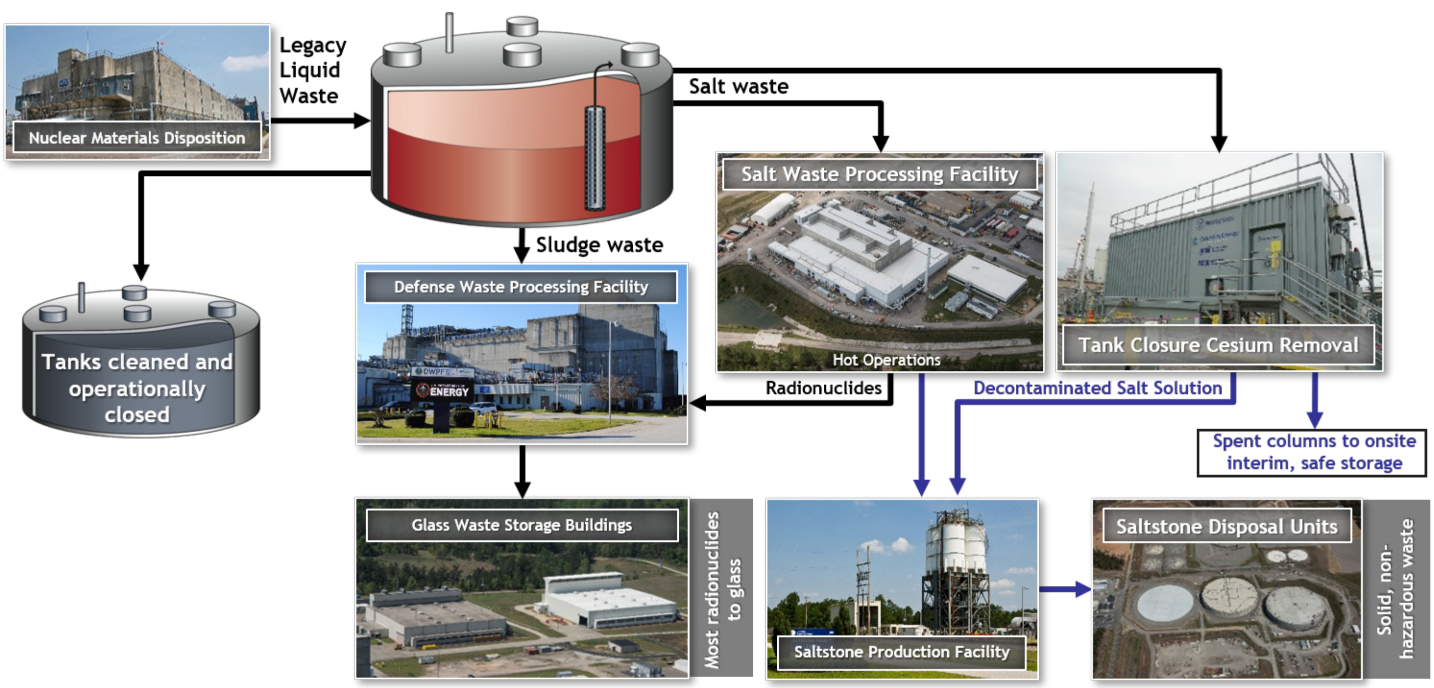
Facts from the Savannah River Site
ENVIRONMENTAL STEWARDSHIP • NATIONAL SECURITY • SCIENCE AND ENERGY

Liquid Waste Facilities

Radioactive liquid waste is generated at the Savannah River Site (SRS) as by-products from the processing of nuclear materials for national defense, research, medical programs, and outer space missions. The waste, totaling about 35 million gallons, is stored in the remaining 43 underground carbon-steel waste tanks grouped into two tank farms at SRS.

The liquid waste program at SRS consists of high-hazard operations, which include complex engineering, procurement, construction, waste treatment, grouting, and disposal in order to operationally close the radioactive liquid waste tanks. Below is a diagram of the process.

SRS Liquid Waste Cycle



TANK FARMS

SRS has a total of 51 waste tanks built in the Site's F and H Areas; eight of those tanks have been operationally closed. Several of the remaining 43 waste tanks are in various stages of the waste removal, cleaning, and operational closure process. In waste tanks, the insoluble solids in the waste settle to the bottom, forming "sludge." Liquid above the sludge, referred to as salt waste, is concentrated by evaporation to reduce its volume. As the concentrated salt waste cools, a portion crystallizes forming a solid "saltcake." This concentration process not only reduces the volume, but also makes the waste less mobile.

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.

SRS SAVANNAH RIVER SITE

March 2021

EVAPORATORS

Since the processing of nuclear materials began, more than 160 million gallons of radioactive liquid waste has been received for storage into the tank farms, exceeding the maximum 59-million-gallon capacity of the 51 underground waste storage tanks.

The salt waste has been reduced to about 25 to 30 percent of its original volume by a controlled evaporation process in five site liquid waste operations evaporators – three of which have since ceased operations. The condensed evaporator "overheads," or water removed from the waste, are transferred to the Effluent Treatment Project for final treatment prior to release to the environment.

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.

EFFLUENT TREATMENT PROJECT

The Effluent Treatment Project treats the low-level radioactive wastewater, which was formerly sent to seepage basins, in accordance with the state of South Carolina regulatory permit. Treated streams include evaporator overheads, segregated cooling water, contaminated surface water runoff, transfer line catch-tank streams, and others.

- Began operating in 1988.
- Processes approximately 10 million gallons of wastewater per year.
- Treatment processes include pH adjustment, filtration, organic removal, reverse osmosis, and ion exchange.
- Treated wastewater streams are released to a permitted outfall.

SALT WASTE PROCESSING

Removing salt waste, which makes up approximately 92 percent of the waste volume in the SRS tank farms, is a major step toward emptying and closing the Site's remaining 43 high-level waste tanks that contain approximately 35 million gallons of waste.

SALT WASTE PROCESSING FACILITY (SWPF)

SWPF will process the majority of the Site's salt solution waste. SWPF incorporates the same technologies as those pioneered during interim salt processing at the Actinide Removal Process (ARP) and Caustic Side Solvent Extraction (CSSX) facilities. The key difference is SWPF processes radioactive liquid waste on a much larger scale in a shielded facility capable of handling salt with higher levels of radioactivity. SWPF is expected to treat most of the salt waste stored in the waste tanks at a rate of approximately six to nine million gallons each year.

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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.

The Alpha Strike Process in SWPF involves adding a chemical to the salt solution that binds with the strontium and alpha emitting radioactive contaminants in the salt solution. The waste is then filtered to remove the MST that has bound to the alpha and strontium materials. The high activity solids are then transferred to the Defense Waste Processing Facility (DWPF). The remaining filtered salt solution is then sent to the Caustic Side Solvent Extraction (CSSX) process. Using principles involving centrifugal force and a specially engineered solvent, CSSX divides the high-activity salt solution into two waste streams. The cesium is removed and sent to DWPF. The remaining decontaminated salt solution (DSS) is transferred to the Saltstone Production Facility, where it is mixed with dry cement-like materials to form a grout for safe, permanent disposal in Saltstone Disposal Units.

Interim Salt Processing Facilities: Actinide Removal Process (ARP) & Modular Caustic Side Solvent Extraction Unit (MCU)

ARP and MCU were pilot projects built with the intention of processing waste for three years while awaiting construction of SWPF. Instead, ARP/MCU served the liquid waste mission for approximately 11 years, removing radioactivity from 7.4 million gallons of salt waste. The removed radioactive material was then transferred to DWPF for immobilization into glass. Both facilities were removed from service in May 2019, and waste feed lines were re-routed to SWPF.

DEFENSE WASTE PROCESSING FACILITY (DWPF)

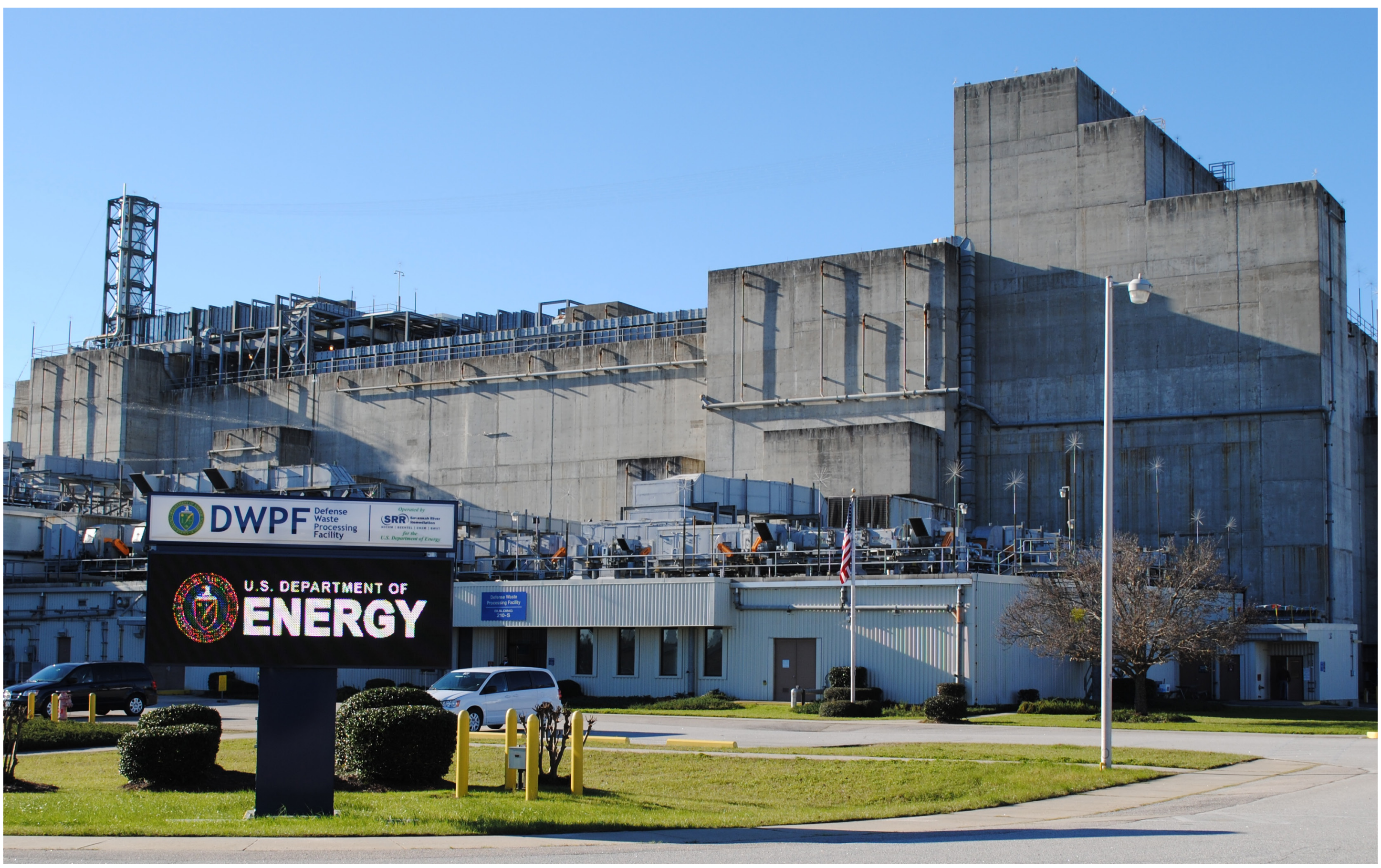
DWPF is the only operating radioactive waste glassification plant in the nation. This facility, which began radioactive operations in March 1996, uses a vitrification process to convert high-level radioactive liquid waste currently stored at SRS into a solid glass form suitable for long-term storage and disposal.

Scientists have long considered vitrification as the preferred option for treating radioactive liquid waste. By immobilizing the radioactivity in glass, DWPF reduces the risks associated with the continued storage of liquid waste at SRS and prepares the waste for final disposal in a federal repository.

SALTSTONE PRODUCTION FACILITY (SPF)

The SPF contains the tanks and equipment necessary to receive the DSS and process it into saltstone grout by mixing the liquid feed with cementitious materials (cement, fly ash, and slag). The grout is pumped from the SPF to the Saltstone Disposal Facility, which contains numerous Saltstone Disposal Units (SDU), where the saltstone grout solidifies into a monolithic, non-hazardous, solid low-level waste form.

SDUs are large concrete vaults used for permanent disposal of the saltstone. The early vaults were rectangular in shape. Subsequent SDUs were cylindrical and based on a design used commercially for storage of water and other liquids. The early cylindrical SDUs held approximately three million gallons of saltstone. In 2012 DOE approved the design for mega-volume units that are 10 times larger than the previous SDUs. The mega-volume units are 375 feet in diameter, 43 feet high, and can hold approximately 33 million gallons of saltstone. They are designed for the larger quantities of DSS produced by SWPF.



DWPF began radioactive operations in March 1996.