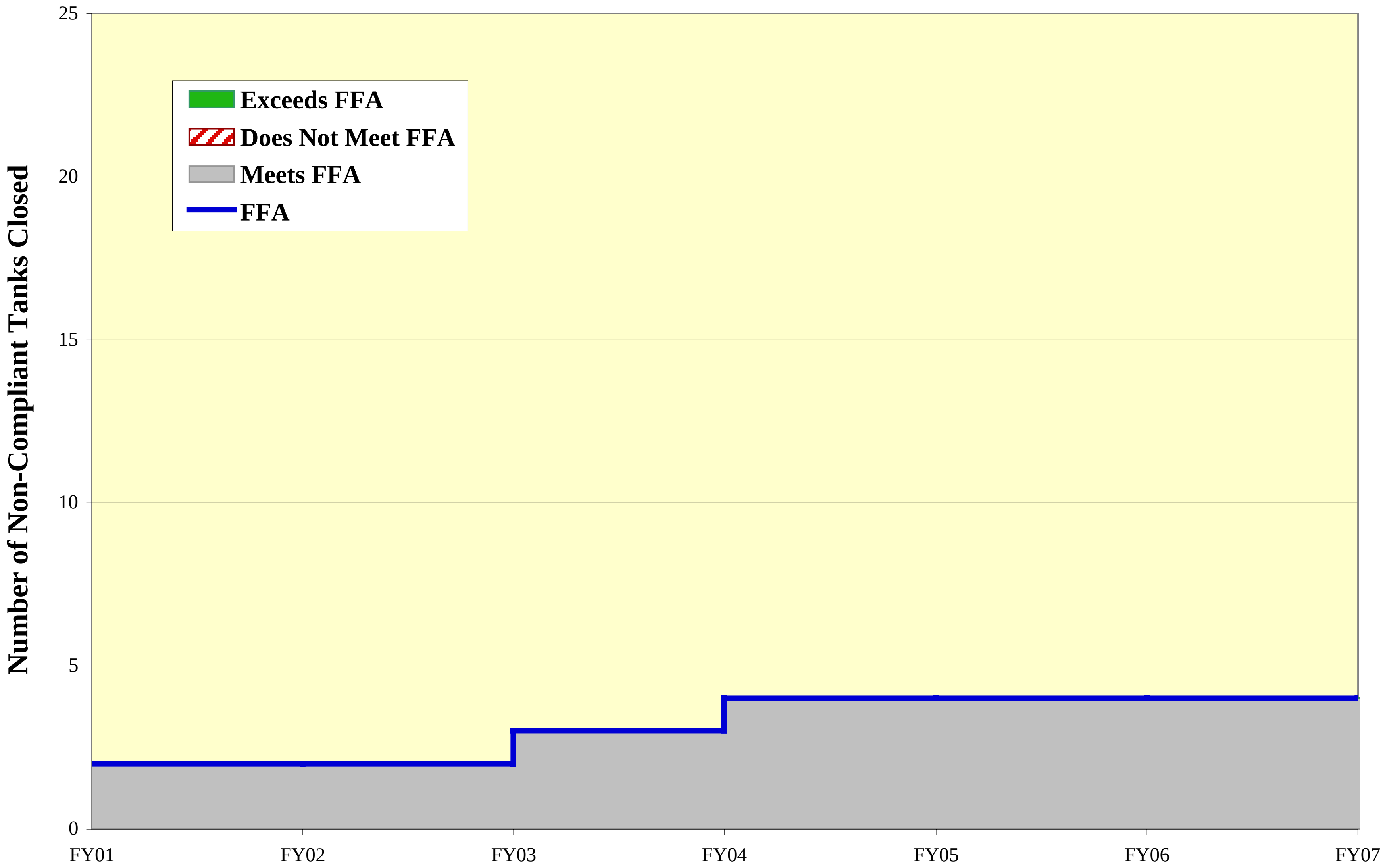
The actual Useable Space was below the forecast for the last half of FY01 due to the transfer of waste from "non-compliant" tanks to Type III tanks earlier than had been forecast. This was caused by the necessity of transfering waste out of Tank 5 when leak sites were discovered in mid FY01. The difference was recovered in the first quarter of FY02 by: 1) better than forecast performance of the 3H Evaporator, 2) Tank 49 returning to HLW service, and 3) space made available by the switch to Tank 40 from Tank 51 for sludge batch feed.

Appendix M.9 – Remaining Tank Inventory (Revision 12 Restate)



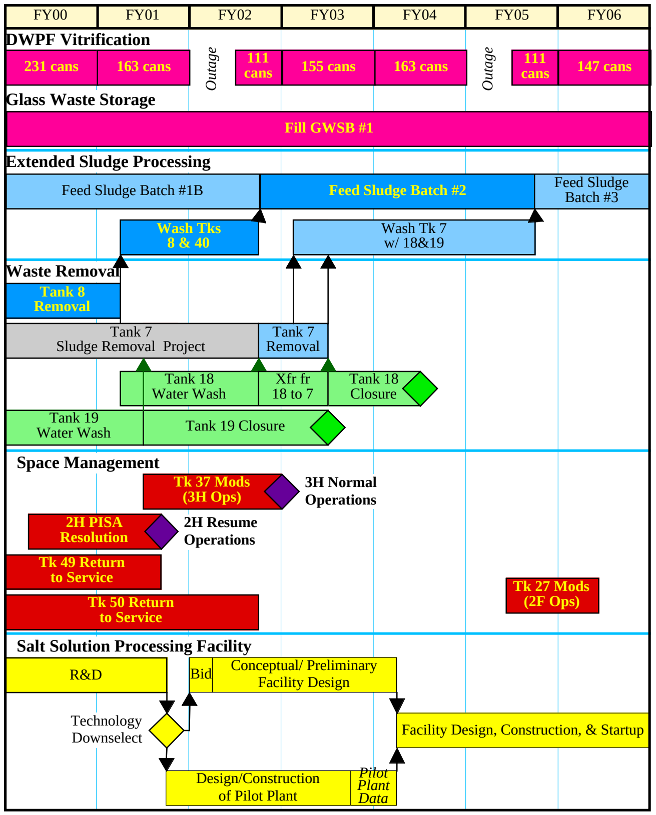
FY01 Analysis:
The actual Total Inventory was approximately the same as the forecast.

Appendix M.10 – Tank Closures
(Revision 12 Restate – Base, Stretch, SuperStretch)

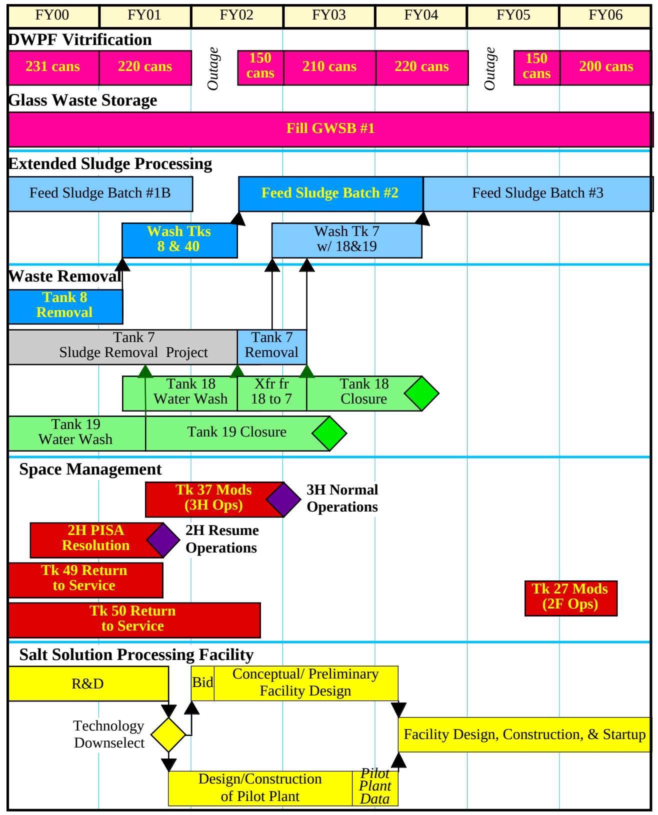


Appendix M.11 – Level 1 Schedule (Revision 12 Restate)

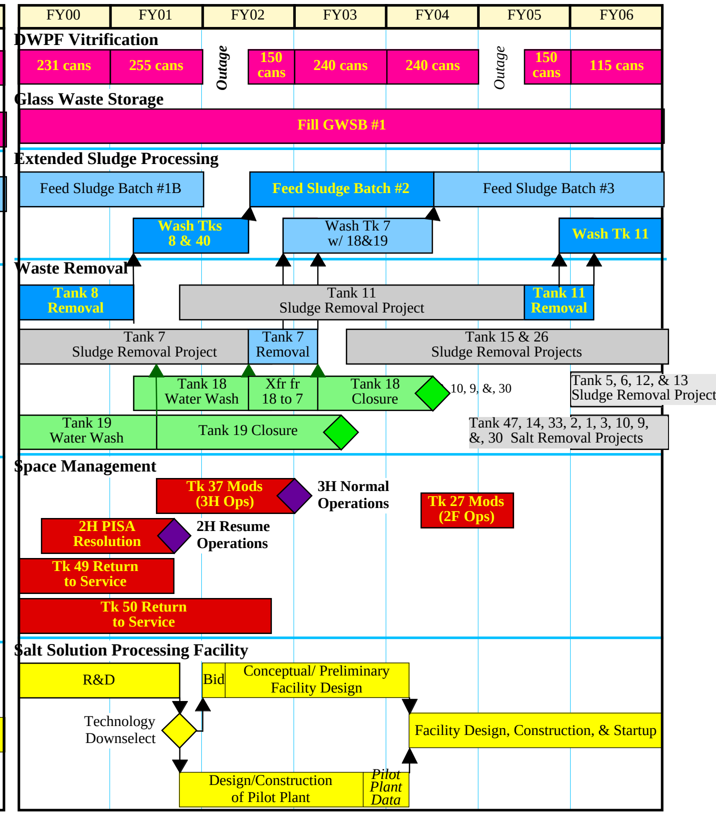
Base Case



Stretch Case



Super Stretch Case



FY01 Analysis:

DWPF produced 227 cans in FY01. No melter outage was required at the beginning of FY02. Sludge Batch #1B was completed and Sludge Batch #2 was initiated in December 2001. Tank 7 is on schedule for transfer to ESP to begin Sludge Batch #3 washing. Tank 19 and Tank 18 are on schedule for closure. Tank 37 is on schedule but temporary repairs to Tank 30 cooling coils have enabled the 3H Evaporator to conduct normal operations in the last half of FY01 and through FY02 to present. The 2H Evaporator resumed operation in October 2001, however, operation difficulties hindered routine operations until December. Tank 49 was returned to HLW service in October 2001. The Technology Downselect was made and a Record of Decision was issued in October 2001. A new integrated Salt Disposition Strategy will alter the schedules provided in Revision 12 of the Plan

Distribution List

DOE–HQ
Chacey, K.A. (Kenneth), EM-42
Fisher, K.W. (Kurt), EM-42
Kaltreider, R.L. (Randall), EM-42
Picha, K.G. (Kenneth), EM-21

DOE–SR
Aleman, S.M. (Suzanne), 703-H
Anderson, C.E. (Charlie), 704-S
Barber, D.A. (Don), 703-H
Blanco, S.M. (Soni), 704-3N
Clark, Jr., W.D. (Bill) (5), 704-3N
Cowart, D.L. (Dave), 704-S
Delaplane, N.R. (Nick), 704-S
Everatt, C.A. (Carl), 704-S
Gonyaw, D.J. (Debbie), 704-S
Gutmann, T.S. (Tom), 704-S
Hannah, Jr., G.R. (Ray), 704-S
Hansen, C.A. (Charles), 703-A
Ling, L.T. (Larry), 703-H
Martin, C.S. (Carol), 704-S
McCullough, Jr., J.W. (Jim), 704-3N
Mikolanis, M.A. (Mike), 704-S
Pearson, W.D. (Bill) (30), 704-S
Spader, W.F. (Bill), 704-S
Spears, T.J. (Terry), 704-3N
Stubbs, W.L. (Bill), 704-S
Suggs, P.C. (Pat), 704-3N

DNFSB
Burns, T.D. (Tom), 703-A
Davis, R.T. (Todd), 719-14A
Ogg, D.G. (Dan) (3), 719-14A

WSRC–Sr. Staff
Amerine, D.B. (Dave), 703-A
Becker, D.L. (Dan), 703-A
Grefenstette, P.D. (Paul), 703-A
Jones, C.B. (Clay), 703-A
Pedde, R.A. (Bob), 703-A

HLWD–Staff
Burch, M.E. (Mike), 703-H
Campbell, P.D. (Dean), 705-A
Cwalina, A.M. (Andy), 703-H
Hay, J.B. (Joanne), 703-H
Herrera, H.F. (Hank), 703-H
Johnson, M.D. (Mike), 703-H
Osmundsen, T. (Tor), 766-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
Mahoney, M.J. (Mark) (120), 703-H
Way, K.B. (Kelly), 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
Williams, R.H. (Rick), 210-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), 704-56H
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
Harp, K.D. (Keith), 704-56H
Herbert, J.E. (Jim), 241-108F
Lampley, C.G. (Charles), 730-2B
Runnels, R.A. (Rick), 707-H
Salmon, R.R. (Ronnie), 241-100F
Thomas, S.A. (Steve), 703-H
Vick, F.D. (Frank), 707-H
Whittenburg, A.L. (Anatia), 704-56H
Wilkerson, S.W. (Steve), 241-100F

HLW–SWP
Adams, R.A. (Bob), 704-3N
Hinds, Jr., R.N. (Bob), 704-3N

HLW–Maint
Guilherme, J.B. (Joel), 704-71S
Hauer, K.A. (Kim), 704-71S
Hill, P.J. (Peter), 703-H
Johnson, G.E. (Glen), 704-71S
Kelly, C.G. (Chuck), 241-2H
Lucas, T.J. (Ted), 210-S
Mohammadi, M.N. (Rod), 704-71S
Willis, Jr., H.S. (Syd), 713-1N
Wilson, R.W. (Robert), 704-71S

HLW–Train & Proc
Burkhart, R.T. (Ron), 704-49S
Thompson, D.G. (Dennis), 766-H
Zareck, R.C. (Ron), 705-1C

HLW–QA
Kuhn, R.J. (Ron), 703-H

HLWE
Allen, V.P. (Trish), 703-H
Bieling, A.B. (Bruce), 704-S
Blocker, R.H. (Roz), 703-H
Broaden, D.A. (Dave), 703-H
Bumgardner, D.C. (Doug), 703-H
Campbell, R.M. (Ron), 703-H
Carter, J.T. (Joe), 766-H
Cauthen, G.L. (Gary), 241-119H
Chapman, N.F. (Noel), 742-4G
d'Entremont, P.D. (Paul), 703-H
Dewes, J.N. (John), 703-H
Edwards, Jr., R.E. (Richard), 704-3N
Elder, H.H. (Hank), 704-3N
Fowler, R.C. (Rick), 704-196N
Freed, E.J. (Eric), 707-H
Gillam, J.M. (Jeff), 703-H
Hayes, Jr., C.R. (Chuck), 703-H
Hester, Jr., J.R. (Bob), 703-H
Jones, J.F. (Janet), 742-13G
Kerley, W.D. (Bill), 704-S
Lewis, B.L. (Brenda), 704-S
Lex, T.J. (Tom), 703-H
Liner, K.R. (Keith), 704-15S
Little, D.B. (David), 704-S
Loibl, M.W. (Marc), 703-H
Martin, D.J. (Dave), 703-H
Matis, G.J. (George), 766-H
Miller, M.S. (Marshall), 703-H
Monahon, T.M. (Tom), 703-H
Morin, J.P. (Jerry), 703-H
Occhipinti, J.E. (John), 704-27S
Ortaldo, J.F. (Joe), 704-S
Owen, J.E. (John), 704-30S
Pike, J.A. (Jeff), 704-196N
Ray, J.W. (Jeff), 704-S
Salizzoni, R.L. (Rich), 703-H
Selvey, J.A. (Jeff), 705-C
Sessions, J.R. (John) (4), 766-H
Sherburne, D.C. (David), 704-S
Smith, M.A. (Mandy), 742-13G
Subosits, S.B. (Steve), 766-H
Taylor, G.A. (Glenn), 704-196N
Thomas, A.B. (Allen), 703-H
Tibrea, S.L. (Steve), 703-H

HLW–Cost & Sched
Ballard, D.C. (Dan), 704-26F
Byrd, D.W. (Dirk), 703-H
Doughty, D.E. (Don), 704-56H
Druce, J.K. (Jerry), 703-H
Gilbreath, K.D. (Kent), 703-H
Haynes, R.S. (Ray), 704-71S
Haynes, S.D. (Steve), 707-H
Howell, W.M. (Mark), 704-3N
Pate, T.E. (Tim), 704-56H
Phillips, J.M. (John), 703-H
Ware, Jr., W.W. (Woody), 703-H

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Boasso, C.J. (Cliff), 742-2G
Brown, K.R. (Kenneth), 742-2G
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Donahue, Jr., C.L. (Troy), 241-109F

NMMD
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Yano, S.A. (Stephen), 221-F

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Delley, A.O. (Alexcia), 730-B
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McNamee, E.M. (Ed), 730-2B

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Meadors, R.E. (Robert), 773-41A
Williams, W.L. (Wendell), 773-41A

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Daniel, Jr., W.E. (Gene), 704-1T
Fink, S.D. (Sam), 773-A
Hobbs, D.T. (David), 773-A
Holding-Smith, C.P. (Cynthia), 773-42A
Holtzscheiter, Jr., E.W. (Bill), 773-A
Marra, S.L. (Sharon), 704-T
Papouchado, L.M. (Lou), 773-A
Tamosaitis, W.L (Walt), 773-A
Wood, S. (Susan), 773-A

SW/ER
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Daugherty, B.A. (Brent), 705-3C
Huber, P.R. (Paul), 730-2B
Kelly, W.S. (Sam), 705-3C
Maxted, A. (Tony), 704-43H
McGovern, H.A. (Hugh), 241-246H
Paveglio, J.W. (John), 705-3C
Sabbe, M.A. (Mike), 730-2B
Wiggins, Jr., A.W. (Skip), 241-152H

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HLW File Copy, (J.B.Hay), 703-H
Records Administration, (), 773-52A
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