

Chapter 1: Introduction

The Savannah River Site (SRS) Environmental Report is the primary document that the U.S. Department of Energy (DOE) uses to inform the public of environmental performance and conditions at SRS. This report meets the requirements of DOE Order 231.1B, Environment, Safety, and Health Reporting. The Site Environmental Report also is the principal document that demonstrates how the Site complies with the requirements of DOE Order 458.1, Radiation Protection of the Public and the Environment.

This document summarizes SRS's environmental information and data to achieve the following:

- Highlight significant Site programs
- Report environmental occurrences and responses
- Describe SRS's compliance with environmental standards and requirements
- Describe SRS's Environmental Management System and sustainability performance
- Provide the results from monitoring material containing residual radioactivity before its release from SRS

Chapter Background

This chapter presents the following:

- A brief history of SRS, along with a summary of its current missions
- Highlights of SRS organizations and their primary responsibilities
- Descriptions of the physical characteristics and attributes of the environment in and around SRS
- Updates of SRS's primary mission and annual programs

1.1 HISTORY

SRS is a DOE site in the western region of South Carolina, along the Savannah River. The U.S. Atomic Energy Commission (the precursor to DOE) constructed SRS in the early 1950s to produce materials used to create nuclear weapons during the Cold War. Over the following decades, five nuclear reactors produced these materials. Several of the support facilities continue to operate, although the reactors ceased operating by 1988. The main activities onsite today involve treating and processing waste, environmental cleanup and remediation, tritium processing, and protecting nuclear material. The Site performs these activities to support its mission, described in the next section.

1.2 MISSION

The SRS mission is to operate safely and efficiently and to protect public health and the environment, while supporting the nation's nuclear deterrent programs and transforming the Site for future use. The Site is recognized as a long-term national asset in the areas of environmental stewardship, innovative technology, national security, and energy independence.

1.3 ORGANIZATION

The DOE Environmental Management (DOE EM) program and the National Nuclear Security Administration (NNSA) oversee the Site mission. These two DOE Program Offices direct the Savannah River Operations Office (DOE-SR). To execute SRS's mission, two federal agencies, two state universities, and several contractors participate in various supporting roles. Figure 1-1 shows the relationship of these contractors to DOE.

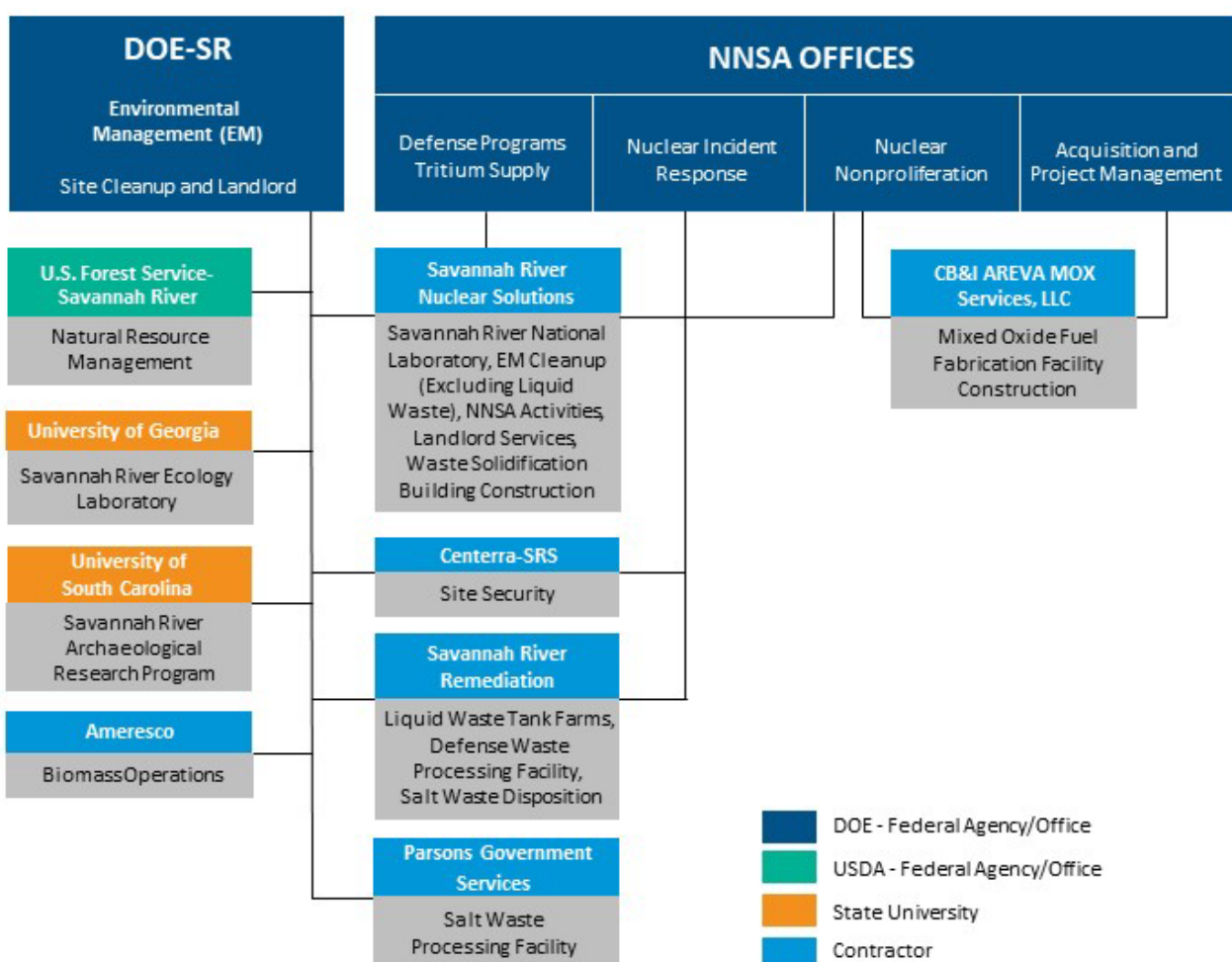


Figure 1-1 SRS Organization, 2018



The DOE-EM mission is to safely clean up the environmental legacy waste consisting of nuclear materials and radioactive waste remaining from five decades of developing nuclear weapons and government-sponsored research. DOE-SR oversees EM operations and landlord services supporting all mission areas at SRS. You will find more information on the [DOE-SR website](#).



NNSA is responsible for the defense programs and nuclear nonproliferation elements of the national security mission. NNSA is also responsible for emergency operations related to SRS tritium facility functions and the national Radiological Assistance Program. You will find more information on the [NNSA website](#).



Savannah River Nuclear Solutions, LLC (SRNS)—a joint venture of Fluor Corporation; Stoller Newport News Nuclear, Inc.; and Honeywell International, Inc.—is the SRS management and operations contractor. SRNS is responsible for nuclear materials facilities, solid waste management facilities, tritium programs, Site infrastructure, and waste site remediation and closure projects. You will find more information on the [SRNS website](#).



Savannah River National Laboratory (SRNL), which SRNS operates, is the only EM-applied research and development laboratory. SRNL creates practical, high-value, cost-effective technological solutions in support of SRS's mission as well as throughout the DOE complex, with other federal agencies, and within the private sector. You will find more information on the [SRNL website](#).



Savannah River Remediation LLC (SRR) is responsible for treating and disposing of radioactive liquid waste and operationally closing waste tanks. SRR is composed of a team of companies led by AECOM with partners Bechtel National, Inc.; Jacobs; and BWX Technologies, Inc. The critical subcontractors for the contract are Orano, Atkins, and AECOM N&E Technical Solutions. You will find more information on the [SRR website](#).



Parsons Government Services, Inc. is responsible for designing, constructing, and commissioning the Salt Waste Processing Facility (SWPF). When completed, SWPF will separate radioactive salt solutions currently stored in below-ground tanks at SRS. SWPF will transfer separated solutions to the Defense Waste Processing Facility (DWPF) or the Saltstone Facility for more processing.



CB&I AREVA MOX Services, LLC was responsible for designing, constructing, starting up, and operating the Mixed Oxide (MOX) Fuel Fabrication Facility (MFFF) in 2018. The MFFF when complete would have converted plutonium that could be used to make weapons to a form that could be used in a commercial nuclear power plant.



Centerra-SRS is the protective force that safely ensures that criminal or terrorist acts do not disrupt the Site and its employees or compromise sensitive information or nuclear materials. You will find more information on the [Centerra website](#).



Ameresco Federal Solutions constructed and now operates biomass steam-generating plants in K and L Areas, and the steam and electricity cogeneration plant near F Area. Ameresco supplies steam to SRS. You will find more information on the [Ameresco website](#).



The Savannah River Archaeological Research Program (SRARP) is a research unit of the University of South Carolina that provides the technical expertise to manage SRS cultural resources. SRARP identifies, evaluates, and protects SRS archaeological sites and artifacts, conducting compliance-based research, offering public outreach programs, and preparing documents and reports for state and federal regulators. You will find more information on the [SRARP website](#).



The Savannah River Ecology Laboratory (SREL) is a research unit of the University of Georgia. For more than 65 years, the lab has independently evaluated the environmental risk associated with DOE activities. This mission includes educating graduate and undergraduate students through advanced hands-on research and providing outreach to public schools and communities surrounding the Site. You will find more information on the [SREL website](#).



U.S. Department of Agriculture
Forest Service
Southern Region

The U.S. Department of Agriculture (USDA) Forest Service-Savannah River (USFS-SR), under an interagency agreement with DOE-SR, manages SRS's natural resources. This includes managing timber; maintaining and improving habitat for threatened, endangered, and sensitive species; maintaining secondary roads and Site boundaries; performing prescribed burns and protecting the Site from wildland fires; and evaluating the effects of its management practices on the environment. You will find more information on the [USFS-SR website](#).

1.4 SITE LOCATION, DEMOGRAPHICS, AND ENVIRONMENT

SRS borders the Savannah River and encompasses about 310 square miles in the South Carolina counties of Aiken, Allendale, and Barnwell. SRS is about 12 miles south of Aiken, South Carolina, and 15 miles southeast of Augusta, Georgia (Figure 1-2). The Savannah River flows along the Site's southwestern border. On Figure 1-2, the capital letters within SRS borders identify operational areas referenced in this report.

Based on the U.S. Census Bureau's 2010 data, the population within a 50-mile radius of the center of SRS is about 781,060 people. This translates to an average population density of about 104 people per square mile outside the SRS boundary, with the largest concentration in the Augusta metropolitan area.

1.4.1 Water Resources

Water resources potentially impacted by SRS activities include the Savannah River, streams located on the Site, and the underlying groundwater. The Savannah River bounds SRS on the southwest for 35 river miles. The upriver boundary of SRS is about 160 river miles from the Atlantic Ocean. The nearest downriver municipal facility that uses the river as a drinking water source (Beaufort-Jasper Water and Sewer Authority's Purrysburg Water Treatment Plant) is about 90 river miles from the Site. Commercial fishermen, sport fishermen, and boaters also use the river. The river is not currently used for any large-scale irrigation projects downriver of the Site.

The groundwater at SRS migrates through the subsurface, primarily discharging into the Savannah River and its tributaries. SRS uses groundwater for both industrial processes and drinking water.



1.4.2 Geology

SRS is located on the southeastern Atlantic Coastal Plain, in an area named the Aiken Plateau. The center of SRS is about 25 miles southeast of the geologic fall line that separates the Coastal Plain from the Piedmont. The Aiken Plateau slopes gently to the southeast and is generally well drained, although many poorly drained depressions exist. Carolina Bays, poorly drained elliptical depressions, are common on the Aiken Plateau. All major streams on SRS originate onsite, except for Upper Three Runs, which begins above the Site. All onsite streams drain into the Savannah River (Denham, 1995).

With nearly three centuries of available historic and contemporary seismic data, the Charleston and Summerville areas remain the most seismically active region affecting SRS. However, levels of earthquake activity within this region are usually low, with magnitudes generally less than or equal to 3.0 on the Richter scale.

1.4.3 Land and Forest Resources

About 10% of SRS's land is industrial; the remaining 90% consists of natural and managed forests that the USFS-SR plants, maintains, and harvests. SRS consists of four major forests: 1) mixed pine-hardwoods, 2) sandhills pine savanna, 3) bottomland hardwoods, and 4) swamp floodplain forests. These forests, as well as Carolina Bays, are accessible to the public when visiting the Crackerneck Wildlife Management Area and Ecological Reserve near Jackson, South Carolina. Carolina Bays provide important wetland habitat and refuge for many plants and animals. More than 345 Carolina Bays exist on SRS.

1.4.4 Animal and Plant Life

SRS is home to many varieties of plants and animals, including

- More than 100 species of reptiles and amphibians
- Approximately 50 species of mammals
- Nearly 100 species of fish
- Nearly 600 species of aquatic insects
- Approximately 1,500 species of plants, of which at least 40 are of state or regional concern

SRS also maintains habitat for more than 250 species of birds, some of which are migratory and do not make SRS their permanent home. Additionally, the Site provides habitat for federally listed as threatened or endangered animal and plant species, including the wood stork, the red-cockaded woodpecker, the pondberry, the gopher tortoise, and the smooth purple coneflower.



A Juvenile Alligator, One of More Than 100 Species of Reptiles and Amphibians at SRS

1.5 DOE-EM PRIMARY SITE ACTIVITIES

The Environmental Management program oversees many Site activities. The following sections highlight key activities. You will find additional information on these activities on [SRS's website](#).

1.5.1 Nuclear Materials Stabilization

In the past, the mission of the F- and H-Areas facilities was to produce materials for nuclear weapons and isotopes for both medical and National Aeronautics and Space Administration applications. Central to these facilities were the canyons, where the radionuclides were chemically separated from nuclear fuels. The end of the Cold War in 1991 shifted that mission to stabilizing nuclear materials and providing safe interim storage or disposal. SRS completed its production mission at F Canyon in 2002 and deactivated it in 2006.

Since 2003, H Canyon has recovered highly enriched uranium from various sites across the DOE complex. DOE now uses H Canyon to blend down highly enriched uranium into low-enriched uranium fuel. Blending down or down blending, as it is sometimes referred to, mixes the uranium with natural uranium to not only make it undesirable to use in nuclear weapons, but also to make it useable for commercial nuclear reactors.

1.5.2 Nuclear Materials Consolidation and Storage

The K-Area Complex is NNSA's facility to safely store non-pit plutonium, pending disposition. The principal operations building formerly housed K Reactor, which produced nuclear materials to support the United States for nearly four decades during the Cold War. DOE has revitalized this robust structure to safely store nuclear materials. Additionally, NNSA uses the K-Area Complex to perform inspections to confirm that the plutonium is stored safely and to dilute plutonium to prepare it for disposal as transuranic waste at the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico.

1.5.3 Spent Nuclear Fuel Storage

SRS supports the DOE National Security mission by safely receiving and storing spent fuel elements from foreign and domestic research reactors, pending disposition. Currently, SRS stores spent nuclear fuel at the L-Area Complex.

1.5.4 Waste Management

SRS manages radiological and nonradiological waste created by legacy operations, as well as newly generated waste created by ongoing Site operations.

1.5.4.1 Radioactive Liquid Waste Management

Processing nuclear materials for national defense, research, and medical programs generates radioactive liquid waste. SRS safely stores approximately 35 million gallons of radioactive liquid waste underground in



Personnel with Spent Fuel Project in L-Area Complex

waste tanks located in the F- and H-Area Tank Farms. SRS waste tanks have been safely storing radioactive liquid waste for decades. Closing the liquid waste storage tanks is a high priority for DOE EM. To do this, SRS must first remove the waste from the tanks, which is mostly salt waste, and then process and treat the waste before disposing of it. In 2018, SRS completed onsite startup testing for the Tank Closure Cesium Removal (TCCR) system to remove the cesium in the salt waste. This system will allow SRS to expedite treating the salt waste and accelerate tank closures.

SRS uses cylindrical tanks, known as Saltstone Disposal Units (SDUs), to dispose of the low-activity liquid waste. In 2018, SRS began constructing SDU 7, the second of seven mega-volume SDUs to be built at SRS. SDU 6, the first mega-volume SDU at SRS, received its first transfer of decontaminated salt solution in August 2018. In fiscal year (FY) 2018, the Saltstone facilities processed and disposed of 384,000 gallons of waste. DOE awarded the SDU 6 project the 2018 Project Management Excellence Award. In 2017, DOE EM named the project the DOE Project of the Year.

SRS uses DWPF to process high-activity waste from the Tank Farms. Since DWPF began operating in March 1996, it has produced more than 16 million pounds of glass—immobilizing 61.2 million curies of radioactivity—and pouring more than 4,100 canisters. Canister pouring resumed in June 2018 when melter 3 replaced melter 2. DWPF in FY 2018 produced 15 canisters of glass, weighing more than 61,000 pounds and immobilizing approximately 257,000 curies of radioactivity.

1.5.4.2 Solid Waste Management

SRS manages the following types of solid waste:

- Low-level radioactive solid waste—including ordinary items, such as coveralls, gloves, and hand tools—contaminated with small amounts of radioactive material
- Transuranic (TRU) waste, which contains alpha-emitting isotopes with an atomic number greater than that of uranium (92)
- Hazardous waste (nonradiological), which is any toxic, corrosive, reactive, or ignitable material that could affect human health or the environment
- Mixed waste, which contains both hazardous and radioactive components
- Sanitary waste, which, like ordinary municipal waste, is neither radioactive nor hazardous
- Construction and demolition waste

All low-level radioactive and hazardous wastes that SRS generates are treated, stored, and disposed of to meet environmental and regulatory requirements. The Site also emphasizes minimizing waste and recycling to reduce the waste volume that SRS must manage.

SRS packages TRU waste and transports it in U.S. Department of Transportation-approved containers for underground disposal at WIPP, DOE's geologic repository. SRS began shipping TRU waste to WIPP in May 2001 and has made more than 1,650 shipments. SRS made one TRU shipment in 2018. In 2018, the Site received approval of the Resource Conservation and Recovery Act Closure Certification Report for Interim Status TRU Pad 2.

DOE conducts annual reviews to ensure that Site operations are within DOE's performance standards. The annual reviews for the E-Area Low-Level Waste Facility Performance Assessment (PA) and the Saltstone Disposal Facility PA showed that SRS continued to operate these facilities in a safe and protective manner.

1.5.5 Waste Site Remediation and Closure

Past operations at SRS have released hazardous and radioactive substances to soil, which subsequently have ended up in the groundwater. SRS's Area Completion Projects is responsible for and focuses on reducing the footprint of legacy waste at SRS's contaminated waste sites and obsolete facilities. Area Completion Projects cleans up contamination in the environment by treating or immobilizing the source of the contamination, mitigating contamination transport through soil and groundwater, and slowing the movement of contamination that has already migrated from the source.

Cleanup includes capping inactive waste sites, installing and operating efficient groundwater treatment units, and using natural remedies, such as bioremediation (using naturally occurring microbes).

In 2018, SRS completed a 5-year project to restore 90 acres located near the former coal-fired power plant in D Area. SRS completed the project more than a year ahead of schedule and saved nearly \$9 million. The restoration included consolidating more than 430,000 cubic yards of coal ash that had



Completed Multi-Layer Protective Landfill Cover at the D-Area Ash Basin

been deposited over decades and associated soils and constructing an engineered cover system. In 2018, the Project Management Institute (PMI) awarded the D-Area Ash Basins project the 2018 PMI Award for Project Excellence. This award recognizes global, large, and complex projects that have superior project management practices, superior organizational results, and positive impacts on society.

1.5.6 Environmental Monitoring

SRS has an extensive environmental monitoring program that has been in place since 1951, prior to the start of Site operations. In the 1950s, onsite environmental monitoring program data were reported in Site documents. Beginning in 1959, SRS made offsite environmental surveillance data available to the public. SRS reported onsite and offsite environmental monitoring separately until 1985, when it merged data from both programs into one publicly available document, the *U.S. Department of Energy Savannah River Plant Environmental Report for 1985*.

SRS continues to conduct an extensive environmental monitoring program to determine impacts, if any, from SRS to the surrounding communities and the environment, both on and offsite. In addition to the onsite environmental monitoring the Site conducts, SRS also monitors a 2,000-square-mile area beyond the Site boundary. This area includes neighboring cities, towns, and counties in South Carolina and

Georgia. SRS collects thousands of samples of air, rainwater, surface water, drinking water, groundwater, food products, wildlife, soil, sediment, and vegetation. The Site checks these samples for radionuclides, metals, and other chemicals that could be in the environment because of SRS activities.

The potential radiation dose to the public from SRS operations is well below the DOE public dose limit. Chapter 6, *Radiological Dose Assessment*, contains more information on the public dose limit.

1.6 NNSA PRIMARY SITE ACTIVITIES

NNSA operates tritium facilities at SRS to supply and process tritium, a radioactive form of hydrogen gas that is a vital component of nuclear weapons. SRS also plays a critical role in NNSA's nonproliferation missions, helping the United States meet its commitments to security and disposing of plutonium and uranium. You will find more information on [SRS's website](#).



Tritium Facility

1.6.1 Tritium Processing

SRS has the nation's only facility for extracting, recycling, purifying, and reloading tritium. SRS replenishes tritium by recycling it from existing warheads and by extracting it from target rods irradiated in nuclear reactors that the Tennessee Valley Authority operates. SRS purifies recycled and extracted gases to produce tritium suitable for use. SRS tritium facilities are part of the NNSA's Defense Program at SRS.

1.6.2 Nuclear Nonproliferation

Since 1999 the NNSA Nuclear Nonproliferation Program had been working to design and build the Mixed Oxide (MOX) Fuel Fabrication Facility (MFFF), which would have converted surplus weapons-grade plutonium into fuel for commercial facilities to generate electricity. Due to project cost over-runs and schedule delays and identifying a less-expensive alternative to dispose of weapons-grade plutonium, NNSA decided to terminate the project in October 2018. It is expected that in April 2019, SRNS will take over managing the MFFF building and prepare it for a future use. The NNSA Materials Management and Minimization Program will now prepare the surplus weapons-grade plutonium for disposal at WIPP, the federal geologic repository, using the dilute and dispose approach. The Surplus Plutonium Disposition Project will expand the current SRS down-blending capability to do so with SRNS as the primary contractor.

1.7 SPECIAL ENVIRONMENTAL STUDIES

SRS provides a unique setting for environmental research with 90% of SRS being in a natural state. Several organizations at SRS—the University of Georgia Savannah River Ecology Laboratory (SREL), U.S. Department of Agriculture (USDA) Forest Service-Savannah River (USFS-SR), Savannah River Archeological Research Program (SRARP), and Savannah River National Laboratory (SRNL)—conduct research to support a better understanding of human impact on both plants and animals.

[SREL](#), [USFS-SR](#), and [SRARP](#) provide annual reports on the environmental studies and research they conduct on SRS. These annual reports are on the [SRS Environmental Report 2018 webpage](#). These reports present and discuss environmental studies and research that occurred during the reporting year and directly affected environmental sampling or dose calculations. Special environmental studies and research directly impacting the SRS environmental monitoring program and dose calculations are presented and discussed in their respective chapters.