

## Waste Management

At the Savannah River Site (SRS), waste was generated as a result of the manufacturing of plutonium, tritium and other nuclear materials required to support our national defense. SRS manages high-level waste, low-level waste, hazardous waste, mixed waste, transuranic waste and sanitary (non-radioactive, non-hazardous) waste.

### High-level waste

After fuel and targets were fabricated, assembled and irradiated in nuclear reactors, the resulting spent fuel and targets were taken to separations plants. There, the desired products were chemically separated, leaving the unusable byproducts as intensely radioactive waste. High-level radioactive waste from the separations process was generated in both solid and liquid forms: insoluble solid chemicals and water soluble salts.

In storage tanks, the insoluble solids settle and accumulate on the bottom of the tanks. This is referred to as “sludge.” Liquid above the sludge is concentrated by evaporation to reduce its volume. The concentrate left behind is a damp “salt cake.”

All of the high-level liquid waste produced at SRS to date is stored in tanks on site, where high-heat waste is given time to decay prior to evaporation. Approximately 100 million gallons of high-level waste have been concentrated by evaporation to a present volume of about 38 million gallons (Savannah River High Level Waste Systems Plan Rev.12).

SRS waste tanks have provided more than 40 years of safe storage for high-level waste. These tanks include four designs, all consisting of a steel tank within a concrete vault.

- Types I and II, the oldest tanks, have 5-foot high secondary steel containment pans within a concrete vault and forced cooling systems. Type I tanks are 75 feet in diameter and hold 750,000 gallons. Type II tanks are 85 feet in diameter and hold 1.03 million gallons. Some of these tanks have developed small hairline cracks that leaked salt solution into secondary pans below the tanks. The cracks were induced by high nitrate concentration in the waste solutions and residual stresses near weld sites.

- Tank 16, a Type II tank, is the only tank to have had a release of waste from the secondary pan. The leak, which occurred in 1960, was from the primary tank into the secondary pan and then through a concrete vault joint into the ground. A few tens of gallons of waste escaped to the soil. The tank was removed from service and cleaned. Currently, Tank 16 is empty awaiting decommissioning and is included in the Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation program. The location where the waste contacted soil has been monitored to ensure that the surrounding soil retained the waste and that it has not migrated to other areas.
- Type III tanks have full-height secondary containment. These tanks, built since the mid-1960s, have been successfully stress-relieved to prevent stress cracking. Corrosion and pitting of the tanks are controlled through a special waste-chemistry program. Under this program, the waste is sampled and chemicals added, if necessary, to maintain corrosion inhibitors within prescribed limits.
- The Type III design holds 1.3 million gallons and is 33 feet high and 85 feet in diameter. The inner (primary) tank that actually holds the waste is shaped like a doughnut around the central concrete column that supports the roof. A secondary containment tank completely surrounds the primary. The secondary tank is surrounded by a 2- to 4-foot thick concrete vault. As a fourth independent containment for the waste, a minimum 10-foot layer of specially selected, impermeable clay is placed around the tank. No cracks or leak sites have occurred in any of the Type III tanks.
- Type IV tanks have a single wall and do not have a forced cooling water system. Type IV tanks are designed for waste storage that does not require auxiliary cooling. This type is basically a steel tank within a prestressed concrete vault in the form of a vertical cylinder with a domed roof. Each tank holds 1.3 million gallons and is 85 feet in diameter and 33 feet high.

High-level waste has been removed from the Type IV tanks, with the exception of a small amount of residual sludge. The Type IV tanks contain less than 1 percent of the total radioactive content of the waste.

Plans call for removing the waste from all of the tanks for processing in new facilities.

- The sludge that remains in the waste tanks (which contains most of the radioactivity), along with the radioactive cesium from the salt solution, will be transferred to the site's Defense Waste Processing Facility for immobilization within borosilicate glass. The Defense Waste Processing Facility began radioactive operations on March 12, 1996.

## **Sanitary Waste**

Sanitary Waste or municipal solid waste is solid waste that is neither radioactive nor hazardous as defined by the AEA or RCRA. Sanitary Waste consists of materials that would be received by a municipal sanitary landfill (office waste, food, garbage, refuse and other solid wastes that are similar to those generated by most households) and industrial waste (construction debris, scrap metals, wood waste, etc).

## **Solid low-level waste**

The site's solid low-level wastes include such items as contaminated protective clothing, tools and equipment that have become contaminated with small amounts of radioactive material. In October 1994, SRS opened engineered concrete vaults for the permanent disposal of solid low-level waste. Low-level waste which is very low in radioactivity may also be disposed in trenches if the waste meets acceptance criteria based on a long-term (10,000-year) radiological performance assessment. Limits are derived to ensure performance criteria such as drinking water standards are adhered to.

Two types of vaults are used, one for low-activity waste (LAW - waste radiating less than 200 mrem/hour) and one for intermediate-activity waste (waste radiating greater than 200 mrem/hour). The concrete used in both was specially formulated. Its composition is designed to mitigate cracking, extending the vault life.

The trenches opened in 1994 are called slit trenches because they are long and narrow, measuring 20 feet wide and 600 feet long. These are used primarily for disposal of soil from potentially contaminated areas containing no measurable radioactivity.

In February 2001, SRS began disposal of low-level waste with extremely low radioactive content in Engineered Trench #1. This "drive-in" trench, located inside E-Area, is designed to extend the useful life of the existing Low Activity Waste Vaults (LAWV) and allow shallow land burial of selected low-level waste. A large percentage of waste (approximately 65 percent), currently stored in the existing LAWV is a candidate for future trench disposal. This approach will enable the more robust LAWVs to be reserved for higher activity low-level waste.

The Engineered Trench measures 200 feet in length by 20 feet in width. It is equipped with a concrete sump and pump system (including sample station) to manage anticipated rainfall. The trench is also equipped with a vadose zone monitoring system (VZMS) installed around the perimeter.

With the ET #1 now fully operational, SRS expects to extend the valuable and expensive LAWV space until 2024.

## **Liquid low-level waste**

Liquid low-level waste is a by-product of the separations process and tank farm operations. This waste is treated in the Effluent Treatment Facility (ETF). This facility treats the liquid waste for discharge to a National Pollutant Discharge Elimination System permitted outfall, effectively capturing all chemical

and radioactive contaminants except tritium. The state-of-the-art process includes: pH adjustment, submicron filtration, organic removal, reverse osmosis and ion exchange. ETF replaced the seepage basins that were used until November 1988.

### **TRU waste**

Waste that contains transuranic (TRU) nuclides (radioactive elements with an atomic number greater than uranium [92]) is stored at SRS while awaiting shipment to the Department of Energy Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico. The initial shipment of waste from SRS was shipped May 8, 2001, and shipments continue.

### **Hazardous waste and mixed waste**

Hazardous wastes and mixed (containing both hazardous and radioactive components) wastes are being stored on site in RCRA-permitted facilities until appropriate treatment facilities become available. Both waste types are now being sent offsite for treatment and disposal.

A new facility, the Mixed Waste Processing Facility, is currently in the construction phase and slated to become operational in FY02. This facility will allow the sorting and segregation of mixed low level radioactive waste. The waste will be removed from its original container, sorted into like waste forms and repackaged into a new waste container. The repackaged waste will then go for further treatment and/or disposal.

### **Waste minimization program**

SRS has an active waste minimization program to reduce volume and/or avoid production of all waste types generated at the site. Efforts to reduce or eliminate waste before it is generated include process modification, use of alternative process material, recycling and reuse. Efforts to reduce waste after it has been generated include segregation of non-radioactive and non-toxic materials and waste compaction.