
Introduction

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This report was prepared in accordance with U.S. Department of Energy (DOE) Order 231.1A, “Environment, Safety and Health Reporting,” to present summary environmental data for the purpose of

- characterizing site’s environmental management performance
- summarizing environmental occurrences and responses reported during the calendar year
- describing compliance status with respect to environmental standards and requirements
- highlighting significant site programs and efforts

This report is the principal document that demonstrates compliance with the requirements of DOE Order 5400.5, “Radiation Protection of the Public and the Environment,” and is a key component of DOE’s effort to keep the public informed of environmental conditions at Savannah River Site (SRS).

Missions

SRS has four primary missions:

- **Environmental Management** - Cleaning up the legacy of the Cold War efforts and preparing decommissioned facilities and areas for long-term stewardship
- **Nuclear Weapons Stockpile Support** - Meeting the needs of the U.S. nuclear weapons stockpile through the tritium programs of the National Nuclear Security Administration (NNSA)
- **Nuclear Nonproliferation Support** - Meeting the needs of the NNSA’s nuclear nonproliferation programs by safely storing and dispositioning excess special nuclear materials
- **Research and Development** - Supporting the application of science by the Savannah River National Laboratory (SRNL) to meet the needs of SRS, the DOE complex, and other federal agencies

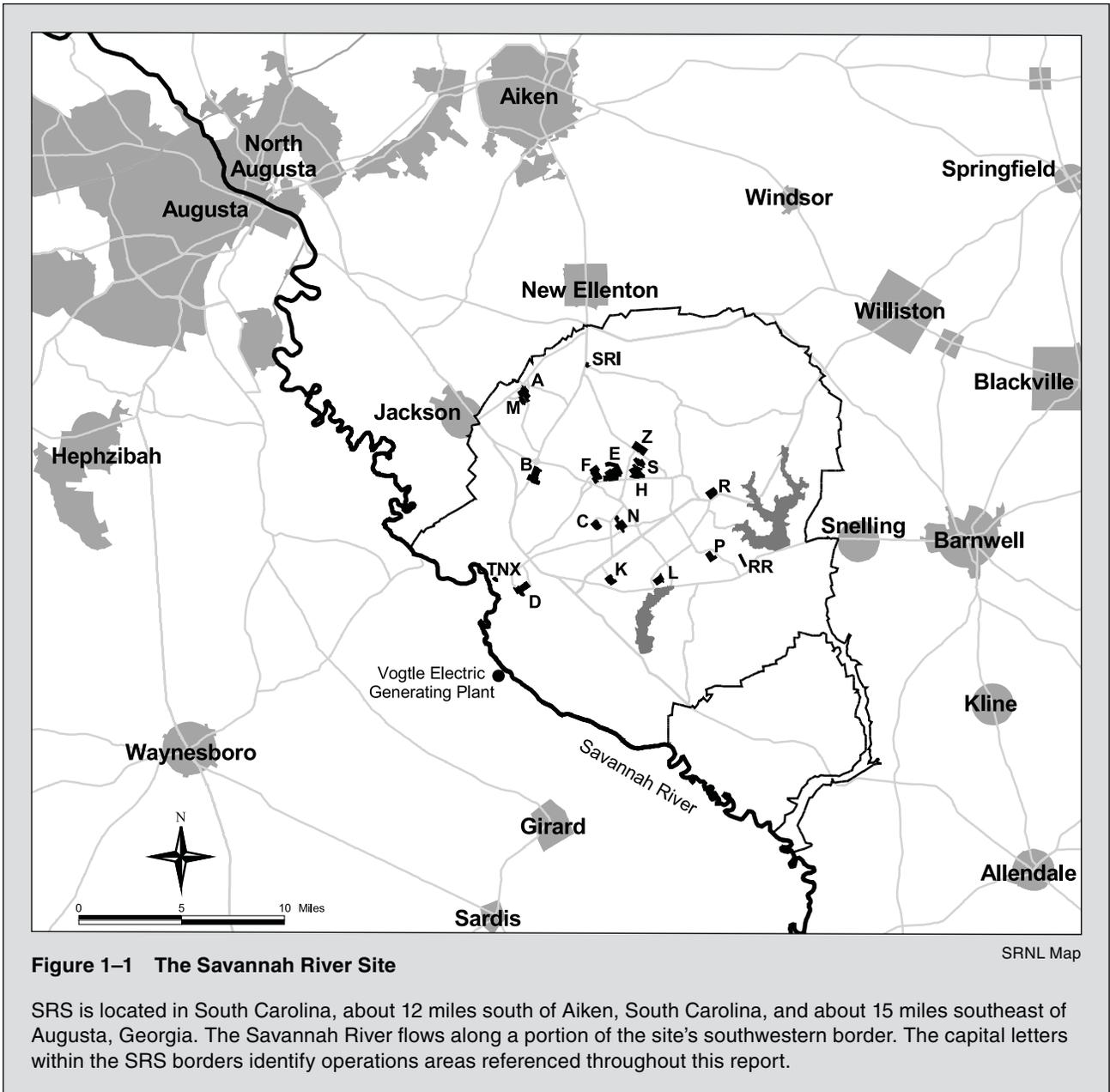
During 2010, SRS worked to fulfill these missions and position the site for future operations. SRS continued to work with the South Carolina Department of Health and Environmental Control (SCDHEC), the Environmental Protection Agency (EPA), and the Nuclear Regulatory Commission to find and implement solutions and schedules for waste management and disposition. As part of its mission to clean up the Cold War legacy, SRS will continue to address the highest-risk waste

management issues by safely storing and preparing liquid waste and nuclear materials for disposition, and by safely stabilizing any tank waste residues that remain on site.

Site Location, Demographics, and Environment

SRS, a DOE complex facility, was constructed during the early 1950s to produce materials (primarily plutonium-239 and tritium) used in nuclear weapons. The site, which borders the Savannah River, covers approximately 310 square miles in South Carolina. Savannah River Nuclear Solutions, LLC (SRNS), assumed responsibility from Washington Savannah River Company (WSRC) for SRS Maintenance and Operations activities in 2008. Savannah River Remediation (SRR) subsequently took over the site’s Liquid Waste Operations functions from WSRC in 2009.

SRS covers 198,344 acres in Aiken, Allendale, and Barnwell counties of South Carolina. The site is approximately 12 miles south of Aiken, South Carolina, and 15 miles southeast of Augusta, Georgia (figure 1–1). Based on the U.S. Census Bureau’s 2010 decennial data, the population within a 50-mile radius of the center of SRS is approximately 781,060—an increase of 9.6 percent over the 2000 population in this area. 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.

Water Resources

SRS is bounded on its southwestern border by the Savannah River for about 35 river miles and is approximately 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 located approximately 90 river miles from the site. The river also is used for commercial and sport fishing, boating, and other recreational activities.

According to officials with SCDHEC and the Georgia Department of Natural Resources, there are no known large-scale uses of the river for irrigation by farming operations downriver of the site.

The groundwater flow system at SRS consists of four major aquifers. Groundwater generally migrates downward as well as laterally—eventually either discharging into the Savannah River and its tributaries or migrating into the deeper regional flow system. SRS groundwater is used on site both for processes and for drinking water.

Geology

SRS is located on the southeastern Atlantic Coastal Plain, which is part of the larger Atlantic Plain that extends south from New Jersey to Florida. The center of SRS is approximately 25 miles southeast of the geological Fall Line that separates the Coastal Plain from the Piedmont. Characterization of regional earthquake activity is dominated by the catastrophic Charleston, South Carolina, earthquake of August 31, 1886 (est. magnitude of 7.0 on the Richter scale). With nearly three centuries of available historic and contemporary seismic data, the Charleston/Summerville area remains the most seismically active region of South Carolina—and the most significant seismogenic region affecting SRS. Ongoing studies by University of South Carolina seismologists suggest a recurrence interval of 500–600 years for magnitude 7.0 or greater earthquakes (similar to the 1886 event) near Charleston. Earthquake activity occurring within the upper Coastal Plain of South Carolina, where the majority of SRS is located, is characterized by occasional small shallow events associated with strain release near small-scale faults and intrusives. Levels of seismic activity within this region are very low, with magnitudes or sizes generally less than or equal to 3.0

Land and Forest Resources

About 90 percent of SRS land area consists of natural and managed forests, which are planted, maintained, and harvested by the U.S. Department of Agriculture Forest Service—Savannah River. The site contains four major forest types: mixed pine-hardwoods, sandhills pine savanna, bottomland hardwoods, and swamp floodplain forests. More than 345 Carolina bays exist on SRS. Carolina bays are relatively small, shallow depressions that provide important wetland habitat and refuge for many plants and animals.

Animal and Plant Life

The majority of SRS is undeveloped; only about 10 percent of the total land area is developed or used for mission-oriented facilities. The remainder is maintained in healthy, diverse ecosystems. SRS is home to about 1,500 species of vascular and nonvascular plants, more than 100 species of reptiles and amphibians, some 50 species of mammals, and nearly 100 species of fish—and provides habitat for more than 250 species of birds. Nearly 600 species of aquatic insects can be found in SRS streams and wetlands. The site also provides habitat for a number of protected species—including the wood stork, the red-cockaded woodpecker, the pondberry, and the smooth coneflower (all federally listed as

endangered)—and at least 40 plant species of state or regional concern.

Primary Site Activities

Nuclear Materials Stabilization Project

In the past, the SRS separations facilities processed special nuclear materials and used fuel from site reactors to produce materials for nuclear weapons and isotopes for medical and National Aeronautics and Space Administration applications. The end of the Cold War in 1991 brought a shift in the mission of these facilities to stabilization of nuclear materials from onsite and offsite sources for safe storage or disposition. F Canyon, one of the site's two primary separations facilities, was deactivated in 2006. The other facility, H Canyon, continues to operate, and an important part of its mission is the conversion of weapons-usable, highly enriched uranium to low-enriched uranium for use in the manufacture of commercial reactor fuel, a key function of the nation's nuclear nonproliferation program.

Used Nuclear Fuel Storage

SRS's used nuclear fuel facilities receive and store fuel elements from a variety of foreign and domestic reactors. The mission of the UNF program is to safely and cost-effectively receive and store used fuel elements from foreign and domestic research reactors—pending disposition—in support of nuclear research and the Global Threat Reduction Initiative.

Tritium Processing

SRS tritium facilities are designed and operated to supply and process tritium, a radioactive form of hydrogen gas that is a vital component of nuclear weapons. These facilities are part of the National Nuclear Security Administration's Defense Programs operations at SRS.

Waste Management

Liquid Waste Operations

SRR continued to manage the SRS Liquid Waste Operations facilities in 2010, and to support the integrated high-activity waste program and tank closure process. This work included dispositioning waste from tanks located in the site's F Area and H Area tank farms. Dispositioning of the waste included operation of the Defense Waste Processing Facility, which immobilizes high-level waste in glass; the Saltstone Production and Disposal Facilities, which process and dispose low-activity salt waste in a grout form; and the salt waste processing facilities, known as the Actinide Removal

Process/Modular Caustic Side Solvent Extraction Unit, which decontaminate the salt waste and send it to Saltstone.

A detailed description of the site's 2010 Liquid Waste Operations activities can be found on the CD accompanying this report.

SRS manages

- the large volumes of radiological and nonradiological waste created by previous operations of the nuclear reactors and their support facilities
- newly generated waste created by ongoing site operations

Although the primary focus is on safely managing the radioactive liquid waste, the site also must handle, store, treat, dispose of, and minimize solid waste resulting from past, ongoing, and future operations. Solid waste includes hazardous, low-level, mixed, sanitary, and transuranic wastes. More information about radioactive liquid and solid wastes is included on the CD housed inside the back cover of this report.

Area Completion Projects

Past operations at SRS have resulted in the release of hazardous and radioactive substances to soil and groundwater, with contamination levels exceeding regulatory thresholds. The mission of Area Completion Projects (ACP) personnel is to deactivate and decommission contaminated facilities and remediate (if necessary) soils, groundwater, surface water, and sediments to levels that comply with established regulatory thresholds and that protect human health and the environment.

Numerous technologies have been pioneered to increase the effectiveness of ACP's remediation efforts and to reduce hazardous risk across the site. ACP utilizes a Green Remediation approach to reduce greenhouse gas emissions and other negative environmental impacts that might occur during characterization or remediation of hazardous waste sites. Green Remediation is the practice of (1) considering all the environmental effects of remedy implementation and (2) incorporating options to minimize the environmental footprints of cleanup actions. Natural remedies used at SRS include phytoremediation (augmented natural vegetative processes), bioremediation (augmented naturally occurring microbial processes), and natural remediation (natural processes to address contamination). These technologies are proving to be a cost-efficient means of

reducing risk to human health and the environment, and have been successful in expediting cleanups.

Cleanup decisions are reached through implementation of a core team process with EPA Region 4 and SCDHEC. In reaching such decisions, the public's and stakeholders' (such as the Citizens Advisory Board) input is solicited and considered. ACP uses a streamlined cleanup strategy to accelerate work and reduce overall lifecycle costs. During 2010, ACP completed final remediation of M Area, the second large former industrial area on SRS (T Area cleanup was completed in 2006).

More information about ACP's 2010 operations is included on the CD accompanying this report.

Effluent Monitoring and Environmental Surveillance

The general purpose of the effluent monitoring and environmental surveillance programs is to

- demonstrate compliance with applicable environmental regulations, DOE orders, and commitments made in environmental documents
- manage SRS effluents and their treatment and control practices
- identify, characterize, quantify, trend, and report the effects (if any) of SRS operations on the public and on the environment in and around the site

SRS sampling locations, sample media, sampling frequency, and types of analysis are selected based on environmental regulations, exposure pathways, public concerns, and measurement capabilities. The selections also reflect the site's commitment to (1) safety; (2) protecting human health; (3) reducing the risks associated with past, present, and future operations; (4) improving cost effectiveness; and (5) meeting regulatory requirements.

Releases

Releases to the environment of radioactive and nonradioactive materials come from legacy contamination as well as from ongoing site operations. For instance, contaminated, shallow groundwater—a legacy—flows slowly toward and into onsite streams and swamps, and eventually into the Savannah River. During routine day-to-day site operations, liquid discharges and air emissions release contaminants to the environment. SRS uses the “as low as reasonably achievable” (ALARA) concept to manage these releases.

Pathways

The routes that contaminants can follow to enter the environment and then reach people are known as exposure pathways. A person potentially can be exposed when he or she breathes the air, consumes locally produced foods and milk, drinks water from the Savannah River, eats fish caught from the river, or uses the river for recreational activities such as boating, swimming, etc.

One way to determine if contaminants from the site have reached the environment is through environmental monitoring. The site gathers thousands of air, water, soil, sediment, food, vegetation, and animal samples each year. The samples are analyzed for contaminants released from site operations, and the potential radiation exposure to the public is assessed. Samples are taken at the points where materials are released from (1) the facilities (effluent monitoring) and (2) the environment itself (environmental surveillance). SCDHEC also had a program in place during 2010 to monitor the environment in and around SRS, as well as near the City of Savannah (for tritium in the Savannah River).

Research and Development Savannah River National Laboratory

SRNL is SRS's applied research and development laboratory. SRNL "puts science to work" to create and implement practical, high-value, cost effective technology solutions in the areas of Environment Management, National and Homeland Security, and Energy Security. SRNL provides technical leadership and key support for future SRS missions. More information can be obtained by contacting SRNL at 803-725-2854, or by viewing the facility's website at <http://shrine.srs.gov/html/srnl/index.html>.

Savannah River Ecology Laboratory

The Savannah River Ecology Laboratory (SREL) is a research unit of The University of Georgia that has been conducting ecological research at SRS for more than 55

years. The facility's overall mission is to acquire and communicate knowledge of ecological processes and principles. SREL conducts fundamental and applied ecological research, as well as education and outreach programs, under a cooperative agreement with DOE. More information can be obtained by contacting SREL at 803-725-2472, or by viewing the laboratory's website at <http://www.srel.edu/>. Also, SREL's technical progress report for 2010 is included on the CD accompanying this document.

USDA Forest Service–Savannah River

The USDA Forest Service–Savannah River (USFS–SR), a unit within the Southern Region of the U.S. Department of Agriculture, manages approximately 170,000 acres of natural resources at SRS. USFS–SR operates under an interagency agreement with DOE–Savannah River Operations Office and implements the *SRS Natural Resources Management Plan* for a variety of natural resources. More information can be obtained by contacting USFS–SR at 803-725-0006, or by viewing the USFS–SR website at www.fs.usda.gov/savannah river. Also, USFS–SR's 2010 report is included on the CD accompanying this document.

Savannah River Archaeological Research Program

The Savannah River Archaeological Research Program (SRARP) provides continued cultural resource management guidance to DOE to ensure fulfillment of compliance commitments. SRARP also serves as a primary facility for the investigation of archaeological research problems associated with cultural development within the Savannah River valley, using the results to help DOE manage more than 1,300 known archaeological sites at SRS. More information can be obtained by contacting SRARP at 803-725-3724, or by viewing the SRARP website at <http://www.srarp.org>. Also, SRARP's 2010 report is included on the CD accompanying this document.

