
Introduction

Timothy Jannik
Savannah River National Laboratory

Jana D. Ackerman
Environmental Compliance and Area Completion Projects



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

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

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 SRS.

Missions

In September 2011, SRS announced and began to implement its Strategic Plan for 2011 through 2015. As described in the Strategic Plan, Enterprise•SRS will use the site’s nuclear materials workforce, knowledge, and assets to help the nation address its critical needs in environmental stewardship, clean energy, and national security.

SRS has three primary mission areas that support activities of the DOE-Environmental Management (EM) program, National Nuclear Security Administration (NNSA) and the needs of the nation and the region:

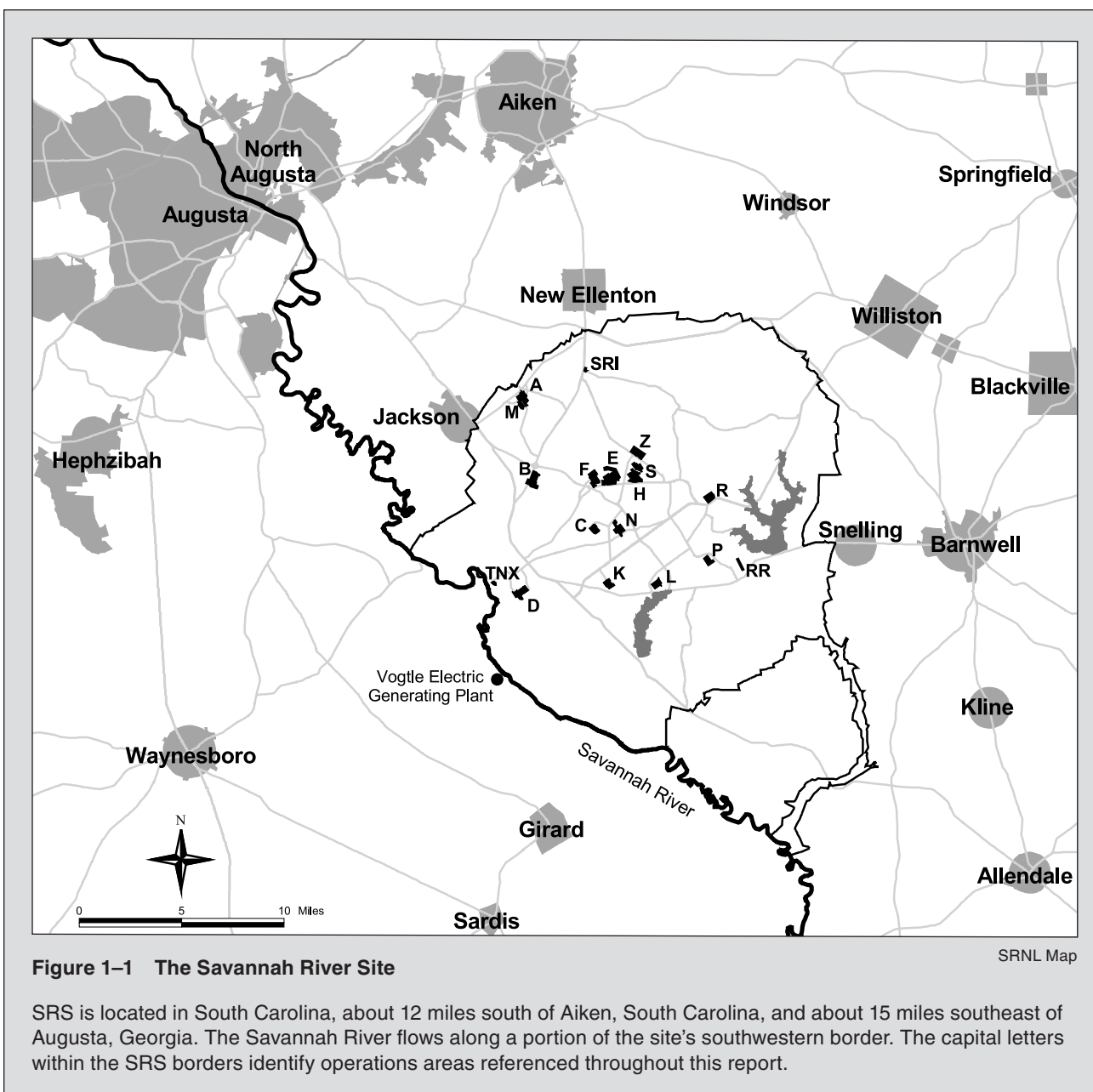
- **Environmental Stewardship** – Focused on reducing the environmental legacy of nuclear materials and radioactive waste at SRS through initiatives such as groundwater restoration, deactivation and decommissioning of excess contaminated facilities, and radioactive waste disposition
- **National Security** – Focused on enhancing national security through innovative solutions to safely manage nuclear materials, including the disposition of surplus nuclear materials, tritium supply, and nuclear stockpile maintenance and evaluation

- **Clean Energy** – Focused on research and development to accelerate technology development through public and private partnerships to sustainably provide regional energy while protecting environmental health

In addition to these three mission areas, the SRS Strategic Plan also describes twelve strategic initiatives that will be pursued to ensure unique resources are effectively employed.

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 Savannah River Nuclear Solutions, LLC (SRNS) is the SRS Management and Operating contractor. Savannah River Remediation (SRR) is the site’s Liquid Waste Operations contractor. The site, which borders the Savannah River, covers 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).



Based on the U.S. Census Bureau's 2010 decennial data, the population within a 50-mile radius of the center of SRS is about 781,060 which is 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 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. The river also is used for commercial and sport fishing, boating, and other recreational activities.

According to officials with South Carolina Department of Health and Environmental Control (SCDHEC) and the Georgia Department of Natural Resources (GDNR) no known large-scale uses of the river exist 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 industrial processes and for drinking water.

Geology

SRS is on the southeastern Atlantic Coastal Plain, part of the larger Atlantic Plain that extends south from New Jersey to Florida. The center of SRS is about 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 Earthquake of 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. (Taiwani 2001) 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, planted, maintained, and harvested by the U.S. Department of Agriculture (USDA) Forest Service–Savannah River (USFS-SR). 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 plants, more than 100 species of reptiles and amphibians, some 50 species

of mammals, 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 purple 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 separations facilities, located in the core area of the SRS, 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. An important part of H-Canyon's mission is the conversion of weapons-usable, highly enriched uranium to low-enriched uranium. The uranium is then used in the manufacturing of commercial reactor fuel, which is a key function of the nation's nuclear nonproliferation program. During 2011, SRS began to use H-Canyon and HB-Line to prepare surplus plutonium materials for disposition at the Waste Isolation Pilot Plant (WIPP) in New Mexico.

Used Nuclear Fuel Storage

SRS's used nuclear fuel (UNF) facilities receive and store fuel elements from a variety of foreign and domestic research 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 NNSA's Defense Programs operations at SRS.

Waste Management

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

Liquid Waste Operations

SRR continued to manage the SRS Liquid Waste Operations (LWO) facilities in 2011 and to support the integrated high-activity waste program and tank closure process. This work included dispositioning waste from tanks in the site's F-Area and H-Area tank farms. Dispositioning of the waste included operation of the Defense Waste Processing Facility (DWPF), which immobilizes high-level waste in glass; the Saltstone Production and Disposal Facilities (SPDF), 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 SPDF.

Solid Waste Management

SRNS is responsible for managing transuranic, low-level, hazardous, mixed and sanitary waste at SRS. Wastes generated site-wide are treated, stored and disposed to meet environmental and regulatory requirements. The site also emphasizes waste minimization and recycling as a way to reduce the volume of waste that must be managed. More information about radioactive and nonradioactive solid waste management is included on the compact disk (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) 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 the U.S. Environmental Protection Agency (USEPA) Region 4 and SCDHEC. In reaching such decisions, the public's and stakeholders' (such as the Citizens Advisory Board [CAB]) input is solicited and considered. ACP uses a streamlined cleanup strategy to accelerate work and reduce overall lifecycle costs. During 2011, ACP completed final remediation of P- and R-Areas, which included the in-situ decommissioning of the P- and R-Reactor buildings.

More information about ACP's 2011 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) meeting regulatory requirements, (4) reducing the risks associated with past, present, and future operations, and (5) improving cost effectiveness.

Research and Development

Savannah River National Laboratory

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 Environmental Stewardship, National Security, and Clean Energy. SRNL provides technical leadership and key support for future SRS missions. More information can be obtained by viewing SRNL's website at <http://srnl.doe.gov>.

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 60 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 viewing the laboratory's website at www.srel.edu. Also, SREL's technical progress report for 2011 is included on the CD accompanying this document.

US Department of Agriculture Forest Service–Savannah River (USDA USFS-SR)

The USDA USFS-SR, a unit of the Southern Region of the U.S. Department of Agriculture, manages an estimate of 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 viewing the USFS-SR website at www.fs.usda.gov/savannahriver. Also, USFS-SR's 2011 report is included on the CD accompanying this document.

Savannah River Archaeological Research Program

The Savannah River Archaeological Research Program (SRARP) provides 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 viewing the SRARP website at www.srap.org. Also, SRARP's 2011 report is included on the CD accompanying this document.

