An Overview of the Savannah River Site

NATIONAL SECURITY • ENVIRONMENTAL STEWARDSHIP • CLEAN ENERGY

A U.S. Department of Energy site located in Aiken, S.C.
The Savannah River Site

Dedicated to maintaining the highest possible safety and security standards, the Savannah River Site (SRS) is a key U.S. Department of Energy (DOE) industrial complex responsible for environmental stewardship, environmental cleanup, waste management and disposition of nuclear materials.

Safety
SRS is committed to its people, missions and the future. SRS has a long track record of being one of the safest sites in the DOE complex and one of the safest major industrial sites in the world. Protecting workers, the public, the environment and national security interests are our highest goals.

Missions
SRS processes and stores nuclear materials in support of national defense and U.S. nuclear nonproliferation efforts. The Site also develops and deploys technologies to improve the environment and treat solid and liquid nuclear and hazardous wastes left from the Cold War. While current missions remain the highest priority, SRS leadership places great importance on developing broader missions for SRS that use its unique capabilities in order to address critical national missions.

History
During the 1950s, SRS began to produce materials used in nuclear weapons, primarily tritium and plutonium-239. Five reactors and support facilities were built to produce these nuclear materials. Irradiated materials were moved from the reactors to one of the two chemical separations plants. In these facilities, known as “canyons,” the irradiated fuel and target assemblies were chemically processed to separate useful products from waste. After refinement, nuclear materials were shipped to other DOE sites for final application. SRS produced about 36 metric tons of plutonium from 1953 to 1988.

Environment
Originally farms and swamp land, SRS now encompasses a timber and forestry research center managed by the U.S. Forest Service-Savannah River. In 1972, SRS was designated as the first National Environmental Research Park. Today, the vast forests of SRS are home to rare and endangered species including wood storks, bald eagles and red cockaded woodpeckers, as well as wild turkeys, white-tailed deer and otters.

SRS is owned by the U.S. Department of Energy; Federal agencies at SRS include:
- Department of Energy: Savannah River Operations Office
- National Nuclear Security Administration: Savannah River Field Office, Office of Fissile Materials Disposition and MOX Project Office
- U.S. Forest Service-Savannah River
- U.S. Nuclear Regulatory Commission
- U.S. Army Corps of Engineers

11,200 current employees
(contractors and federal agencies)

6 major contractors
- Savannah River Nuclear Solutions, LLC
- Savannah River Remediation LLC
- CB&A AREVA MOX Services
- Parsons
- Centerra Group, LLC
- University of Georgia

310 square-mile site
Located near Aiken, S.C. on the Savannah River, which borders South Carolina and Georgia. SRS covers 198,046 acres, including parts of Aiken, Barnwell and Allendale counties in South Carolina.

1950
President Harry S. Truman authorizes construction of SRS
Six towns were moved to make way for the Savannah River Plant (now SRS).

6 reactors originally constructed
Also, two chemical separations plants, a heavy water extraction plant, a nuclear fuel and target fabrication facility, a tritium extraction facility and waste management facilities.

$1.9 billion annual budget

$2.6 billion annual regional economic impact across the two-state area

$200 million spent annually in local procurements
Spent nuclear fuel (SNF) is nuclear fuel that has been irradiated in a nuclear reactor. SNF from the Site’s former production reactors and from foreign and domestic research reactor programs is currently safely stored in an underwater storage facility in L Area, called a disassembly basin. L Basin has concrete walls two and a half to seven feet thick and holds approximately 3.4 million gallons of water, with pool depths of 17 to 50 feet. The basin water provides shielding to protect workers from radiation. Since 1964, SRS has received more than 2,352 casks containing over 46,700 SNF assemblies.

K Area Complex

Operations at SRS’s K Area Complex (KAC) provide for the handling and interim safe storage for much of DOE’s excess plutonium and other special nuclear materials (SNM). The principal operations building formerly housed K Reactor, which produced nuclear materials to support the U.S. during the Cold War for nearly four decades. It was DOE’s last operating production reactor, shutting down in 1992. A DOE decision in 2000 allowed K Reactor to go through significant seismic, structural and security upgrades to become DOE’s only Category 1 SNM storage facility. Since that time, SRS has assisted DOE in saving millions of taxpayer dollars through the safe receipt and storage of nuclear materials from the Rocky Flats Environmental Technology Site, SRS’s FB Line, the Hanford Site, Lawrence Livermore National Laboratory and Los Alamos National Laboratory. Verification measurements and other surveillance examinations ensure the security of SNM in K Area. In the future, stabilization and repackaging capability can be added to the KAC to further enhance DOE’s ability to manage excess plutonium and other SNM until a final disposition path is achieved.

Our Missions

60% EM
Environmental Management
Management, stabilization and disposition of nuclear materials
Management and disposition of solid, liquid and transuranic wastes
Spent fuel management
Environmental remediation and cleanup

35% NNSA
National Nuclear Security Administration
Tritium operations and extraction
Helium-3 recovery
Nonproliferation support
Mixed Oxide Fuel Fabrication Facility
Uranium blending and shipping
Foreign fuel receipts

5% WFO
Work for Others
Other federal agencies
Other DOE sites
Private industry
Other minor entities

The ‘City’ of SRS
To support operations, SRS maintains an infrastructure similar to a small city.
- Fire department and emergency services
- Medical facilities
- 230 miles of roads and first S.C. cloverleaf
- Water and electrical utilities
- Weather center
- Information technology networks
- Locomotive and train tracks
- Biofuels plant for power generation

Nuclear Fuel Operations

Spent nuclear fuel (SNF) is nuclear fuel that has been irradiated in a nuclear reactor. SNF from the Site’s former production reactors and from foreign and domestic research reactor programs is currently safely stored in an underwater storage facility in L Area, called a disassembly basin. L Basin has concrete walls two and a half to seven feet thick and holds approximately 3.4 million gallons of water, with pool depths of 17 to 50 feet. The basin water provides shielding to protect workers from radiation. Since 1964, SRS has received more than 2,352 casks containing over 46,700 SNF assemblies.
H Canyon • HB Line
by the numbers

1955  30   22
H Canyon began operations. The facility is still in use. NASA deep-space explorations powered by plutonium-238 recovered in H Canyon. 22 hours to dissolve a fuel bundle in nitric acid.

335 trailers of low enriched uranium sent to the Tennessee Valley Authority since March 2003. That’s enough to power all S.C. homes for 8.5 years or all U.S. homes for 47 days.

22 metric tons of highly enriched uranium downblended to low enriched uranium. That’s the equivalent of 1,028 million barrels of oil.

1,028 feet long, more than three football fields.

H Canyon
SRS’s two primary separations facilities, called “canyons,” are located in F and H Areas. F Canyon and H Canyon—together with FB Line and HB Line, which are located atop the canyons—are where nuclear materials historically have been chemically recovered and purified. F Canyon and FB Line have been deactivated and await further disposition decisions.

H Canyon and HB Line support the DOE Enriched Uranium and Plutonium Disposition programs by reducing the quantity of fissile materials in storage throughout the U.S. This supports environmental cleanup and nuclear nonproliferation efforts, and a smaller, safer, more secure and less expensive nuclear weapons complex.

H Canyon is the only operating production-scale, nuclear chemical separations facility in the U.S. The facility’s operations historically recovered uranium-235 and neptunium-237 from spent nuclear fuel rods from Site production reactors and from domestic and foreign research reactor programs.

More recently, SRS has used H Canyon to downblend highly enriched uranium, which can be used in nuclear weapons, into low enriched uranium (LEU). LEU is not desirable for weapons use and can be used to make fuel for the Tennessee Valley Authority’s (TVA) commercial power reactors. Since March 2003, over 330 trailers of LEU have been shipped to TVA, providing enough LEU to provide power for all the homes in South Carolina for over 8.5 years or every home in the U.S. for approximately 47 days.

HB Line
HB Line, located on top of H Canyon, is the only chemical processing facility of its kind in the DOE complex.

HB Line has produced plutonium-238 for the National Aeronautics and Space Administration (NASA). In 1995, SRS completed a five-year campaign to supply plutonium-238 for NASA’s Cassini mission. The unmanned expedition to Saturn was launched Oct. 13, 1997, and arrived on July 1, 2004. Cassini’s missions will run through 2017.

HB Line has more recently been used to make plutonium oxide, a non-weapons usable form of plutonium. After leaving HB Line, the plutonium oxide will be sent to a different facility to be made into fuel for commercial nuclear power reactors.

(Clockwise from left) A shipment of low enriched uranium on its way to TVA; plutonium-238; an artist’s rendering of the Cassini spacecraft.
Savannah River Tritium Enterprise

SRS is the nation’s only facility for extracting, recycling, purifying and reloading tritium, a radioactive isotope of hydrogen that is a key element of modern nuclear weapons.

SRS supports five tritium and gas transfer system-related missions on behalf of NNSA: tritium supply, stockpile maintenance, stockpile evaluation, helium-3 recovery, and research and development (R&D).

Plutonium Disposition

SRS missions include the use of its unique facilities, capabilities and expertise to address issues of national security and nonproliferation, including legacy material disposition. Plutonium and nuclear material management missions have long been conducted at SRS, using facilities in various areas. The current Plutonium Disposition mission includes disposition of excess material from across the DOE complex and other materials returned to the U.S. through the Gap Removal program. Additionally, SRS missions include disposition of nuclear material from dismantled weapons, consistent with the U.S.-Russian agreement on nonproliferation. The Mixed Oxide Fuel Fabrication Facility being constructed at SRS is designed to convert excess weapons-grade plutonium to a form that can be used in commercial power reactors. DOE is also evaluating an alternate approach to dispose of this excess weapons-grade material by mixing the nuclear material with inhibitor material, which is referred to as “downblend and disposal.”
Savannah River National Laboratory

Savannah River National Laboratory (SRNL) is a multi-program national laboratory that puts science to work to provide practical, cost-effective solutions for our nation’s environmental cleanup, nuclear security and clean energy challenges.

The laboratory has a staff of more than 1,000, including many internationally recognized experts. SRNL researchers have made significant scientific and technological advances in glass technology, hydrogen storage technology, nonproliferation, environmental characterization and cleanup, radioactive waste treatment, sensors and probes, and other fields.

SRNL is the national laboratory for DOE’s Environmental Management program. In this capacity, SRNL applies its expertise and applied technology capabilities to assist sites across the DOE complex in meeting cleanup requirements.

SRNL’s unique facilities include laboratories for the safe study and handling of radioactive materials, a field demonstration site for testing and evaluating environmental cleanup technologies, laboratories for ultra-sensitive measurement and analysis of radioactive materials, and the only radiological crime investigation laboratory for contaminated evidence in the U.S.

While the laboratory continues to provide the science and technology support for SRS operations, much of SRNL’s work comes from non-SRS customers, including DOE-HQ, National Nuclear Security Administration (NNSA)-HQ, other DOE sites, and federal agencies such as the Department of Homeland Security and the Federal Bureau of Investigation.

To maximize the nation’s return for its investment in the laboratory, SRNL forms strategic partnerships with private industry, academia and government agencies to apply the laboratory’s unique expertise to challenges of mutual interest. The laboratory also shares its expertise by licensing private companies to manufacture and market technologies created at SRNL, a move that helps American businesses sharpen their competitive edge and provides taxpayers a second return on their investment.

Underpinning the laboratory is a world-class culture of safety and security that enables SRNL to tackle some of the nation’s most difficult challenges in environmental stewardship, nuclear security and clean energy, and to provide leadership for DOE in nuclear chemical manufacturing.

SRNL by the numbers

- 27 states where SRNL works
- 20 U.S. federal office and agency clients
- 52 countries where SRNL works
- 7 R&D 100 awards received
- 489 patents issued since the 1950s
- 900 FBI personnel trained in radiological forensic operations
Liquid Radioactive Waste Tank Closure

SRS is home to the first two liquid radioactive waste tank operational closures in the nation. These two closures were followed with two in 2012, two in 2013, one in 2015 and one in 2016.

Tank 20, the first closed, was certified closed by the South Carolina Department of Health and Environmental Control (SCDHEC) and applicable DOE Orders in July 1997. SCDHEC certified closure of Tank 17 in December 1997. Both tanks were constructed in 1958 and first used in 1960.

The DOE, SCDHEC, the U.S. Environmental Protection Agency, SRS workers and the public worked closely together to establish strict closure requirements that supported all state and Federal regulations.

Closure activities for the tanks begin years before the actual operational closing of the tanks. Initially, once agreements and closure plans with state and federal regulators are finalized, radioactive waste is removed from each tank to the extent practical. The final closure activities begin with workers pouring specially formulated grout (a cement-like substance) into one million gallon tanks. This special grout stabilizes the tank and is used to impede the leaching and migration of the waste. Over the course of several weeks, the tanks are filled with grout and tank top penetrations are sealed.

The old-style waste tanks are being closed in accordance with the Federal Facility Agreement. This process reduces risks to human health and the environment by securing residual waste in the tanks, which minimizes the potential for groundwater contamination.

Solid Waste

Solid Waste Management is responsible for the disposition of SRS solid waste, which includes sanitary, construction and demolition (C&D), hazardous, and low-level (LLW) and transuranic (TRU) radioactive waste. Sanitary is household waste that is recycled or disposed of at the Three Rivers Landfill. C&D waste is generated by SRS construction activities and is disposed of in a SCDHEC landfill. Hazardous waste is collected and then disposed off-site. Radioactive waste is classified into two categories, the majority of which is LLW. LLW waste is contaminated with predominantly short-lived isotopes. This waste is disposed of at SRS in engineered facilities.

The second type of radioactive waste is TRU waste. This waste typically consists of protective clothing, tools, rags, equipment and miscellaneous items contaminated with small amounts of plutonium. TRU waste is collected, characterized and packaged for offsite shipment to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, N.M.

When the SRS TRU Ship-to-WIPP program began, over 30,000 containers of TRU waste were stored at SRS. SRS has made over 1,650 shipments to WIPP through 2014. WIPP waste receipts were stopped in February 2014. All remaining legacy TRU waste at SRS is packaged and ready to be shipped upon WIPP’s reopening.

Waste Management

Liquid Waste Operations

Past SRS nuclear material production created unusable byproducts, such as radioactive waste. About 36 million gallons of radioactive liquid waste are stored in 43 underground tanks at SRS.

The Defense Waste Processing Facility (DWFP) is processing the high activity waste by immobilizing radioactive elements within a borosilicate glass structure, a stable disposition waste form. Since DWFP began operations in March 1996, more than 16 million pounds of radioactive glass have been produced.

Much of the liquid waste in the tanks is separated as a decontaminated salt solution through an innovative approach to salt waste processing, called the Actinide Removal Process and Modular Caustic Side Solvent Extraction Unit. The facilities use the same unit processes that will be used in the Salt Waste Processing Facility (SWPF), currently scheduled to begin radioactive operations in December 2018. SWPF will be the key liquid waste facility for processing approximately 90 percent of the 36 million gallons of tank waste. SWPF will separate the salt waste into a low-volume, high-radioactivity fraction for vitrification in DWFP and high-volume, decontaminated salt solution to the Saltstone Facility for disposal as low-level waste.

Decontaminated salt solution from salt processing is sent to the Saltstone Production Facility, where it is mixed with cement, ash and furnace slag and poured into above-ground, cylindrical concrete vaults called Saltstone Disposal Units (SDU) for permanent disposition. SDU-6, currently under construction, will be 10 times larger than the other SDUs, and will hold approximately 30 million gallons of grouted decontaminated salt solution. Filled units will be capped with an engineered cover consisting of several layers of impermeable materials, isolating them from the environment. SRS is the first site in the DOE complex to disposition salt waste.

SRS waste tanks have provided more than 60 years of safe storage for nuclear waste. Removing waste from the tanks will allow for operational closure of the Site’s high-level waste tanks. To date, eight waste tanks have been closed.
SRS Environmental Compliance and Area Completion Projects (EC&ACP) coordinates and provides environmental support and compliance-based oversight of SRS operations. EC&ACP ensures that SRS activities are conducted in accordance with state and federal environmental regulations and are safe and protective of workers, the public and the environment.

EC&ACP also manages extensive environmental and groundwater monitoring programs to determine impacts, if any, from SRS operations to the public, surrounding communities and the environment. More than 9,000 environmental and groundwater samples are collected at SRS and in neighboring areas each year, and are analyzed for radionuclides, metals or other chemicals.

EC&ACP investigates and remediates environmental contamination, e.g., by removing, treating, capping or immobilizing the source of contamination preventing or mitigating the spread of contamination. SRS performs these remedial activities in accordance with the Federal Facility Agreement (FFA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA), with public involvement and the full support of DOE-SR, the U.S. Environmental Protection Agency-Region 4 and the South Carolina Department of Health and Environmental Control. Fieldwork is a top priority and includes closure and post-closure care/maintenance of inactive SRS waste units, e.g., seepage basins, rubble pits, rubble piles and disposal facilities.

Site remediation continues at SRS with more than 78 percent of the 515 inactive waste units completed, and over 25 percent of 1,126 total number of excess facilities safely dispositioned to date.

Cleanup and decommissioning will continue until all areas at SRS are completed. Units at which waste is left, are placed under post-closure care with institutional controls including access and land use restrictions, inspections, maintenance, long-term monitoring and reporting, and ground water corrective actions and effectiveness monitoring are performed as appropriate.