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SAVANNAH RIVER SITE TANK WASTE PROCESSING SUMMARY

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This Savannah River Site Tank Waste Processing Summary provides an overview of the strategy for salt and sludge waste disposition and tank closures in the Liquid Waste and Waste Solidification System. It addresses the major activities and sequences of permits, tank activities, and facility utilization required prior to the start up of the Salt Waste Processing Facility (SWPF) in April 2009.

The Common Goals and Values – as developed by the Department of Energy (DOE), the South Carolina Department of Health and Environmental Control (SCDHEC), and the Governor's Nuclear Advisory Council – provide the framework for this strategy. These Common Goals and Values are as follows:

1. Reduce operational risk and the risk of high-level waste (HLW) leaks to the environment by removing waste from tanks.
2. Remove actinides from waste expeditiously since they impact on the environment most significantly if a leak occurs
3. Maximize amount of waste ready for disposal in a deep geologic repository. Make significant effort to ensure maximum amount of long-lived radionuclides are disposed in a deep geologic repository.
4. Remove as much cesium as practicable from salt waste and dispose in parallel with vitrified sludge.
5. Dispose of cesium in HLW as soon as practicable to avoid having cesium-only waste when sludge vitrification is complete.
6. Limit disposal of radioactive waste onsite at SRS so that residual radioactivity is as low as reasonably achievable.
7. Ensure DOE's strategy and plans are subject to public involvement and acceptance.

There is a critical shortage of processing and storage space in the SRS waste tanks. To maximize risk reduction, an adequate amount of compliant tank space must be maintained through the disposition of a limited volume of decontaminated salt solution to the Saltstone Production Facility (Saltstone) prior to the availability of the SWPF. Failure to preserve adequate tank space significantly extends the use of the aging tanks for waste storage, significantly increases risk of insult to the environment, and delays risk reduction activities significantly beyond the forecast completion date of 2019.

This strategy provides for three overarching and highly integrated activities: salt processing and disposition, sludge processing and disposition, and tank closure.

1. Salt Processing and Disposition

To maintain sufficient space for sludge processing and the staging of salt solution prior to SWPF startup, limited removal of salt waste from the Tank Farms is required. This allows removal of sludge waste, the material with the majority of the long-lived actinides such as plutonium, for vitrification in DWPF. This strategy also permits the SWPF to achieve maximum salt processing capacity in the shortest period of time which results in the safe disposition of the tank waste as quickly as practical. Disposition of low-activity salt waste at Saltstone is necessary to prepare the Tank Farm for the startup of the SWPF. The strategy presented in this document represents a refinement in the selection of tanks

that support interim salt processing (period of time prior to the startup of the SWPF). To minimize the curie content dispositioned in Saltstone, tanks were carefully selected for salt removal and the volumes were planned to provide only the minimum essential tank space. This selection process limits the total estimated inventory in the Saltstone vaults to approximately 3 MCi. Due to the uncertainty associated with the current characterization of the saltcake waste, the actual curie content of this material may be as high as 5 MCi. Nearly all of these curies are associated with Cs-137 which has a half-life of approximately 30 years.

The tanks necessary to support SWPF processing and to maintain evaporator viability for sustained sludge processing are:

Tank	Planned Service
41	SWPF staging tank
42	SWPF staging tank
48	Modular Caustic Side Solvent Extraction (CSSX) Unit (MCU) and Actinide Removal Process (ARP) feed tank
49	SWPF feed tank
28	F-Tank Farm salt solution staging tank
37	3H Evaporator concentrate receipt tank
38	2H Evaporator concentrate receipt tank

Sufficient waste from these tanks must be removed to support the processing needs. These seven tanks currently contain 6.6 million gallons of waste and 40 MCi. To enable utilization of these tanks, only the minimal essential volume of lower activity material in the tank farm will be dispositioned at Saltstone. The balance of the space required for support of interim salt processing is made available by redistribution of higher activity waste throughout the tank farm for future processing at SWPF. Actions taken to date include emptying concentrated supernate from Tank 49 (involving 12 transfers totaling over 3 million gallons) and extracting interstitial supernate from Tank 41. Another example of the redistribution of higher activity waste within this plan involves the disposition of salt from F-Tank Farm tanks. Saltcake in Tank 25 in F-Tank Farm has a lower curie content than the salt solution currently stored in Tank 42. This plan minimizes curies by dispositioning the lower curie material from Tank 25 to provide storage space for the transfer of higher curie material from Tank 42 into the space created in Tank 25. Ultimately, this provides the required processing space in Tank 42 to support the operation of the SWPF.

During interim salt processing, the interstitial liquid in the saltcake is extracted to the maximum extent practical, thus removing a large fraction of the radioactive material. Treated water is then added to dissolve the salt and the resultant salt solution is transferred to a processing tank. Approximately 8.6 million gallons of decontaminated salt solution will be processed using this technology with an estimated 2.5 MCi dispositioned in the Saltstone vaults from these streams.

Once the MCU and ARP facilities are operational in FY07, the majority of waste will be further processed through these facilities. The combination of these facilities and their associated treatment processes significantly lowers the curies in the decontaminated salt

solution dispositioned in Saltstone. Approximately 2.8 million gallons of salt waste will be treated by these facilities prior to the start up of the SWPF with an estimated 0.3 MCi dispositioned in the Saltstone vaults from these facilities. Had this 2.8 million gallons of salt solution not been processed through ARP and MCU, an estimated 3.4 MCi would have been sent to Saltstone from this material alone, i.e., the total number of curies ultimately dispositioned in the Saltstone vaults would double.

The major Salt Processing and Disposition activities during Interim Salt Processing include:

- Process salt solutions originating from Tanks 25, 28, 38, 41 and 48 per the attached schedule
- Start-up the MCU and ARP by August 2007

The SWPF is the cornerstone of the salt processing strategy. This facility will be capable of processing 6 to 9 million gallons of salt solution per year after the first year of operation with a nominal annual processing rate of 7 million gallons. The SWPF will become operational in FY09 with a planned processing rate of 5 million gallons during the first twelve months of operation. The decontaminated salt solution produced by the SWPF will be below Class A limits for both Cs-137 and actinides, and will add less than 0.2 MCi to the Saltstone vaults' inventory through 2019.

The attached schedule depicts the salt waste disposition activities in the interim time period prior to the start up of the SWPF.

2. Sludge Processing and Disposition

Since the startup of DWPF, initial processing has focused on removing sludge from non-compliant tanks. This emphasis is maintained to maximize risk reduction.

Sludge removal begins by mechanically mixing the waste tanks to suspend the sludge particles. Once suspended, the sludge slurry is transferred to a sludge feed preparation tank. After this transfer a small heel of sludge remains in the waste tank.

The sludge heel is removed through water additions and mechanical mixing and transferred to a sludge feed preparation tank. Chemical additions combined with mechanical mixing may be used to minimize the residual material to meet tank closure criteria.

In the sludge feed preparation tank the sludge batch is washed by adding water, mixing, settling and decanting. The sludge washing process removes most soluble salts remaining in the sludge. This reduces the amount of waste to be vitrified and ensures the sludge meets the DWPF WAC and Federal Repository requirements. After sludge washing, the sludge batch is transferred to the DWPF feed tank for transfer to the DWPF facility where the waste is vitrified.

On average, approximately two million gallons of water are used to wash a sludge batch. Although the wash water is volume reduced in the evaporator systems, the resulting salt and concentrated supernate diminish compliant tank space. Every gallon of settled sludge processed from a non-compliant tank results in the accumulation of about 1.3 gallons in

compliant tank space. Without the successful processing of salt, the preparation of additional sludge batches will cease due to the lack of compliant tank space. This would result in the shutdown of DWPF in or around 2008.

The major Sludge Processing and Disposition activities include:

- Feed and operate DWPF to vitrify sludge waste at a rate of 250 canisters per year.
- Remove sludge waste from non-compliant Tanks 4, 5, 6, 11, 12, and 13 to support sludge batch preparation

The attached schedule depicts the preparation and feeding of the batches required to maintain DWPF operations through the interim time period.

3. Tank Closure

After completion of the bulk sludge removal, the tank heel residual material is removed to the extent technically and economically practicable. The remaining residual material is sampled and characterized to determine both the radiological and non-radiological source terms. This data is input into the Fate and Transport groundwater model. The tank residual characterization results and the modeling results must demonstrate that the proposed closure will meet the overall performance objectives determined from the applicable environmental regulations.

The next step is stabilization of the residual contaminants and closure of the tanks under the industrial wastewater permits for Tank Farm operations. The SRS Federal Facility Agreement (FFA) requires that the twenty-two remaining High Level Waste tanks not meeting the secondary containment standards be operationally closed in accordance with the FFA Waste Removal Schedule. The FFA schedule requires operational closure of Tank 19F by October 31, 2006 and Tank 18F by February 28, 2007. The 242-F Evaporator system, which is not included in the FFA schedule, will be operationally closed after Tank 18F.

The Industrial Wastewater Closure Plan for F- and H-Area High Level Waste Tank Systems – the General Closure Plan – is being revised based on:

- the enactment of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, Section 3116 for Waste Determinations,
- lessons learned from the previous tank closures,
- internal reviews, and
- changes to be incorporated as identified by SCDHEC and the Environmental Protection Agency (EPA) in their most recent reviews.

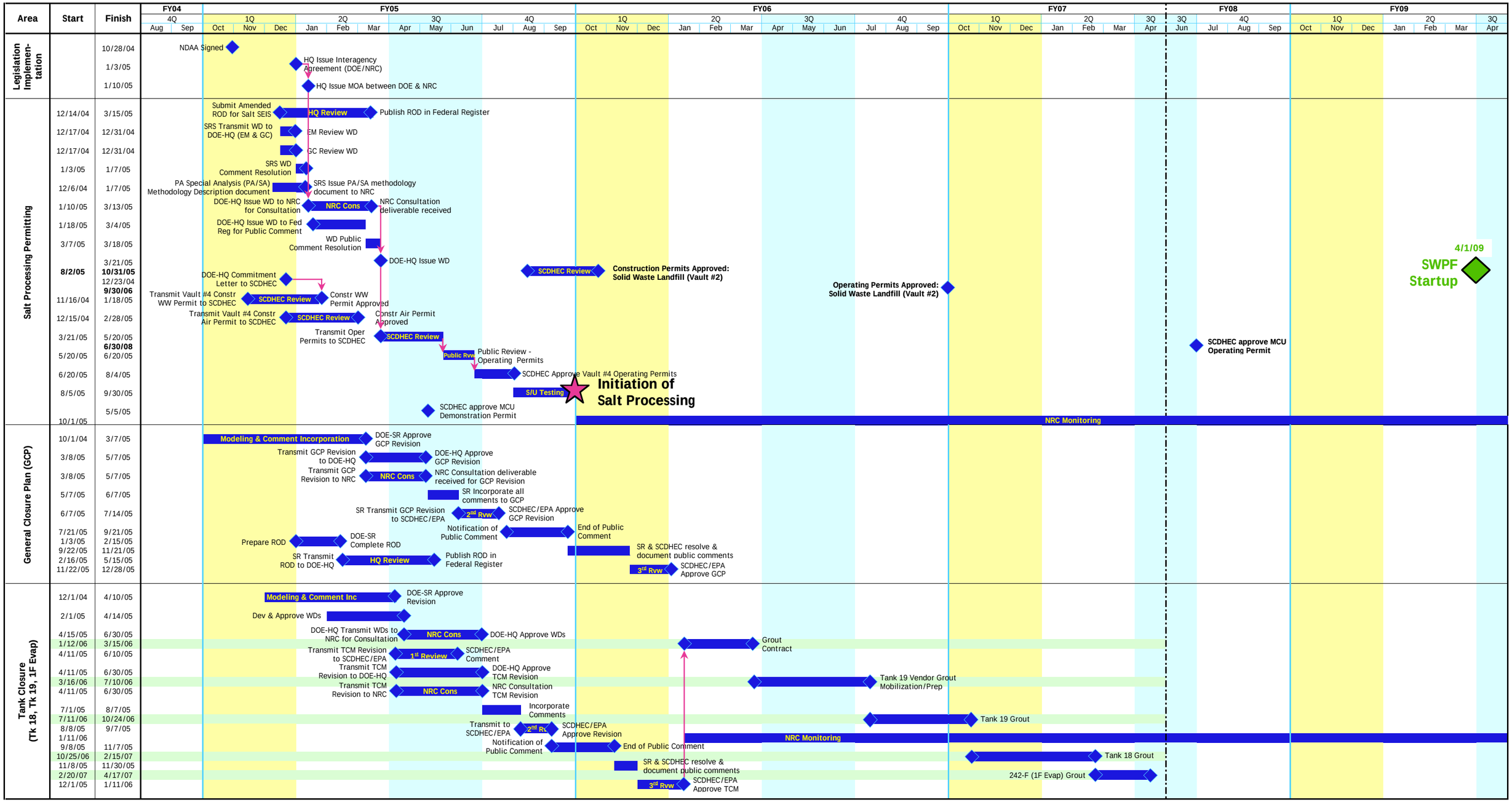
There will be a public comment process on the General Closure Plan in 2005 after the identified changes are incorporated and the necessary reviews and approvals completed. The individual Industrial Wastewater Closure Modules for Tank 18, Tank 19 and the 242-F Evaporator System are also being revised. A public comment process for the Industrial Wastewater Closure Modules is required as well. After final approval of the Closure Modules by SCDHEC, grouting of Tanks 19 and 18 will occur.

In addition, an accounting of the closure impacts of all tanks against the performance objectives will be maintained to ensure ultimate conformance when the last tanks are

closed. Tanks 17F and 20F, which were closed using this process, were the first High Level Waste tanks in the United States to be closed.

The major Tank Closure activities include:

- Close Tanks 18 and 19
- Close 242-F Evaporator

The timing of tank closure activities in the interim period is shown in the attached schedule.

SRS Tank Waste Processing Summary