

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. In 1972, DOE named SRS the nation's first National Environmental Research Park, an outdoor ecological research laboratory.

As Dr. J. Walter Joseph, III, cofounder and director of the SRS Heritage Foundation and SRS retiree, describes in the *Savannah River Site at 50*, “The history of the Savannah River Site can be divided into two stages: the period in which it was known as the Savannah River Plant, a ground-breaking facility for the research and production of nuclear materials, and the time in which it was identified as the Savannah River Site, when responsibilities shifted from research and production to research, production and remediation.” E. I. du Pont de Nemours Company was the operating contractor through the years the Site was called the Savannah River Plant. Beginning in 1989, when the Westinghouse Savannah River Company (WSRC) became the operating contractor, the Site became known as the Savannah River Site. In 2008, the Site contract transitioned from WSRC to two contractors, Savannah River Nuclear Solutions LLC (SRNS) as the management and operating contractor, and Savannah River Remediation LLC (SRR) as the liquid waste operations contractor. Both contracts were ongoing in 2019.

1.2 MISSION AND CURRENT OPERATION

The SRS mission is to safely and efficiently operate SRS to protect the public health and the environment while supporting the nation's nuclear deterrent programs and transforming the Site for future use. The Site is a long-term national asset in the areas of environmental stewardship, innovative technology, national security, and energy independence. The current main activities involve treating and processing waste, environmental cleanup and remediation, tritium processing, and protecting nuclear material.

The DOE Office of Environmental Management (DOE-EM) and the National Nuclear Security Administration (NNSA) oversee the Site mission. These two DOE Program Offices direct the Savannah River Operations Office (DOE-SR). DOE-EM is the property owner and oversees cleanup of the environmental legacy waste. NNSA is responsible for the defense programs and nuclear nonproliferation elements of the national security missions. SRS executes the mission with the support of contractors and their subcontractors, universities, and federal agencies. Several of the contractors directly support both the DOE-EM and NNSA programs, with other members of the mission execution team supporting environmental resource management.

SRNS, SRR, and Centerra-SRS directly support both the DOE-EM and NNSA missions. In addition to its role as the management and operating contractor, SRNS supports SRS missions through the Savannah River National Laboratory. As the liquid waste operations contractor, SRR is responsible for treating and disposing of radioactive liquid waste and operationally closing waste tanks. Centerra-SRS is the Site's protective force.

To support the cleanup of SRS's legacy waste, Parsons Government Services, Inc. is designing, constructing, and commissioning the Salt Waste Processing Facility (SWPF), a key component in processing and dispositioning radioactive liquid waste.

The DOE Office of Environmental Management manages the Savannah River Site and its environmental resources. The U.S. Department of Agriculture (USDA) Forest Service-Savannah River (USFS-SR), the University of Georgia, the University of South Carolina, and Ameresco support DOE-EM in managing and conserving the Site's environmental resources. Through an interagency agreement with DOE-Savannah River, USFS-SR manages SRS's natural resources. For more than 65 years, the University of Georgia has

managed the Savannah River Ecology Laboratory (SREL), independently evaluating the environmental risk associated with Site activities. Since 1978, the University of South Carolina has managed the Savannah River Archaeological Research Program (SRARP), a research unit that provides the technical expertise to manage SRS cultural resources. Ameresco Federal Solutions supports SRS's environmental resource management by supplying biomass-generated steam to SRS. This effort has allowed SRS to discontinue using coal to generate steam.

1.3 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 1-1). The Savannah River flows along the Site's southwestern border. On Figure 1-1, 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.

1.3.1 Water Resources

SRS activities potentially impact water resources including the Savannah River, Site streams, 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.

1.3.2 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. Elliptical-shaped Carolina Bays, for example, 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).



An Aerial View of a Carolina Bay at SRS

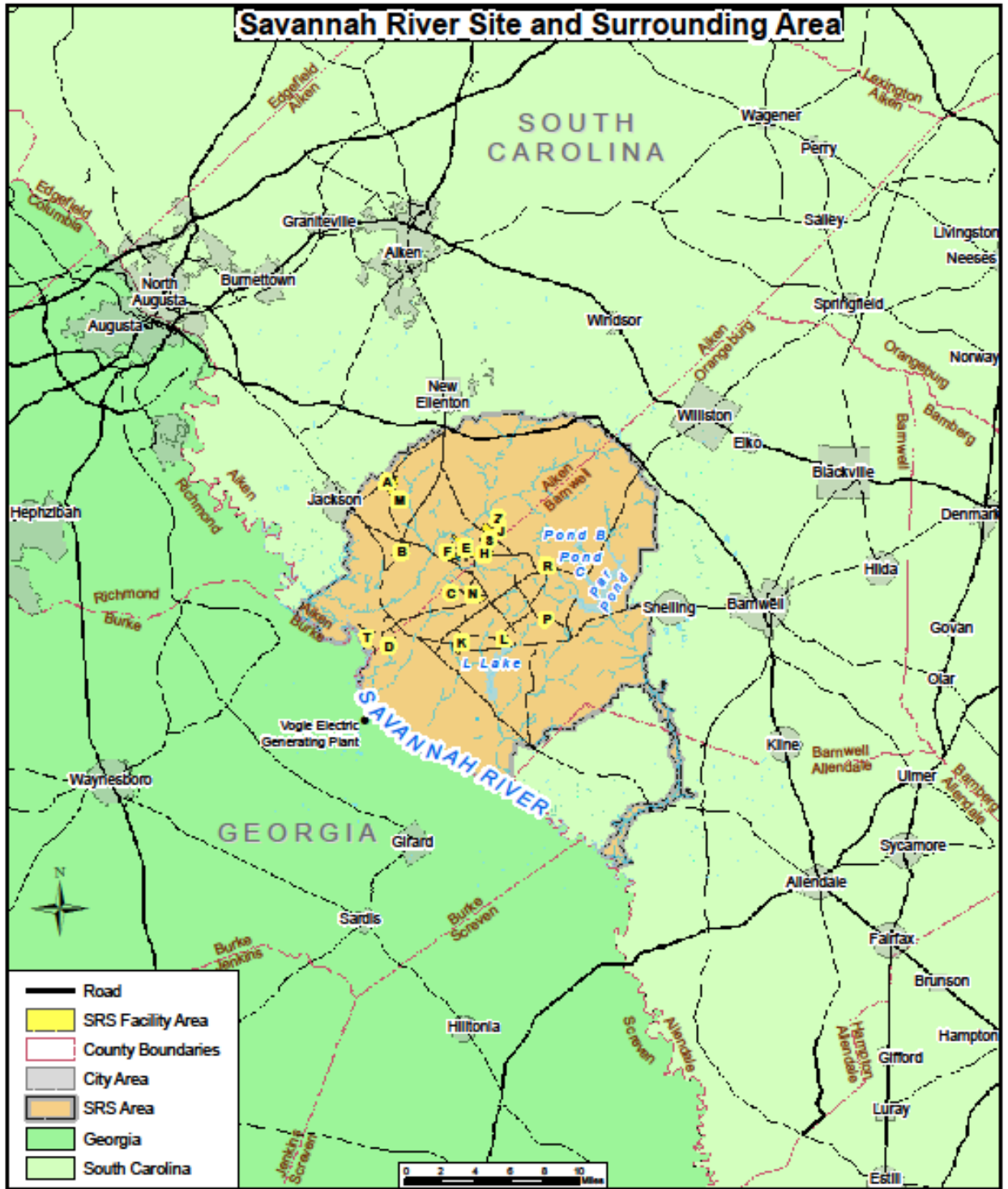


Figure 1-1 The Savannah River Site and Surrounding Area

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.

1.3.3 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. As many as 300 Carolina Bays exist on SRS.

1.3.4 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



A Wild Turkey is One of the Many Bird Species at SRS

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.

1.4 DOE-EM PRIMARY SITE ACTIVITIES

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

1.4.1 Nuclear Materials Stabilization

In the past, the mission of the F- and H-Area 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 Site chemically separated radionuclides 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.

1.4.2 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.

1.4.3 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.

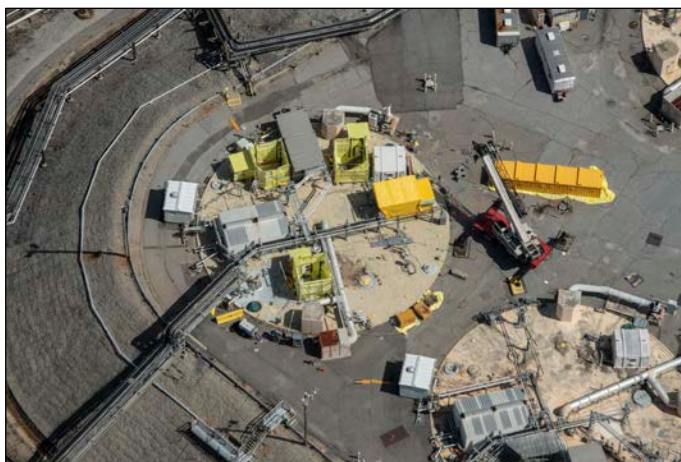
1.4.4 Waste Management

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

1.4.4.1 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 the F- and H-Area Tank Farms. SRS waste tanks have been safely storing radioactive liquid waste for decades. Closing the 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 2019, SRS began operating the Tank Closure Cesium Removal (TCCR) system and processed 210,000 gallons of salt solution. The TCCR system removes the cesium in the salt waste, allowing SRS to expedite treating the salt waste and accelerate tank closures.

SRS mixes the decontaminated salt solution at the Saltstone Production Facility to make saltstone and disposes of this low-activity liquid waste in cylindrical tanks, known as Saltstone Disposal Units (SDUs). In fiscal year (FY) 2019, the Saltstone facilities processed and disposed of approximately 734,000 gallons of waste. SDU-6, the first mega-volume SDU at



SRS Stores Radioactive Liquid Waste in Underground Tanks in F and H Areas

SRS, received the saltstone for disposal. In 2019, SRS continued constructing SDU-7, the second of seven SRS mega-volume SDUs. Site preparation for the next two mega-vaults, SDU-8 and SDU-9, also began in 2019.

SRS uses the Defense Waste Processing Facility (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 61.7 million curies of radioactivity—and pouring more than 4,200 canisters. DWPF in FY 2019 produced 34 canisters of glass, weighing more than 126,000 pounds and immobilizing approximately 643,000 curies of radioactivity.

1.4.4.2 Solid Waste Management

SRS manages the following types of solid waste:

- Low-level 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

To meet environmental and regulatory requirements, SRS treats, stores, and disposes of all low-level radioactive and hazardous waste that it generates. The Site also emphasizes recycling and minimizing waste 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 five TRU shipments in 2019.

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.

1.4.5 **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. SRS 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; removing and disposing of contaminated material; and using natural remedies, such as bioremediation (using naturally occurring microbes).

During 2019, SRS remediated the G-Area Oil Seepage Basin Operable Unit and the Wetland Area at Dunbarton Bay. In addition, SRS installed remediation technologies at the C-Area Groundwater Operable Unit and P-Area Groundwater Operable Unit. These technologies will work with the environment to destroy the organic solvents transported by groundwater.



G-Area Oil Seepage Basin Operable Unit Remediation

1.4.6 Environmental Monitoring

SRS has an extensive environmental monitoring program, with records and documents from 1951, prior to the start of Site operations. 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.

1.5 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.

1.5.1 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.

In 2019, SRS repurposed a previously dormant industrial furnace, dedicating it to increase the amount of tritium it can extract from target rods that have been irradiated in a Tennessee Valley Authority commercial power nuclear reactor. With two, instead of one, operating furnaces, the Site enhanced the

operational flexibility and capability needed to perform multiple extractions annually, positioning it to meet the important national mission of nuclear deterrence now and in the coming years.

SRS tritium facilities are part of the NNSA's Defense Program at SRS. The [Defense Programs](#) page of SRS's website includes more information.

1.5.2 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. DOE decided to terminate the project in October 2018. On March 29, 2019, SRNS accepted custodianship and operational responsibility for the MFFF facility and began preparations for future use.

The NNSA Materials Management and Minimization Program is preparing 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 prepare additional surplus plutonium for disposal at WIPP.

1.6 SPECIAL ENVIRONMENTAL STUDIES

SRS provides a unique setting for environmental study. 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 2019 webpage](#). These reports present and discuss environmental studies and research that occurred during the reporting year. Special environmental studies and research directly impacting the SRS environmental monitoring program and dose calculations are presented and discussed in their respective chapters.