Facts from the Savannah River Site
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Salt Waste Processing

The Savannah River Site's (SRS) radioactive liquid waste operations include the management of space in the remaining 43 underground waste tanks, including the removal of waste materials. The bulk of the stored waste is in one of two forms: salt waste and sludge waste. Sludge waste is approximately eight percent of the total waste volume in the SRS tank farms; salt waste is the other 92 percent.

Removing salt waste is a major step toward emptying the Site's waste tanks that currently contain approximately 35 million gallons of waste. Additionally, salt waste must be dispositioned to ensure adequate tank space to prepare sludge for vitrification.

The processes involved in the treatment of that waste typically increase the total waste volume through dilution with the addition of water and chemicals.

Five different processes have been used at SRS to treat salt waste:

1. Deliquification, Dissolution, and Adjustment - Deliquification (i.e. extracting the interstitial liquid) was an effective decontamination process because the primary radionuclide in salt is Cesium-137 (Cs-137), which is highly soluble. To accomplish the process, the salt was first deliquified by draining and pumping. The deliquefied salt was then dissolved by adding water and pumping out the salt solution. The resulting salt solution was aggregated with other Tank Farm waste to adjust batch chemistry for processing at the Saltstone Production Facility (SPF). This process was used from March 2007 to April 2008 and treated approximately 2.8 million gallons of salt waste.

2. Actinide Removal Process (ARP) – In ARP, Monosodium Titanate (MST) was added to the waste as a finely divided solid. Actinides sorbed on the MST and were then filtered out of the liquid to produce a clarified salt waste stream that was sent to the Modular Caustic Side Solvent Extraction Unit (MCU) for additional treatment. The solids, containing the MST with the actinides, were dispositioned at the Defense Waste Processing Facility (DWPF) through vitrification.

3. Modular Caustic Side Solvent Extraction Unit (MCU) – The ARP clarified salt waste stream required reduction in the concentration of Cs-137 using the MCU processes. MCU was a solvent extraction process for removal of Cs-137 from caustic salt solutions. The solvent was fed to a bank of centrifugal contactors while the waste was fed to the other end in a counter-current flow. The solvent extracts the cesium, with each successive contactor stage extracting more, resulting in a decontaminated salt solution stream and a cesium-laden solvent stream. The solvent stream was stripped of its cesium, washed, and the solvent reused. The cesium was transferred to DWPF. ARP and MCU were utilized at SRS to process salt waste from April 2008 to May 2019. A total exceeding 7.4 million gallons of salt waste was treated by ARP and MCU.

Removing salt waste, which fills approximately 92 percent of the tank space in the SRS tank farms, is a major step toward emptying the Site's waste tanks that currently contain approximately 35 million gallons of waste.

U.S. DEPARTMENT OF ENERGY

The Savannah River Site is owned by the U.S. Department of Energy. Savannah River Nuclear Solutions is the management and operations contractor at the Savannah River Site. Savannah River Remediation is the current liquid waste contractor at the Savannah River Site.

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4. Tank Closure Cesium Removal (TCCR) – TCCR consists of an ion exchange process for the removal of cesium from liquid salt waste to provide supplemental treatment capability. Building on the experience of modular commercial nuclear plant decontamination and following the disaster response associated with Fukushima, technology exists to efficiently accomplish selective removal of the cesium component of the bulk salt waste. The configuration is an "at-tank" modular arrangement. Cesium removal takes place inside of TCCR; the spent TCCR columns containing the removed cesium are placed in interim safe storage. TCCR began operation on Tank 10H in 2019 and will continue to treat salt waste from tanks 10H and 9H over the next few years. Future application of this technology to other waste tanks is under evaluation.

5. Salt Waste Processing Facility (SWPF) – SWPF incorporates the same technologies as those used in the ARP and MCU processes but on a much larger scale in a shielded facility capable of handling salt with higher levels of radioactivity. SWPF is expected to treat the majority of salt waste stored in the waste tanks at a rate of approximately six to nine million gallons each year. Before treatment, that salt waste must be dissolved and diluted in the tank farms to meet required sodium concentrations in SWPF. Similarly, concentrated supernate liquid in the tanks must be diluted to meet the allowable aluminum and sodium limits at the facility. Those necessary adjustments will increase the 35 million gallons in the tanks to approximately 100 million gallons during processing from the addition of water and chemicals.

The high-activity radionuclides removed from the salt waste are transferred to DWPF for vitrification, while the decontaminated salt solution (DSS) is pumped to the SPF. The SPF contains the tanks and equipment necessary to receive the DSS and treat and process it into saltstone grout, by mixing the liquid feed with cementitious materials (cement, fly ash, and slag). When mixed with those materials, each gallon of DSS becomes approximately 1.76 gallons of grout. The grout is pumped from the SPF into Saltstone Disposal Units (SDUs), which are permanent disposal units. There, the saltstone grout solidifies into a monolithic, non-hazardous, solid low-level waste form.

The goal is to immobilize all of the waste into one of two final solid forms for safe, long-term storage. The high-level sludge is converted to glass at DWPF and stored in stainless-steel canisters. The DSS is converted to a cement-like grout stored in SDUs, for disposal of low-activity salt waste.