Department of Energy
Washington, DC 20585

February 13, 2002

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW
Suite 700
Washington, D.C. 20004-2901

Dear Mr. Chairman:

The purpose of this letter is to inform you that one action identified in the Implementation Plan for Recommendation 2001-1, High-Level Waste Management at the Savannah River Site, was completed by the Department of Energy (DOE) in January 2002. The completed action is:

> Commitment 3.1 - Assess Tank Farm Space Management options and system vulnerabilities, due January 2002. The assessment results are documented in two enclosed reports. Additionally, enclosed are two reports summarizing the results of the space management evaluation pertaining to options for add new evaporators or new tanks.

Since the issuance of the report on options for new evaporators, the DOE contractor has issued a subsequent report to DOE regarding alternative methods to process the Defense Waste Processing Facility recycle stream. DOE is currently evaluating this report.

If you have any questions, please contact me at (202) 586-7710.

Sincerely,

Paul Golan
Chief of Staff
Office of Environmental Management

Enclosures

DOE F 1325.8 (Rev 11-12-91)

United States Government | Department of Energy (DOE)

Memorandum

Savannah River Operations Office (SR)

DATE: January 29, 2002

REPLY TO ATTN OF: AMHLW (Anderson/(803) 208-6072)

SUBJECT: Transmittal of Deliverable 3.1 for Recommendation 2001-1, (Memo, Rudy to Golan, 01/18/02)

To: Paul M. Golan, Chief of Staff, Office of the Assistant Secretary for Environmental Management (EM-1), HQ

In accordance with the schedule provided in my memorandum to you dated 01/18/02, I am transmitting the deliverables for Commitment 3.1 of DOE's Implementation Plan (IP) for the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2001-1, *High-Level Waste Management at the Savannah River Site.* Commitment 3.1 required DOE to assess the High-Level Waste (HLW) system vulnerabilities and tank farm space management options.

The assessment reports (Attachment 1 and 2) document the results of systematic reviews of HLW system vulnerabilities and space management options. The vulnerability study confirmed our understanding of known problems and also identified new vulnerabilities (e.g., availability of critical evaporator spares) that must be addressed to ensure safe and reliable operation of the HLW system. Attachment 3 documents a just completed review of the need for new waste storage tanks and new evaporators to support HLW missions. DOE-SR concurs with this report that concludes, with one exception, construction of new tanks and evaporators at the Savannah River Site (SRS) is not warranted at this time. The exception is the need to further consider an evaporator to reduce the volume of Defense Waste Processing Facility effluents.

DOE-SR is focused on assuring safe and effective operations of the HLW system at SRS, and we consider there is sufficient operational flexibility and adequate tank space within the HLW system (now and for the future) to assure safety and timely response in the event of an unusual or emergency situation.

Additionally, the HLW system has the capacity and flexibility for continuing progress in the disposition of HLW without impacting canister production. This has been demonstrated recently with the return to service and improved operational performance of the three HLW evaporators, as well as, the return to available service of a one million gallon type three tank; progress in preparations to dispose of low-activity wastes to the Saltstone facility; the initiation of the Salt Waste Processing Project with the issuance of the Request for Proposal of the pilot facility; and a series of successful efforts to reduce inflows to the tank farms from other site activities. Each of these actions is a positive step toward ensuring processing of HLW to final disposal at the earliest time.

As part of the Secretary's Top-to-Bottom initiative, the Environmental Management Program is being reviewed to assure that the best use of resources is occurring and that appropriate risk reduction for workers, public, and the environment will result. This entails a risk management approach to ensure that any investments are necessary and result in a commensurate and appropriate level of risk reduction. DOE-SR continues to examine the state of the HLW system (both infrastructure and operating practices) for continued improvement in risk reductions.

The results of the space management and vulnerability studies are being incorporated into the continuous activity that culminates in annual revisions to the HLW System Plan.

If you have any questions, please contact me or Charlie Anderson at (803) 208-6072.

for Greg Rudy
Manager

ED:MAM:kl

PC-02-015

Attachments:
1) HLW Tank Space Management Team #2 Final Report
2) HLW Tank Farm Vulnerability Assessment Report
3) Letter, S.F. Piccolo to C.E. Anderson, Dtd 1/29/02

cc w/o attach:
Jessie Roberson (EM-1), HQ
Barry Smith (EM-42), HQ
Randy Scott, Acting (EM-40), HQ
Mark Whitaker, (EH-9), HQ

SPACE MANAGEMENT EVALUATION
NEW EVAPORATOR

INTRODUCTION

This report summarizes the Space Management review identified in commitment 3.1 of DOE's revised Implementation Plan concerning the Defense Nuclear Facilities Safety Board's Recommendation 2001-1 as related to new evaporators. The Space Management review assessed multiple new evaporator options as a longer-term enhancement to the High Level Waste (HLW) Program. In general, the evaporator issues that impacted tank space management during 2000 and 2001 were not associated with evaporator capacity, but were process and equipment related problems that would have also impacted a new evaporator that utilized existing tank farm support systems.

Significant progress has been made to improve the operational reliability of the existing evaporator systems. The 2H Evaporator did not operate for twenty months after chemistry issues were identified in January 2000. The 2H Evaporator has now been cleaned and returned to service in October 2001. Operational strategies have been put in place to safely and effectively operate the 2H Evaporator. Aggressive measures are being taken to address the longer-term waste compatibility chemistry issues.

The 3H evaporator operation was limited to 10% utility from November 2000 to May 2001 due to failure of the cooling coils in Tank 30 (the 3H Evaporator drop tank) in November 2000. A repair was initiated in May of 2001, and the evaporator has continued to perform successfully. Subsequently, 3H Evaporator has averaged operating 60% of the time (60% utility). In addition, a project to convert Tank 37 to the 3H Evaporator drop tank is in progress.

DISCUSSION

Evaporator operations are essential to the success of the High Level Waste (HLW) Programs. The three evaporator systems currently available have sufficient capacity to handle the expected demands of the HLW system. The current HLW System Plan (Revision 12) shows that the 2H evaporator must achieve 40% utility (1,860,000 gallons/year), 3H must achieve 10% utility (367,000 gallons/year) presently and 40% utility (1,260,000 gallons/year) after the 3H/Tank 37 project is complete, and 2F must achieve 35% utility (960,000 gallons/year) to handle the current evaporator forecasts. Past evaporator performance shows that these evaporator utilities are reasonable and can be achieved. The 2H Evaporator achieved 60% utility in FY97, FY98, and FY99; the 3H Evaporator has averaged 60% utility since the Tank 30 cooling coils were repaired in May 2001; and 2F Evaporator achieved 50% utility in FY01. (Note: The 2F Evaporator achieved 35% utility in FY98, 99, and 2000. This low achievement was limited by lack of feed. With the evaporator issues in the 3H Evaporator system, waste was sent to the 2F Evaporator and a 50% utility was achieved.)

As a further example, during December 2001, the three evaporators produced approximately 1,000,000 gallons of overheads and increased tank space (i.e. net reduction in Tank Farm inventory) by 500,000 gallons. This was accomplished with an average utility of 60% for the three-evaporator systems. Even in the Super Stretch Case identified in Revision 12 of the HLW System Plan (this is the maximum forecast influent to the Tank Farm) the total influents to the Tank Farms are as follows:

Year	Tank Farm Influents	Planned Evaporation
FY02	3,920,000 gallons	3,610,000 gallons
FY03	3,860,000 gallons	5,010,000 gallons
FY04	4,180,000 gallons	3,850,000 gallons
FY05	2,670,000 gallons	3,750,000 gallons
FY06	2,330,000 gallons	3,330,000 gallons
Total:	16,960,000 gallons	19,550,000 gallons

These values include F and H Canyon receipts, DWPF recycle receipts (maximum case), inhibited water additions, jet dilution, and other water sources additions (e.g., sumps). While evaporation rates are dependent on the chemistry of the waste being processed, the 1,000,0000 gallons of evaporation in one month is a clear demonstration that the three existing evaporator systems have more than adequate capacity to handle the maximum forecasted Tank Farm influents. Therefore, the three-evaporator systems operating at expected utility would provide margin to accommodate future system upsets. If the expected operational performance is achieved, the 2F Evaporator system could potentially be used to facilitate increased operational flexibility (salt disposition) or early waste removal from old style tanks with the potential to shut down the 2F Evaporator system at some point in the future. HLW has taken additional initiative to further improve the utility of the present evaporators.

Prior to 2000, DWPF recycle and H-Canyon wastes were both fed primarily to the 2H Evaporator. This resulted in process chemistry problems that kept the 2H Evaporator from operating from January 2000 until October 2001. Subsequently, operational strategies have been put in place to safely and effectively operate the 2H Evaporator. These strategies are reflected in the HLW System Plan. While these operational strategies pose a restraint on the handling of waste within the Tank Farms, many of the new evaporator ideas would realize the same restraints. An exception would be those ideas that eliminate waste from entering the Tank Farm. Aggressive measures are being taken to address the longer-term waste compatibility chemistry issues to relax these restraints.

Space Management Team #2 (SM2) Evaluation

The Space Management Team #2 (SM2) Team performed a comprehensive systems engineering evaluation of Tank Space management options to identify specific strategies to restore operational flexibility with respect to storage space. This evaluation can be found in *Savannah River Site High Level Waste Tank Space Management Team #2 Final Report (U), WSRC-RP-2001-00606, Revision 0, May 31, 2001.* This SM2 final report discusses the evaluation process, the key assumptions, the criteria, the scoring process, and gives references to further detailed reports. As key assumptions change, the SM2 concepts would need to be addressed as part of the HLW System Planning process.

As part of the SM2 evaluation, the key evaporator assumptions in Revision 12 of the High Level Waste (HLW) System Plan were re-assessed as well as ideas for 1) new evaporators, 2) alternate waste stream evaporators, and 3) evaporator operational strategies were evaluated. These options were evaluated as a longer-term enhancement to the HLW Program.

The magnitude of a space management concept was based on post-evaporated space gained between the time the idea was implemented and the proposed Salt Processing Facility was on-line. For example, if a concept reduced an influent stream by 100,000 gallons per year and 100,000 gallons would have been reduced by evaporation to 25% of its original volume, then the concept was credited as saving 25,000 gallons of space per year. If the concept could be implemented immediately, then the idea was credited with nine years of space gain.

This methodology supports the position that:

1 The sooner a concept could be implemented, the more potential space gain it achieves; unless it was a one time space gain, (e.g., new storage tank.)

2 Actual space gain is achieved by:
- reducing influents to the Tank Farm (i.e., less waste to be evaporated and stored)
- increasing post evaporated effluents (i.e., salt and sludge removal)
- by increasing the evaporation reduction (more concentration of waste)
- increasing storage space (e.g., new storage tanks)

A key assumption for the SM2 evaluation was the startup date of the Salt Processing Facility. If the Salt Processing Facility startup date were to be delayed, those concepts that achieved annual space gain would realize additional space gain. Likewise, if earlier salt processing concepts can be realized, then those concepts that achieved annual space gain would realize less space gain.

<u>Key Evaporator Assumptions</u>

The key evaporator assumptions of the SM2 evaluation and present status are as follows:

- 2H Evaporator starts up in August 2001 and operates at an average utility of 40% *[The 2H Evaporator returned to service in October 2001. While no space gains were realized in October and November, the 2H Evaporator system achieved a 67% utility in December and gained 224,000 gallons of space.]*

- 3H Evaporator operates at 10% utility until the long term cooling fix (e.g. 3H/Tank 37 project) is complete in October 2002. Then the 3H Evaporator will operate at an average utility of 45%. *[Following a cooling coil repair in May 2001, the 3H Evaporator has averaged 53% utility and gained 1,800,000 gallons of space. The 3H/Tank 37 project is on schedule.]*

- The 2F Evaporator will operate at an average utility of 35% and the evaporator vessel will not fail until the 2H and 3H Evaporators are back on line. *[The 2F Evaporator averaged 50% utility in 2001 and gained 725,000 gallons of space.]*

- Liquid waste will continue to be evaporated, including the backlog of liquid waste that is waiting to be fully concentrated. *[The 2H Evaporator capacity at 40% utility is 1,850,000 gallons per year compared to the DWPF recycle stream of 1,200,000 per year. Much of the backlog waste is DWPF recycle and can be evaporated in the 2H Evaporator. Aggressive measures are being taken to address the longer-term waste compatibility chemistry issues.]*

Evaluation

The past two years have also shown that relevant changes and new conditions can impact the utility and versatility of the evaporator systems. Therefore, continued improvements in the versatility and utility of the evaporator systems can reduce the risk in the HLW System Plan. The SM2 team affirmed the critical nature of 1) completing the 3H Evaporator/Tank 37 modifications and 2) aggressively resolving the Tank Farm evaporator waste compatibility issues. The Tank Farm evaporator waste compatibility issues include increasing the 2H Evaporator system limits, as well as final resolution to allow all waste to be available for all evaporators.

Over thirty-five (35) ideas were proposed and evaluated by the SM2 Team to improve evaporator capacity. After screening and combining with other similar ideas, ten ideas were developed for further evaluation. These ideas can be grouped as follows:

I New Tank Farm Evaporator Ideas
- New Tank Farm Evaporator
- Mobile Evaporator
- Wiped film Evaporator
- In-Tank Riser Evaporator

II Alternate Waste Stream Evaporators
- DWPF Salt Cell Evaporator
- Late Wash Evaporator
- In Tank Precipitation Facility Evaporator
- Canyon Evaporator

III Operational Strategies
- Increase Evaporator Hold Time
- Switch High Silica Waste Evaporation from the 2H Evaporator to the 3H Evaporator

Most of the operational strategies represented good operating practices and were already incorporated in the HLW system Plan and operations practices (e.g., minimization of flush water).

I New Tank Farm Evaporator

Numerous ideas were proposed to install additional evaporators in the Tank Farms. After screening and combining with other similar ideas, there were four ideas developed for further evaluation. These four ideas are:

- *Build a new evaporator to be used with Tanks 49 and 50*
- *Install a mobile package evaporator near Tank 22*
- *Install a small riser evaporator*
- *Install a wiped film evaporator in Tank 22*

Build a new evaporator to be used with Tanks 49 and 50

This idea involves designing and installing a new Tank Farm waste evaporator near Tank 49 and 50. These two tanks were judged to be the best choice for feed and drop tanks for this new evaporator. Tank 49 and 50 were proposed because both tanks are scheduled to be returned to normal Tank Farm service and are not filled with salt. (Tank 49 was successfully returned to normal Tank Farm service in October 2001.) Use of Tank 49 and 50 also eliminate the potential for similar evaporator equipment problems (cooling coil failure) that was experienced by the 3H Evaporator. The new evaporator was postulated to be similar to the 3H Evaporator system, which was the Tank Farm's newest evaporator. The 3H Evaporator took 10 years to build and cost $150 million.

As discussed above, the three-evaporator systems currently available have sufficient capacity to handle the expected demands of the HLW system and reduce the unevaporated backlog. Based upon that, this idea realized no additional space gain over the existing evaporator capacity. In addition, the evaporator process issues that impacted tank space management would have impacted the new evaporator.

Based on no additional space gains over existing capacity, as well as the cost, timeliness, and potential for similar process problems, the Space Management Team 2 concluded that construction of an additional Tank Farm evaporator is not a viable alternative.

Install a mobile package evaporator near Tank 22

This idea involves designing and installing a mobile Tank Farm waste evaporator near Tank 22. Tank 22 was proposed because it is a primary receiver for DWPF recycle. The new evaporator was postulated to be a small (5-10 gpm) mobile package evaporator, which could be built off site and set on a pad near Tank 22. The idea called for cleaning out the sludge in Tank 22 using existing Waste Removal technology. The idea proposed installing a feed pump in Tank 22 and building a concentrate return line to Tank 22. Because of the close proximity to the old 1H Evaporator, the 1H Evaporator overhead system and Effluent Treatment Facility (ETF) tie-in could be utilized. When Tank 22 was fully evaporated, the mobile evaporator could be moved to another pad and evaporation of another tank could begin.

As discussed above, the three evaporator systems currently available have sufficient capacity to handle the expected demands of the HLW system. Because this idea does not decrease the post-evaporated volume, this idea realized no additional space gain over the existing evaporator capacity. It was estimated that 2-3 years minimum would be required to develop and implement. This estimate is impacted by the fact that there is no existing design for this type of evaporator. Therefore, this estimate to design, procure, and install a mobile evaporator is aggressive. It was also seen as a high operational risk based on the increased operational complexity and required tank-top operations. Shielding and containment problems were considered significant. Cost was judged to be less that $10 million.

Based on no additional space gains over existing capacity, the Space Management Team 2 concluded that construction of a mobile evaporator is not a viable alternative.

Installing a small evaporator into a waste tank riser

This idea involves designing and installing a small evaporator into or above a waste tank riser. Existing evaporators require a minimum of 200,000 gallons of working space to efficiently operate. A smaller evaporator mounted on a waste tank riser would require a smaller working space, perhaps 50,000 gallons. Assuming that this idea could replace the three existing evaporators, a one-time space gain of 450,000 gallons was projected. Therefore, it represents a novel approach and would realize some space gain over typical evaporator operation. However, a smaller evaporator would also reduce the processing rate. To achieve the processing capacity of the existing evaporators, an extremely high utility (>95%) would have to be realized.

This idea was the only evaporator idea that was scored using the weighted selection criteria. This idea scored low because of the relatively small space gain. A three-year design and construction schedule was used for this evaluation. This would be extremely aggressive based on the fact that there is no existing design for this type of evaporator and must be designed, procured, and installed. It was also seen as a high operational risk based on the system utility requirement, the complexity of support systems, and operations required on a tank top. In addition, significant cost would be incurred to develop the evaporator and to provide the supporting infrastructure (e.g., steam, controls, procedures, etc.). Furthermore, the evaporator process issues that impacted tank space management would have similar impacts on a small evaporator. Cost was judged to be less than $10 million.

Based on the relatively small space gains over existing evaporator capacity, timeliness risk, impact of similar process problems, cost, and high utility requirements, the Space Management Team 2 concluded that construction of a small waste tank riser evaporator is not a viable alternative.

Install a wiped film evaporator in Tank 22

This idea proposed the development of a wiped film evaporator to be installed directly above a Tank 22 riser. This idea is similar to the small evaporator in a waste tank riser discussed above. However, this evaporator has a smooth internal surface that allows for any deposits that may form during evaporation to be scraped by a wiper and dropped directly into a tank.

There are two potential benefits to this type evaporator. This type evaporator would allow for *In-situ* concentrating of the supernate in the tank to 15-20 molar sodium ion. Normal evaporator activity requires the transfer of waste to and from the evaporator. At the concentrations envisioned for this alternative, waste transfer would be impractical and, therefore, the evaporator must be positioned directly above a tank riser. In addition, the evaporator process issues that impacted tank space management are partially addressed by this type evaporator because it would be self-cleaning.

This idea was considered technically immature and would require multiple years to develop and implement. A long development, design, and construction schedule was based on the fact that there is no existing design for this type of evaporator. This idea may have potential benefit in future years but must be further evaluated. Therefore, the SM2 Team has recommended that this idea be evaluated for further technical development. This idea is in the HLW budgeting process for technical development. It was not selected for funding in FY02 based upon higher priority initiatives.

II Alternate Waste Stream Evaporators

Numerous ideas were proposed to install evaporators that would process incoming waste streams prior to entering the Tank Farm. Ideas that could decrease or eliminate the amount of recycle that comes from DWPF to the Tank Farms were of prime importance. (This include both evaporation ideas and other ideas.) At the present time, DWPF recycles approximately 1,200,000 gallons per year (200-can basis) to the Tank Farm. (Note: This is down from 2,200,000 gallons per year in FY99.) DWPF recycle consumes approximately 60-100,000 gallons per year of useable tank space in the Tank Farms after evaporation. Also, the present Tank Farm operating strategy has been changed to evaporate this recycle waste primarily through the 2H Evaporator system, where previously, this waste was evaporated by all three evaporators. This poses a restraint on the operational flexibility within the Tank Farms.

Several ideas were developed and discussed that could decrease or eliminate the volume of waste that comes from the Canyons to the Tank Farms. At the present time, the Canyons send between 400,000 and 700,000 gallons per year to the Tank Farm. This utilizes approximately 120,000 to 200,000 gallons per year of useable tank space in the Tank Farms after evaporation.

After screening and combining similar ideas, there remained three ideas that dealt specifically with new evaporators that could decrease or eliminate the amount of DWPF recycle that comes to the Tank Farms and one idea that dealt specifically with a new evaporator in the Canyon Facilities.

These four ideas are:

- DWPF Salt Cell Evaporator
- Late Wash Evaporator
- In Tank Precipitation Facility Evaporator
- Canyon Evaporator

Install an Acid Evaporator in the DWPF Salt Cell to Evaporate all DWPF Recycle.
In this idea, the DWPF salt cell is converted to allow evaporation of acidic aqueous waste streams generated at DWPF. New piping (jumpers) would be required to transfer condensate from the Slurry Mixer Evaporator Condensate Tank (SMECT) to the Salt Cell. Either a new evaporator or the Precipitate Reactor (PR), which is located in the Salt Cell, was proposed to evaporate the SMECT stream. Condensate from evaporation would be sent to the Organic Waste Storage Tank (OWST) and subsequently transferred to the Effluent Treatment Facility (ETF). A demister system would need to be developed and designed. Extension of the existing line now going to the Consolidated Incineration Facility (CIF) would be required to transfer the condensate to ETF. Evaporator bottoms would be recycled within DWPF and incorporated into the next feed batch.

Several key technical issues would need to be resolved. The flow capacity of the system would need to be verified (in particular the use of the PR). The impact of the evaporator bottoms on DWPF process would need to be evaluated for potential impact to glass qualification. The effluent stream to ETF would also need to be validated.

Multiple documents and permits would need to be modified. This would include extensive changes to the DWPF Authorization Basis, Waste Compliance Plans, and Waste Acceptance Criteria documents. The OWST and ETF permits would need to be modified with South Carolina Department of Health and Environmental Control (SCDHEC).

The cost was believed to be less than $10 million (assuming that most of the existing Salt Cell equipment could be utilized) and that funding becomes available in FY02. The project was assumed to take less than three years to complete for the purpose of this evaluation. A space gain of 250,000 to 450,000 gallons was projected based on four years of operation between the completion of this project and the start up of the Salt Processing Facility. If the project completion for a DWPF Acid Evaporator were delayed, the actual space gain would be reduced. If the Salt Processing Facility were delayed, the actual space gain would increase.

This idea ranked the highest among the three alternate waste stream evaporator ideas for two reasons. One, assuming the current PR and the other equipment in the salt cell can be utilized, the implementation schedule was assumed to be 3 years. While some modifications and technical issues must be addressed, a number of equipment and controls already exist. Two, the overall risk is judged to be small. The salt cell location provides the necessary shielding and containment while maximizing the relatively clean effluent to ETF and minimizing any return to the Tank Farms for processing. Decoupling the high volume of DWPF recycle also minimizes divisional risk by eliminating the silicon-rich recycle stream from the H-Area evaporator systems. This separation would reduce any aluminum silicate problems to canyon influents.

Based on the assumed cost, timeliness, impact of similar processes, and estimated space gains, the Space Management Team 2 concluded that construction of a DWPF Salt Cell Acid Evaporator was a viable alternative and recommended that this idea be pursued. Therefore, a technical evaluation was started in July 2001. Preliminary results indicate that several key pieces of equipment like the PR cannot be used (i.e. inadequate capacity) and the project would significantly exceed $10 million and the 3 years assumed in the evaluation. A WSRC recommendation is scheduled in the second quarter of FY02.

Ref 1 Attachment 2, page 26
Ref 2 Attachment 10, page 39, 13 pages
Ref 3 Attachment IL-11, page 77

Install an evaporator in the Late Wash Facility (LWF) for DWPF recycle

A batch evaporator could be installed in the Late Wash Facility (LWF) to handle all of the DWPF recycle. Condensate would be transferred to ETF. Bottoms would be sent to DWPF and mixed with sludge to incorporate into glass. This idea is similar to the DWPF Salt Cell Acid Evaporator idea except for the location of the evaporator at the LWF.

Acidic waste from the Slurry Mix Evaporator Condensate Tank (SMECT) and the Off-Gas Condensate Tank (OGCT) would be collected in the Recycle Collection Tank (RCT) of the DWPF. The aqueous waste would then be transferred to the Late Wash Facility and received into one of the existing tanks, which would be used as an evaporator feed tank. A new evaporator would be installed in place of the second tank in the LWF. After the waste is evaporated, bottoms would be returned from the evaporator to the Precipitate Reactor Feed Tank (PRFT) in the DWPF Salt Cell, transferred to the Precipitate Reactor Bottoms Tank in the Chemical Cell, and fed to the Slurry Receipt Adjustment Tank (SRAT). Overheads would be collected in the third tank, sampled and sent to ETF for further treatment. As with other ETF feeds, treated water would be released to the outfall, and ETF evaporator bottoms would be sent to Z Area for disposal as saltstone.

Several key technical issues would need to be resolved. The impact of the evaporator bottoms on DWPF process would need to be evaluated for potential impact to glass qualification. And the effluent stream to ETF would need to be validated.

Multiple documents and permits would need to be revised. This would include extensive DWPF Authorization Basis changes and Waste Compliance Plans and Waste Acceptance Criteria document modified.

This idea is similar to the DWPF Salt Cell Acid Evaporator idea except for the location of the evaporator. The project cost was judged to be in the range of $25 million. Higher cost was based on the knowledge that a new evaporator would have to be designed and installed in the LWF. Because the location at the LWF was further from DWPF, longer transfer routing would be required to pipe the evaporator concentrate back to DWPF. Furthermore, there is a potential that a new line for the acid feed (from DWPF) to the evaporator would be required. Therefore, this idea presented slightly greater risks to the site in all aspects graded. It also used a prime location that had a large impact to site missions since salt processing initiatives will utilize the LWF. A space gain of 250,000 to 450,000 gallons was projected based on four years of operation between the completion of this project and the start up of the Salt Processing Facility. If the project completion for a LWF Evaporator were delayed, the actual space gain would be reduced.

Based on the additional risk and the same space gains as the DWPF Salt Cell Acid Evaporator idea, the Space Management Team 2 concluded that construction of a LWF Acid Evaporator was a less favorable alternative and did not recommend this idea for further consideration.

Ref 1 Attachment 2, page 29
Ref 2 Attachment 13, page 42, 13 pages
Ref 3 Attachment IL-14, page 94

Install an evaporator in the In Tank Precipitation (ITP) Facility
Rather than placing a new evaporator in the LWF, this idea proposed a new evaporator in the filter cell of the In Tank Precipitation (ITP) Facility. Existing Filtrate Hold tanks would serve as the evaporator feed tank and the condensate receipt tank for this new evaporator. After evaporation is completed, bottoms would be neutralized and sent to a HLW storage tank in the Tank Farm. The existing Filtrate Hold Tanks would be used as condensate receivers. Overheads would be transferred to the ETF for final treatment before release to the outfall.

Because this idea is almost identical to the LWF evaporator, this idea was considered a variation of the previous idea and not evaluated separately.

Install an evaporator in the Canyons to reduce influent to the Tank Farm
This idea proposed to install an evaporator in both the 221-F and 221-H Canyons. These evaporators would concentrate the waste stream while it was still acidic. The bottoms would then be sent to the Tank Farms. While the initial volume was reduced by evaporation, this would serve only to make the solution more acidic. Therefore, more caustic would have to be added to meet the Waste Acceptance Criteria thereby increasing the volume. This resulted in only a marginal net space gain projected.

Therefore, the Space Management Team 2 concluded that no further evaluation was warranted.

Reevaluation of this idea would have to be integrated with site missions and the recognition of the evolving canyon missions (e.g., F Canyon availability).

III Operating Strategies

Two ideas presented good operating practices and deserve special mention.

- Increase Evaporator Hold Time
- Switch High Silica Waste Evaporation from the 2H Evaporator to the 3H Evaporator

The first idea recommends providing a hold tank in front of the evaporator feed tank. This is consistent with how the evaporator systems were operated in the past. It is believed this may help alleviate the aluminosilicate problem. The theory is that with increased hold time, by staging waste to be evaporated, the aluminosilicate would have more time to form in the hold tanks and would, therefore, not form in the evaporator vessel or drop line. The second idea meriting special mention was to remove the aluminum rich supernate out of the 3H system. The 3H system could then be used to evaporate the largest influent stream to the Tank Farm (i.e., DWPF recycle). The DWPF recycle could be used as a cooling agent for Tank 30. By adding cold DWPF recycle to Tank 30, the 3H system could run at near capacity. This idea appears to have merit and as our knowledge grows on the formation of aluminosilicate, this idea should be further reviewed.

SUMMARY

The Space Management Team 2 concluded that construction of an additional Tank Farm evaporator is not a viable alternative at this time for the following reasons:

- The present three evaporators have adequate capacity to handle the forecasted Tank Farm influents even for the System Plan super stretch case. The present three evaporators systems operating at expected utilities would provide margin to accommodate future system upsets
- Process Chemistry issues which restrain the present evaporators would impact new Tank Farm evaporators
- Operational strategies have been put in place to safely and effectively operate the 2H Evaporator while aggressive measures are being taken to address the longer term waste compatibility chemistry issues.
- The operational equipment issues that restrained the 3H Evaporator have been successfully repaired, while modifications are proceeding to Tank 37 for a long-term solution.

The Space Management Team 2 concluded that construction of a DWPF Salt Cell Acid Evaporator was the most viable alternative to address influent waste streams to the Tank Farm. This idea is presently being evaluated and is scheduled for a WSRC recommendation in the second quarter of FY02.

With the possible exception of a DWPF Salt Cell Acid Evaporator, the SM2 Team considers that a more prudent and cost-effective approach to manage the HLW space management problem is to resolve waste compatibility and equipment degradation problems that have hampered the efficient operations of the existing evaporators.

The results of the Space Management assessment are included in the process to develop the HLW System Plan. If circumstances result in changes to key assumptions (e.g. startup date of the Salt Processing Facility,) viability of these ideas would need to be revisited during development of future the HLW System Plans

References:

1 HLW-SDT-99-0066, Rev 1, "Savannah River Site High Level Waste Tank Space Management Team Results Report on the Intermediate List of Ideas Based on Space Gain Contributions", dated 7/19/99

2 HLW-SDT-99-0147, Rev 0, "Savannah River Site High Level Waste Tank Space Management Team Results Report on the Risk Analysis of Intermediate List Ideas", dated 7/27/99

3 HLW-SDT-99-0203, Rev 3, Letter, "Life Cycle Cost Estimates Intermediate List Ideas", dated 8/19/99

4 WSRC- RP-2001-0006, Rev 0, "Savannah River Site High Level Waste Tank Space Management Team #2 Final Report", dated 5/31/2001

SPACE MANAGEMENT EVALUATION
NEW WASTE TANKS

INTRODUCTION

This report summarizes the Space Management review identified in commitment 3.1 of DOE's revised Implementation Plan concerning the Defense Nuclear Facilities Safety Board's Recommendation 2001-1 as related to new waste tanks. The Space Management review assessed multiple new waste storage tank options, including fabrication of smaller tanks as part of or separate from the Tank Farm.

The SRS Site Treatment Plan (STP) and Federal Facilities Agreement (FFA) call for closing the HLW Tanks via removal of high level waste and subsequent vitrification of both the long-lived and short-lived radioisotopes in the Defense Waste Processing Facility (DWPF) in preparation for transport to the national high level waste repository. To make this program economically feasible, it is necessary to limit the volume of HLW glass produced by removing much of the non-radioactive salts and incidental wastes for disposal as saltstone.

Past salt processing and affected space gains led to a study of alternative options to minimize glass production. Currently, salt processing will not proceed until alternatives are investigated, designed, and constructed. Presently, this could take to FY2010. In the meantime, the Tank Farms must continue to safely receive, concentrate, and store HLW.

The Tank Farm available space is now managed under close scrutiny. No new tanks have been built since 1981. All are presently in service (or have been closed and are no longer available). The purpose of the Space Management Team #2 was to evaluate alternatives to assure that adequate space could be maintained to continue to safely receive, concentrate, and store HLW.

DISCUSSION

Waste Disposition is the primary objective of the Westinghouse Savannah River Company. Safe storage of HLW is an essential parameter to the success of the High Level Waste (HLW) Disposition Programs. Highly radioactive waste is stored in underground waste tanks built between 1951 and 1981. The HLW Program is dedicated to continuing to safely store this waste while aggressively removing the waste from the older tanks, ultimately processing the waste into its safest configuration as glass.

Several major initiatives are in progress to return previously existing tank space to normal HLW Tank Farm service.

- In October 2001, Tank 49, which was previously part of the In Tank Precipitation (ITP) Facility, was returned to waste concentrate storage service. This gained approximately 1,000,000 gallons of additional storage space to the Tank Farms.

- Tank 50, which is a 1,300,000-gallon tank currently being used as a receipt tank for the Effluent Treatment Facility (ETF), will be available in March 2003.

- Tank 48 is a 1,300,000 gallon tank presently storing approximately 240,000 gallons of waste and organic material. Recovery of Tank 48 for HLW service is being aggressively evaluated for technical options for concentrate storage service.

Ultimately, the processing of salt is the primary way to gain space in the Tank Farms other than building new waste tanks. The HLW Program has formed focus teams to develop 1) a low curie salt process, 2) an actinide removal process, and 3) a high curie salt process (e.g. Tank 48 recovery). These teams were formed to aggressively process salt in the Tank Farms. While these processes may utilize the above tanks, they will ultimately remove waste from old style tanks and provide processing space in the newer, RCRA compliant double wall tanks.

Space Management Team #2 (SM2) Evaluation

The Space Management Team #2 (SM2) performed a comprehensive systems engineering evaluation of Tank Space management options to identify specific strategies to restore operational flexibility with respect to storage space. This evaluation can be found in *Savannah River Site High Level Waste Tank Space Management Team #2 Final Report (U), WSRC-RP-2001-00606, Revision 0, May 31, 2001.* This SM2 final report discusses the process used, the criteria utilized, the scoring process, and gives references to further detailed reports.

The past two years have also shown that relevant changes and new conditions can impact the available storage space in the Tank Farms. Therefore, a comprehensive and wide range of options to restore operational flexibility with respect for available space is needed to reduce the risk in the HLW System Plan. The SM2 Team affirmed the critical nature of 1) recovery of Tank 49 (complete-October 2001), 2) recovery of Tank 50, 3) optimizing contingency space, 4) removal of waste from older style tanks, 5) development of the technology to return Tank 48 to HLW storage service, and 6) development of the new salt recovery process.

As part of the SM2 evaluation, ideas were developed and evaluated to provide new waste storage space and to increase utilization of existing storage space. Approximately twenty-eight (28) ideas were proposed and evaluated by the SM2 Team to increase the Tank Farm's waste tank storage capacity. After screening and combining with other similar ideas, eleven ideas were developed for further evaluation. These ideas involved 1) the building of new Tank Farm waste storage tank ideas and 2) ideas that increased the utilization of existing storage space. These ideas are as follows:

I New Tank Farm Storage Tank Ideas
- Construct new Waste Tanks
- Purchase small tanks for Contingency Storage Space

- Utilize former Allied General Nuclear Services (AGNS) HLW Tanks
- Store waste in Reactor Area Drain Tanks and 500,000 gallon Storage Tank
- Store waste within existing tank storage in the Canyon Facilities

II Utilization of Existing Storage Space
- Use Tank 48 for H-Area Contingency Spare Space
- Use ESP Tanks for Contingency Spare Space
- Modify Inlets to Tanks to Raise Operating Limit
- Develop Tank 48 Recovery Technology
- Resolve "Potential" Organic Issue for Tanks 26, 33, and 43
- Increase maximum operation level in Type III tanks

I New Tank Farm Waste Storage Tank Ideas

Numerous ideas were proposed to build, purchase, and install waste storage tanks in the Tank Farms. After screening and combining these with other similar ideas, there were five ideas developed for further evaluation. These five ideas are:

- Construct new Waste Tanks
- Purchase small tanks for Emergency Space
- Utilize former Allied General Nuclear Services (AGNS) HLW Tanks
- Store waste in Reactor Area Drain Tanks and 500,000 gallon Storage Tank
- Store waste within existing tank storage in the Canyons Facilities

An issue with building new HLW storage tanks is the permitting of these tanks. Since HLW waste is RCRA waste, the new tanks may require RCRA permits. The South Carolina Department of Health and Environmental Control (SCDHEC) has adopted the federal regulations. Thus, SCDHEC would control the permitting and use of any new HLW tank.

Outside stakeholders' acceptance of constructing new HLW tanks could also be an issue. The addition of more HLW tanks could be seen as a planned increased in the amount of waste stored in South Carolina. It could also be perceived as a retreat from the SRS commitment to close HLW tanks.

Construct New Waste Tanks
To implement this idea, a line item project for the construction of new waste tanks and supporting Tank Farm infrastructure is needed. Construction of four (4) new tanks similar to existing Type III tanks (constructed of carbon steel) is assumed for this idea with the first new tank placed in service in 2007. In evaluating this idea, the SM2 Team assumed construction for this major project could begin in 2004. This schedule is extremely aggressive by assuming that Congressional Line Item funding and NEPA evaluation are done in parallel (3 years), design and permitting requires an additional year, and construction requires 3 years. Therefore, this space would not be available until 2007 if aggressively worked. (It has been estimated that the permitting and construction

period required to have tanks suitable for storage of HLW would more realistically take from seven to ten years.)

Outside stakeholders' acceptance of constructing new HLW tanks was identified as a risk to implementing this idea. The addition of four more HLW tanks would be seen as a planned increase in the amount of waste stored in South Carolina. It could also be perceived as a retreat from the SRS commitment to close HLW tanks. As part of the risk analysis for this idea, the SM2 Team assumed that 40% of the space provided would be used to store salt cake waste removed from older tanks to allow earlier tank closure. This strategy was judged by the SM2 Team to be necessary to gain outside stakeholders' acceptance of constructing new HLW tanks. Funding for preparing these tanks to remove salt would be needed in FY2007 and FY2008. The salt solution generated from dissolving this salt cake waste (~3,300,000 gallons) is assumed to be volume reduced by evaporation to ~2,000,000 gallons (~40% of the total new space). Therefore, the net increase in available space for these four tanks is thus reduced to 3,200,000 gallons of the total new space of 5,200,000 gallons provided.

Extensive modification within the HLW Tank Farms would be required. To use these new tanks, either new transfer lines or changes to existing lines would be needed. A new diversion box would also be needed because of the new interconnections. They would require appropriately sized ventilation systems, with redundant ventilation fan systems. Tanks would also be equipped with vapor space monitoring equipment, cooling coils, annulus leak detection, radiation monitoring, slurry pumps, transfer pumps and transfer jets. Steam must be supplied for the annulus systems and the transfer jets.

The Tank Farm Authorization Basis (AB) and the Federal Facility Agreement (FFA) would require renegotiation and revision, since four additional HLW tanks requiring eventual closure would be built. It was assumed that the Tank Farm Waste Water Permit would require revision and negotiation, and there is a risk that an RCRA permit would be required.

This idea was attractive because it gained a significant volume (3,200,000 gallons) of space. However, this idea was estimated at over $300 million. In addition, this idea has regulatory, stakeholder and permitting issues. Constructing and operating new HLW tanks would also add to the ultimate environmental management and restoration cleanup mission.

Based on the complexity of implementing a project to put tanks into near term service, the timeliness, cost, stakeholder concerns, and permitting risk, the Space Management Team 2 concluded that construction of additional HLW Storage Tanks is not a viable alternative. However, if significant delays to salt processing were to occur, then a project for new waste tanks should be reevaluated.

Ref 1 Attachment 2, Rev 1, page 11
Ref 2 Attachment 1, page 30 (7 pages)
Ref 3 Attachment IL-01, page 32

Purchase Small Tanks for Contingency Storage Space
This idea proposed that commercially available prefabricated tanks be used for contingency storage. These would be procured and installed with appropriate transfer for use in the event of a HLW tank leak. Tanks similar to those used for solvent storage, which are doubly contained, would be used. These tanks would be installed in a clean area, avoiding the expense of working in a contaminated area during installation. With tanks available as large as 35,000 gallons (16-ft. diameter), the required contingency inventory of 1,300,000 gallons would require the use of 42 tanks.

To use these new tanks, the tanks would be placed underground, so they would need no additional shielding. Additional infrastructure including either new transfer lines or changes to existing lines are needed. A new diversion box would also be needed because of these new interconnections. They would be equipped with appropriately sized ventilation systems, with redundant ventilation fan systems. Tanks would also be equipped with vapor space monitoring equipment, level monitoring, temperature monitoring, cooling coils, annulus leak detection, radiation monitoring, slurry pumps, transfer pumps and transfer jets. Steam must be supplied for the annulus systems, ventilation systems, and the transfer jets. Procurement and receipt of the portable tanks would take four years. The schedule assumed for the purpose of this evaluation was one year for permitting and conceptual design, one year for Title II design, 18 months for construction, and 6 months for testing and turnover. Congressional Line Item funding makes the schedule assumption extremely aggressive and a significant risk.

A risk involved with this idea was based on the expected perception of the regulators and public that SRS proposes to build more tanks at the expense of salt processing. Although the Team felt that this perception could be changed by 1) explaining that the new tanks are necessary to enable the continued operation of DWPF and the Canyons and 2) by committing not to put HLW in these tanks unless a HLW storage tank is leaking. To date, this has not been discussed with regulators and shareholder groups.

The net space gain is accomplished by providing 1,300,000 gallons of new contingency space, thereby allowing the existing 1,300,000 gallons of contingency space to be available.

The Tank Farm Authorization Basis (AB) and the Federal Facility Compliance Agreement (FFCA) must be revised and renegotiated. It was assumed that the Tank Farm Waste Water Permit would require revision and negotiation, and there is a risk that a RCRA permit would also be required. Based on EPD discussions with SCDHEC about using other SRS tanks for HLW service, some of the ideas would likely be considered a new function and SCDHEC would require the tank to be permitted as a RCRA Treatment, Storage, and Disposal (TSD) facility.

This idea was attractive because it gained a significant volume (1,300,000 gallons) of space. However, this idea's score was reduced because this idea has regulatory, stakeholder, and permitting risks and a significant capital investment, which was estimated at over $100 million. In addition, there were major operational risks identified with the complexity of piping the forty-two tanks together.

Based on the timeliness, stakeholder and permitting risk, the operational complexity, and the cost, the Space Management Team 2 concluded that construction of numerous small, HLW contingency storage tanks is not a viable alternative.

Ref 1 Attachment 2, Rev 1, page 17
Ref 2 Attachment 15, page 44 (13 pages)
Ref 3 Attachment IL-16, page 119

Utilize Former Allied General Nuclear Services (AGNS) tanks to store waste
To implement this idea, a line item project is needed for 1) procurement of two 300,000 gallon tanks from the former Allied General Nuclear Services (AGNS) in Barnwell, SC, 2) transportation of the tanks to the Tank Farm, and 3) the construction of the supporting Tank Farm infrastructure. These two tanks are presently stored at AGNS and can be readily available. It is assumed that these tanks could be placed in service in 2006. The SM2 Team assumed construction for this major project could begin in 2004 for the purpose of this evaluation. This schedule aggressively assumes that budgeting and NEPA evaluation are done in parallel (3 years), design and permitting requires an additional year, and construction requires 3 years. (While the two tanks are available, the construction of the support systems would still take significant time.)

To use these new tanks, either new transfer lines or changes to existing lines are needed. A new diversion box would also be needed because of these new interconnections. This box would need to be tied in with the Tank Farm, eventually with the Salt Processing Facility and possibly with DWPF to maximize the future use of these tanks. They would be equipped with appropriately sized ventilation systems, with redundant ventilation fan systems. Tanks would also be equipped with vapor space monitoring equipment, cooling coils, annulus leak detection, radiation monitoring, slurry pumps, transfer pumps, and transfer jets. Steam must be supplied for the annulus systems and the transfer jets.

The Tank Farm Authorization Basis (AB) and the Federal Facility Compliance Agreement (FFCA) must be revised and renegotiated, since two additional HLW tanks requiring eventual closure would be built. It was assumed that the Tank Farm Waste Water Permit would require revision and negotiation, and there is a risk that a RCRA permit would also be required. Based on EPD discussions with SCDHEC about using other SRS tanks for HLW service, some of the ideas would likely be considered a new function and SCDHEC would require the tank to be permitted as a RCRA Treatment, Storage, and Disposal (TSD) facility.

This idea gained only 600,000 gallons of space and has regulatory and permitting issues. In addition, this idea's scored low because of the large cost, which was estimated at about $25 million.

Based on the timeliness, stakeholder and permitting risk, the operational complexity, and the cost, the Space Management Team 2 concluded that installation of the two 300,000 gallon AGNS tanks to be uses as HLW storage tanks is not a viable alternative.

Store Waste in Tanks in Reactor Areas
This idea proposes to use three Reactor Drain tanks (55,000 gallons total), five Reactor Storage tanks (185,000 gallons total), and four 500,000–gallon basin tanks for HLW salt solution. Limited shielding on some of these tanks may preclude their use without major modifications. These tanks are located in C-, P-, L-, and K-Reactor Areas. The Drain Tanks and Storage Tanks are located within the shielded Reactor Building. The unshielded 500,000-gallon tanks are located below grade in the Reactor Area basins. HLW must be loaded in tanker trucks and transported to each Reactor Area, then unloaded into these tanks for storage. A new transportation trailer with suitable shielding to transport HLW must be procured, qualified, and permitted. Stations must be constructed for loading and unloading waste in the Tank Farm and in each reactor area (a total of 5). Total increase in available space for this approach is 2,240,000 gallons, if fully implemented for HLW. However, only the larger tanks are assumed to be utilized for the net increase in available space of 2,000,000 gallons.

Permitting of these tanks would be an issue. The SRS Environmental Compliance Division evaluated the use of the 500,000-gallon tanks as a possible storage facility for HLW salt solution from the HLW Tank Farms. The environmental concerns include: 1) integrity of the tanks, 2) requirement for secondary containment, and 3) permit requirements. The use of these remote tanks (outside the HLW system) would be governed by RCRA regulations, 40 CFR 260-266, since they are not part of the totally enclosed wastewater storage and treatment system (Tank Farms, DWPF, Z Area, and ETF).

The South Carolina Department of Health and Environmental Control (SCDHEC) would control the permitting and use of the tanks. The tank must meet design standards for material to be stored and must be leak tested. The leak test is an annual requirement. Secondary containment is required. While "tank integrity" requirements cover existing tank systems without secondary containment, the design criteria may require the addition of secondary containment and leak detection system. Based on EPD discussions with SCDHEC, this use for these tanks would likely be considered a new function and SCDHEC would require the tank to be permitted as an RCRA Treatment, Storage, and Disposal (TSD) facility. SRS may be required to upgrade the tank to current design standards before an operating permit for this use would be issued by SCDHEC

In discussions with the Onsite Transportation and Packaging group of SRTC, a qualified waste transport container would need to be developed, tested, and qualified. The waste trailers must meet all appropriate regulations. About $1 M is needed to procure, test, and qualify a new trailer for on-site waste transport, according to the Onsite Transportation and Packaging group.

The SM2 Team assumed two years are needed to complete preliminary design and permitting. An additional two years are needed to upgrade a tank to meet RCRA requirements and install truck unloading stations. Because these tanks are located in separate areas, upgrades would be spread over four years. Staffing for receipt, monitoring, and shipment of waste will also be required in the four reactor areas.

This idea utilizes the four unshielded 500,000-gallon tanks located below grade in the P-, L-, C-, and K-Reactor Area basins. Therefore, the complexity of operation needed to implement this idea would be significant. To implement this idea, HLW would be stored in six different areas on site and would require significant increase in manpower to appropriately monitor and respond. This would require monitoring and response beyond existing controls. In addition, it would require 200 separate transfers to fill each tank. The tanks are several miles from the existing Tank Farms and HLW would have to be transported over the site roads. Surface spills of HLW in the volume at risk would be unacceptable and no acceptable risk handling strategy was identified.

The SM2 team performed a risk analysis on this idea and evaluated that the safety risk and operational risks were a "High Unmitigatable Risk." Therefore, this idea was dropped from further consideration.

Ref 1 Attachment 2, Rev 1, page 13
Ref 2 Attachment 7, page 36 (3 pages)

Store Waste in Existing Facility's Tanks in the Canyons
This idea uses existing or builds new stainless steel tanks in unused portions of F and H Canyons. These tanks would be temporary holding tanks for acid waste until salt processing came on line. The additional storage capacity was estimated at 240,000 gallons. Based on the low volume increase of this idea, this idea was not evaluated further.

II Utilization of Existing Storage Space.

Numerous ideas were proposed to utilize space presently existing in the waste storage tanks in the Tank Farms. After screening and combining with other similar ideas, there were six ideas developed for further evaluation.

These six ideas are:

- Use Tank 48 for H-Area Contingency Spare Space
- Use ESP Tanks for Contingency Spare Space
- Modify Inlets to Tanks to Raise Operating Limit
- Develop Tank 48 Recovery Technology
- Resolve "Potential" Organic Issue for Tanks
- Increase maximum operation level in Type III tanks

Use Tank 48 for H-Area Contingency Spare Space
Tank 48 currently contains 240,000 gallons of precipitate left over from the 1983 ITP demonstration and the single batch of salt solution processed in 1996. This waste must be stored in a tank with nitrogen inerting capabilities due to flammability concerns associated with benzene generation. The contingency spare space for this waste is maintained in Tank 49. As such, Tank

49 also has a nitrogen inerted system. The waste in Tank 48 will remain in storage until salt processing starts up or technology to recover Tank 48 is developed.

Until September 2001, Tank 49 contained about 100,000 gallons of organic bearing water. The organic compounds were destroyed using elevated temperatures and a copper catalyst. The contents were then transferred to Tank 50 for disposal via Saltstone. Tank 49 has subsequently returned to concentrate waste storage and has been refilled with concentrated HLW supernate. The AB requires that at least 240,000 gallons of contingency space be maintained in Tank 49 in case Tank 48 leaks. Expanding the scope of this AB change to enable supernate to be added to Tank 48 in the event of a tank leak is the basis for this idea. About 1,031,000 gallons of space in Tank 48 could therefore be credited as contingency spare space in H Area and thus generate that much space in other Type III tanks for HLW use. This space could be made available in FY02 with no capital cost.

The risks identified by the Team involved the potential to create a larger legacy organic bearing waste if supernate waste were added to Tank 48 and the potential for complications during the future startup of salt processing.

Currently, Tank Farm waste cannot be added to Tank 48. Authorization Basis documents changes would be required with the Department of Energy's approval prior to waste actually being transferred into Tank 48. Agreement with the Department of Energy to credit space in Tank 48 as contingency space has not been achieved.

This idea provides a large increase in available space, it was not expensive, and it could be accomplished in the near future. Scores were moderately reduced because of the technical/operational risk.

Based on the timeliness, operational simplicity, and cost, the Space Management Team 2 concluded that efforts to credit the space in Tank 48 as H Tank Farm Contingency space should be pursued.

Use Extended Sludge Processing (ESP) Tanks for Contingency Spare Space

Extended Sludge Processing now uses two tanks: Tanks 40 and 51. One tank contains a batch of qualified sludge feed while the other contains a batch of sludge undergoing sludge washing and qualification. This idea would credit the 500,000-700,000 gallons of space in these tanks as contingency spare space.

The risk in this idea is that two to three years of canister production could be lost in the event of a tank leak and the credited space had to be used. Transferring several hundred thousand gallons of salt solution into a batch of washed sludge would re-contaminate the sludge with salt. Washing would then need to start over again.

Based on the smaller space gain and a higher negative site mission impact of this idea compared to the utilization of Tank 48 as contingency space, the Space Management Team 2 concluded that the use of ESP tanks as contingency space is a viable idea. However, they recommended the utilization of Tank 48 as contingency space be given higher consideration.

Modify Inlets to Tanks to Raise Operating Limit

This idea was applied only to Type III tanks. Each tank has one inlet line, one outlet line, a gravity drain line, and in some cases, a Concentrate Transfer System (CTS) loop line. The elevation of these lines relative to the bottom of the tank determines the fill limit of the tank as it is undesirable to fill the tank to a level where the liquid will flow back into the lines. This idea employs a loop seal on each line installed as close to the tank as possible. The loop seal limits the backflow of waste into the lines enabling each tank to increase the allowable fill limit. This additional space could be used to store waste or it could be used as part of the contingency space calculation.

This idea was not applied to the following tanks for the stated reasons:

- salt receiver Tanks 30, 37, 38 and 46 due to pluggage concerns;
- feed Tanks 26 and 43 due to concerns with the pump motor elevation; and
- rapid LFL Tanks 26, 32, 33, 35, 39, 43, and 46 due to concerns with reduced reaction time as the tank vapor space approaches the LFL

This idea was applied to all Type III tanks that are projected to be used for storage only over the next several years. These tanks are 25, 27-29, 31, 34, 36, 41-42, 44-45, 47, 49-50 after they are recovered. This idea could increase the fill limit of each tank by ten inches or a total of 491,000 gallons. The SM2 Team scored this idea significantly low because of the high cost (over $10M) and radiation exposure required to implement.

Develop Tank 48 Recovery Technology

This idea was to concentrate the 240,000 gallons of Tank 48 waste precipitate from 4% to 10%. This idea gained only 100,000 gallons. Based on the low volume increase of this idea, this idea did not make the Intermediate List. However, the SM2 Team recognized that the Tank 48 material will sit there until the new salt processing is achieved. Development of the technology to recover Tank 48 would 1) allow recovery of the 240,000 gallons of waste and 2) allow the recovery of 1,300,000 gallons. Therefore, the SM2 team recommended that further technical development be pursued. An assessment of the technical feasibility of dispositioning the current waste in Tank 48 with the purpose of returning Tank 48 to HLW service is commitment 3.5 of the DOE Revised Implementation Plan concerning the DNFSB Recommendation 2001-1.

Resolve "Potential" Organic Issue for Tanks

There are three potential organic waste tanks (Tanks 26, 33, and 43). When making transfers out of these tanks, a margin of 24 inches of waste must not be transferred (and therefore not subsequently concentrated) to prevent the possible transfer of organics to downstream waste tanks and pump tanks. If the organic issue could be resolved and the controls eliminated, then an additional 24 inches of waste per tank could be transferred to the evaporator and concentrated by about 70%. This would result in a one-time increase in available space of 179,000 gallons. Based on the low volume increase of this idea, this idea did not make the Intermediate List. However, preliminary work has shown that this is a viable option. Therefore, the SM2 team recommended that further technical development be pursued. Resolution of this issue is being addressed as part of the new Tank Farm Safety Analysis.

Increase maximum operation level in Type III tanks

This idea applied only to Type III tanks. Each tank has one inlet line, one outlet line, a gravity drain line, and in some cases, a Concentrate Transfer System (CTS) loop line. The elevation of these lines relative to the bottom of the tank determines the fill limit of the tank as it is undesirable to fill the tank to a level where the liquid will flow back into the lines. The operation limit is set conservatively 8 inches below these lines. This idea was to increase the operation limit and to utilize 3 inches of additional space. If the removal of 3 inches of conservatism can be justified with Authorization Basis uncertainty calculations, this would increase the available space by only 240,000 gallons. Based on the low volume increase of this idea, and the uncertainty that the reduction could be justified, this idea was not further developed.

SUMMARY

It is concluded that construction of additional HLW Waste storage tanks is not a viable alternative. This is based on:

- The construction of new tanks would add additional complexity to the operation of the Tank Farms. Waste tanks require ventilation systems, level monitoring, temperature monitoring, vapor space monitoring equipment, cooling coils, annulus leak detection, radiation monitoring, slurry pumps, transfer pumps and transfer jets. Steam must be supplied for the annulus systems, ventilation systems, and the transfer jets.
- The construction of new tanks would be very costly ($25 to >$300 million). Since the time necessary to obtain Congressional Line Item approval for a project of this size would not provide the added capacity for many years, it does not represent a good return on investment.
- Outside stakeholders acceptance of constructing new HLW tanks could be an issue. The addition of more HLW tanks could be seen as a planned increase in the amount of waste stored in South Carolina. It could also be perceived as a retreat from the SRS commitment to close HLW tanks.
- Permitting issues may exist to the building of new HLW storage tanks. Since HLW waste is RCRA .waste, the new tanks may require RCRA permits. The South Carolina Department of Health and Environmental Control (SCDHEC) has adopted the federal regulations. Thus, SCDHEC would control the permitting and use of any new tank.

The SM2 Team considered that a more prudent and cost-effective approach is to develop the technology to recover Tank 48, and to develop new salt recovery process that can be implemented early while enhancing our current equipment performance for space management.

Based on the estimated space gains, timeliness, and assumed cost, the Space Management Team 2 concluded that optimization of contingency space should be pursued including:

- the use of Tank 48 as contingency space for H Tank Farm; and
- if required, the use of Extended Sludge Processing tanks as contingency space.

The results of the Space Management assessment are included in the process to develop the HLW System Plan. If circumstances result in changes to key assumptions (e.g., startup date of the Salt Processing Facility), viability of these ideas would need to be revisited during development of future HLW System Plans.

References:

1 HLW-SDT-99-0066, Rev 1, "Savannah River Site High Level Waste Tank Space Management Team Results Report on the Intermediate List of Ideas Based on Space Gain Contributions", dated 7/19/99

2 HLW-SDT-99-0147, Rev 0, "Savannah River Site High Level Waste Tank Space Management Team Results Report on the Risk Analysis of Intermediate List Ideas", dated 7/27/99

3 HLW-SDT-99-0203, Rev 3, Letter, "Life Cycle Cost Estimates Intermediate List Ideas", dated 8/19/99

4 WSRC- RP-2001-0006, Rev 0, "Savannah River Site High Level Waste Tank Space Management Team #2 Final Report", dated 5/31/2001

ATT. 1

Savannah River Site

High Level Waste Tank Space Management Team #2

Final Report (U)

WSRC-RP-2001-00606

Revision: 0

May 31, 2001

Att. 2

HIGH LEVEL WASTE TANK FARM VULNERABILITY ASSESSMENT REPORT (U)

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CONTROLLED NUCLEAR INFORMATION

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