High-Level Waste Disposition – 2002 Report

"High–level waste" is highly radioactive liquid waste that results primarily from the reprocessing of spent nuclear fuel. This category includes liquid waste produced directly in reprocessing. The waste contains both transuranic waste and fission products in concentrations requiring permanent isolation from the environment.

SRS continues to manage and disposition approximately 37 million gallons of high–level liquid radioactive waste (about 400 million curies), which is stored in 49 large, shielded, and partially underground tanks grouped into two "tank farms." Twenty–nine tanks are located in the H Area Tank Farm and 20 in the F Area Tank Farm. All SRS tanks are built of carbon steel inside reinforced concrete containment vaults.

The major waste streams in the F Area and H Area tank farms include transfers from the canyons, receipts from the Receiving Basin for Offsite Fuels, and a low–activity waste stream from the Defense Waste Processing Facility (DWPF).

High–Level Waste Facilities

The F Area and H Area tank farms consist of large underground storage tanks that hold high–level liquid radioactive waste. Fresh waste received from the processing of the spent nuclear fuel separates into two parts, as follows:

- A sludge (which contains most of the radioactivity) that settles on the bottom of the tank
- A watery "supernate" that occupies the area above the sludge

The supernate is transferred to an evaporator system, where it is processed further. The evaporator system reduces this supernate to 30 percent of its original volume. The concentrated supernate that remains will eventually form a solid as it is cooled. This solid, commonly known as salt cake, generally resides in the evaporator concentrate tanks. The sludge layer remains in its original tank until a sludge processing campaign is executed.

Both F Area and H Area have their own evaporator systems. F Area has one operating system (2F) while H Area has two (2H and 3H). These evaporators reclaimed about 4 millions gallons of tank farm space in 2002.

SRS has successfully conducted this space reclamation operation in the tank farms since 1960, when the first evaporator facilities began operation. More than 100 million gallons of space have been reclaimed during this time. Without these evaporator systems, SRS would have required 86 additional waste storage tanks—at $50 million apiece—to store waste produced over the site's lifetime.

The Extended Sludge Processing Facility, one of two DWPF pretreatment operations in the Liquid Waste Disposition area, washes sludge (settled insoluble waste) to reduce the concentration of sodium salts, which ensures glass quality when the sludge is processed at DWPF. In 2002, the facility began processing the third of 10 sludge batches that will be required to vitrify all the high–level waste sludge, and continued preparation of the fourth sludge batch As part of the fourth sludge batch, 30,000 gallons of Americium/Curium solution from F Canyon was transferred to Tank 51 in H Area in a single transfer. Three million gallons of sludge must be pretreated in this manner.

The washed and decanted sludge is transferred to DWPF as part of "sludge only" operations. DWPF then processes the sludge from the original waste by combining it with glass frit. The mixture is heated until it melts, then is poured into stainless steel canisters to cool. The glass–like solid that forms contains the highly radioactive material and seals it off from the environment. Another word for this process is "vitrification." The sealed canisters will be stored at SRS until a federal repository is established.

The Salt Waste Processing Facility, the second pretreatment operation for DWPF, was expected to process the salt cake and highly concentrated supernate waste (the result of the evaporation process) in tanks. However, work on salt processing was suspended in January 1998 because of technical issues with the system.

In October 2001, DOE approved a record of decision 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 salt.

In December 2001, a request for proposal was issued by DOE for a two–phased design/build process for design, construction and commissioning of a Salt Waste Processing Facility using CSSX technology. 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 high–level waste system and to meet commitments for the closure of high–level waste tanks.

In 2002, DOE approved another processing option for salt cake with low levels of radioactivity. This process involves removal of the majority of the Cesium–137 contamination from the salt cake by draining the interstitial liquid from the tank. The remaining dry salt cake, with low activity, will be dissolved with water and transferred to a hold tank for sampling. If it meets permit requirements, the liquid will be dispositioned to the Saltstone facility.

Accomplishments

SRS continued to manage its high–level waste facilities in support of the integrated high–level waste removal program in 2002.

Tank Farms

The tank farm evaporators recovered more than 4 million gallons of tank space in 2002 through evaporation of the watery supernate that resides atop the sludge in the tanks. The 2H evaporator system contributed two million gallons to the recovery of space during 2002. The 3H evaporator system recovered more than one million gallons during the year, while the 2F evaporator system also recovered more than one million gallons. One of the keys to this achievement was an inter–area line used to transfer waste from H Area to F Area via a 2–mile underground system. Approximately one million gallons of radioactive waste were transferred via the inter–area line during 2002. The tank farms conducted a total of more than 700 transfers, moving over 40 million gallons of waste, during FY 02.

Modifications to the evaporator systems and tank farms ensured the continuation of safe operations in 2002—without affecting productivity. For example, some of the salt cake in Tank 37 was removed and the tank was outfitted as a receipt tank for the 3H Evaporator, giving the system extra flexibility by having two receipt tanks. Use of Tank 49 and the impending release of Tank 50 for other uses, have also added increased flexibility to the high–level waste system.

DWPF

The original DWPF melter has ended its successful operation by producing 119 radioactive canisters in 2002, bringing the total to 1339 canisters since radioactive processing began in March 1996.

The original melter has been successfully deinventoried and removed from service due to reduced production output. This melter's operation was extended by approximately four years with innovative and prudent engineering controls, combined with disciplined operations.

DWPF will continue processing sludge until the 'precipitate' from one of the salt processing facilities is available.

Approximately 200 canisters of glass are expected to be produced in 2003. Research and technology development is expected to result in increased waste in each canister in 2003.