

Savannah River Site Footprint Reduction Results under the American Recovery and Reinvestment Act- 13302

Mary Flora¹, Angelia Adams², Robert Pope³

¹Savannah River Nuclear Solutions Bldg. 730-4B, Aiken, SC 29808

²United States Department of Energy Bldg. 730-B, Aiken, SC 29808

³United States Environmental Protection Agency Region IV Atlanta, GA 30303

ABSTRACT

The Savannah River Site (SRS) is an 802 square-kilometer United States Department of Energy (USDOE) nuclear facility located along the Savannah River near Aiken, South Carolina, managed and operated by Savannah River Nuclear Solutions. Construction of SRS began in the early 1950s to enhance the nation's nuclear weapons capability. Nuclear weapons material production began in the early 1950s, eventually utilizing five production reactors constructed to support the national defense mission. Past operations have resulted in releases of hazardous constituents and substances to soil and groundwater, resulting in 515 waste sites with contamination exceeding regulatory thresholds. More than 1,000 facilities were constructed onsite with approximately 300 of them considered radiological, nuclear or industrial in nature.

In 2003, SRS entered into a Memorandum of Agreement with its regulators to accelerate the cleanup using an Area Completion strategy. The strategy was designed to focus cleanup efforts on the 14 large industrial areas of the site to realize efficiencies of scale in the characterization, assessment, and remediation activities. This strategy focuses on addressing the contaminated surface units and the vadose zone and addressing groundwater plumes subsequently. This approach streamlines characterization and remediation efforts as well as the required regulatory documentation, while enhancing the ability to make large-scale cleanup decisions.

In February 2009, Congress approved the American Reinvestment and Recovery Act (ARRA) to create jobs and promote economic recovery. At SRS, ARRA funding was established in part to accelerate the completion of environmental remediation and facility deactivation and decommissioning (D&D). By late 2012, SRS achieved 85 percent footprint reduction utilizing ARRA funding by accelerating and coupling waste unit remediation with D&D of remnant facilities.

Facility D&D activities were sequenced and permitted with waste unit remediation activities to streamline regulatory approval and execution. Achieving footprint reduction fulfills the Government's responsibility to address legacy contamination; allows earlier completion of legally enforceable compliance agreement milestones; and enables future potential reuse of DOE resources, including land and infrastructure for other missions.

Over the last 3.5 years significant achievements were met that contributed to footprint reduction, including the closure of 41 waste units (including 20 miles of radiologically contaminated stream) and decommissioning of 30 facilities (including the precedent-setting *in situ* closure of two former production reactors, the first in the DOE Complex). Other notable achievements included the removal of over 39,750 cubic meters of debris and 68,810 cubic meters of contaminated soils, including 9175 cubic meters of lead-contaminated soil from a former site small arms testing range and treatment of 1,262 cubic meters of tritium-laden soils and concrete using a thermal treatment system.

INTRODUCTION

A key objective of the U.S. Department of Energy (DOE) under the 2009 Recovery Act Program was to significantly reduce the Environment Management (EM) footprint of the Savannah River Site (SRS). By implementing an Area Completion strategy in which large exterior (or perimeter) areas of the SRS were cleaned up, 683 square-kilometers, or 85% of the site, was freed up for potential re-use or re-development. Footprint reduction focused on decreasing the operational footprint of SRS into a smaller geographic area near the center of the Site and increasing the buffer zone between the ongoing core operations and the Site's 802 square-kilometer boundary. Through ARRA funding, accelerated area completions were accomplished in P, R, D, M, B, and the Savannah River areas, along with the *in situ* decommissioning of both P and R Reactors (Figure 1). Project efficiencies achieved between the inception of the ARRA cleanup efforts and the end of Fiscal Year 2011, allowed for the completion of additional footprint reduction scope in C-Area and the Lower Three Runs stream.

Footprint reduction provides future opportunities for that land area. Footprint reduction was achieved when all soils and ground surface contamination associated with waste units and remnant facilities were cleaned up to industrial worker standards, where only surveillance and maintenance, operations activities, or future groundwater and/or surface/sediment remain in those areas. Long-term stewardship (LTS) activities such as operating, maintaining and monitoring engineered controls and ensuring the continued effectiveness of institutional controls (ICs) is still required for all closed areas.

ESTABLISHMENT OF THE SRS FOOTPRINT

In 1949, with a goal of expanding the nation's nuclear defense, the U.S. Atomic Energy Commission (AEC) searched the United States for a location to construct a new production facility. The evaluation of hazards associated with the operation of production facilities for fissionable materials would ultimately shape the boundaries of the selected site. The proposed layout was to allow for five reactors, with two potential areas left for expansion. Based on a calculation of thermal power, there was to be a 10 km exclusion area around each reactor and a safety distance of 4 km between any two major manufacturing areas. The distance between any reactor and the property line was at least 10 km.

The site selected for the new production facility was in South Carolina's western Aiken and Barnwell counties, situated within two subdivisions of the Atlantic Coastal plain: the Aiken Plateau and the Alluvial terraces that lie along the river. Eighty percent of the site is situated within the Aiken Plateau. The terraces were composed of three tiers of varying widths banding the river. From north to south, six streams dissected the tract: Upper Three Runs Creek, Four Mile Creek, Pen Branch Creek, Steel Creek, Hattie Creek, and Lower Three Runs Creek. Five streams emptied into the river in a southwesterly direction; the sixth, Lower Three Runs, flowed to the southeast and drained the eastern portion of the site. Sixty-seven percent of the selected site's acreage was wooded, while thirty-three percent was either cultivated or used for pasture. Between January 29, 1951, and June 30, 1952, the U.S. Army Corps of Engineers completed the acquisition of 802 square-kilometer (1,706 tracts) of land to construct the Savannah River Plant.

THE FIRST ENVIRONMENTAL BUFFER

The cornerstone of the Site's early environmental history is the site itself—its size, location, and layout. Environmental safeguards were mandated within the site-selection criterion that required a large area of land be selected that was relatively isolated and within specified "safe" distances from major population centers. The size and isolation of the 802 square-kilometer site was based on protecting the public in the unlikely event of a nuclear accident. In such a case, the effects of the accident would be contained within the site boundaries or sufficiently mitigated to minimize impact on the population. The distance between the reactor and separations facilities, as well as the distance between any single facility and the plant perimeter, was carefully selected to maximize safety and security within the site, as well as to populations external to the site boundary. The process areas, five reactors and two separations plants, were spaced approximately 4 to 6 km apart along a roughly seven-mile-diameter circle at the center of the Site. These areas were located 13 km or more up the tributaries from the Savannah River. This arrangement provided the greatest possible protection of the public from a nuclear accident. Between the manufacturing core and the site perimeter lies a safety envelope 10 km in width. These distances safeguarded the surrounding area from two possible dangers: the possible release of radioactivity to the atmosphere and to the area streams and, second, the adverse impact of cooling water pumped from the river, heated and passed through the reactors, then returned to the river via streams. While distance may not have guaranteed safety, it provided the best-known defense at the time the plant was designed and constructed.

THE END OF PRODUCTION

By the early 1990s, Savannah River Plant had been renamed SRS, and all five of the production reactors were shut down. The end of the Cold War mandated changes in old missions and new directions for the forty-year-old production site, with the primary emphasis on cleanup rather than production. In 1993, DOE declared R, P, L, and C

Reactors as “excess”, with no further production mission. SRS’s mission was defined as the safe and secure stewardship of the nation’s nuclear weapons stockpile, nuclear materials, and the environment. Further explained, this means that the SRS mission was to meet the needs of the enduring U.S. nuclear weapons stockpile; store, treat, and dispose of excess nuclear materials safely and securely; and, finally, treat and dispose of legacy wastes from the Cold War and clean up environmental contamination.

AREA COMPLETION PROJECTS (ACP)

ACP’s scope is to remediate contaminated waste units and groundwater, as well as to deactivate and decommission surplus facilities. The SRS Federal Facility Agreement (FFA) signed between DOE, the South Carolina Department of Health and Environmental Control (SCDHEC) and Environmental Protection Agency-Region 4 (USEPA-4) establishes the requirements for meeting regulatory commitments. The three parties use an area completion strategy to integrate and sequence the activities required for facility decommissioning and soils, surface water, and groundwater cleanup in 14 specific SRS areas.

Environmental restoration began on Site in 1981 with the identification of groundwater problems emanating from M-Area settling basin. DOE, SCDHEC and USEPA-4 established the SRS’s current restoration program in the early 1990s. Under the program, DOE has remediated 399 of the site’s 515 inactive waste and contaminated groundwater units. These units ranged in size from a few cubic meters of soil to tens of square km, and the types of wastes include sanitary, radioactive, hazardous, and mixed wastes (a mixture of hazardous and radioactive waste).

RECOVERY ACT FOOTPRINT REDUCTION

The boundaries for each area addressed under the ARRA footprint reduction initiative were developed, for the most part, by using watershed boundaries, major roads, streams, and buffers around certain features such as facilities, waste units or ponds.

Through ARRA funding, accelerated area completion was accomplished in M, P and R Area and significant cleanup progress was made in D, B, and C Areas, as well as the general Savannah River area. Figure 1 depicts the areas that constituted the 85% footprint reduction achieved under the ARRA, including:

- D Area – D Area contained the Heavy Water Facilities that provided heavy water for the five nuclear production reactors. The area also contains coal-fired one powerhouse and some ancillary facilities that are scheduled for operational termination; however, this powerhouse work will occur outside of the Recovery Act period of performance. In D Area, soils cleanup was conducted. D Area accounted for 83 square-kilometers of footprint reduction.

- M Area – In the past, SRS manufactured the nuclear fuel and target assemblies in M Area. Also included within M Area was the SATA, where Site protective forces once trained. Waste unit and D&D activities conducted in M Area enabled this entire industrial area to be closed early. M Area accounted for 126 square-kilometers of footprint reduction.
- P, R & C Areas – These are three of the five SRS reactor areas with the original mission of producing material for the national nuclear weapons program. P and R reactors and their ancillary facilities were declared as excess facilities and were D&D'd. Additionally, as a result of nuclear reactor operations in the past, there were waste units within these areas that were remediated. P, R & C Areas accounted for 205 square-kilometers of footprint reduction.
- B Area – B Area is comprised of several facilities that were D&D'd, including the Heavy Water Components Test Reactor (HWCTR), a prototype energy production reactor that was built and tested at SRS in the early 1960s. Several waste units were in B Area were also remediated. Other components of B-Area footprint include the Sanitary Landfill (SLF), which was completed prior to ARRA, and Three Rivers Landfill (TRL), which is an area that is already being commercially re-utilized. B Area accounted for 73 square-kilometers of footprint reduction.
- Savannah River Area – this area contained the K-Cooling Tower that was D&D'd along with a number of waste units where soils remediation has been completed. The Savannah River Area accounted for 96 square-kilometers of footprint reduction.
- PAR Pond – The PAR Pond area was comprised of several primary and ancillary buildings that were D&D'd. PAR Pond accounted for 25 square-kilometers of footprint reduction.
- Lower Three Runs (LTR) – LTR is a large black water stream that originates in the northeast portion of SRS and follows a southerly direction through the LTR tail to the Savannah River. LTR Upper Section and Tail Section remediation accounted for 76 square-kilometers of footprint reduction.
- L Area Northern Groundwater - The L Area Northern Groundwater (LANG) Operable Unit (OU) encompasses all of the groundwater north of the L-Area groundwater divides. Remediation of the LANG OU accounted for 3 square-kilometers of footprint reduction.

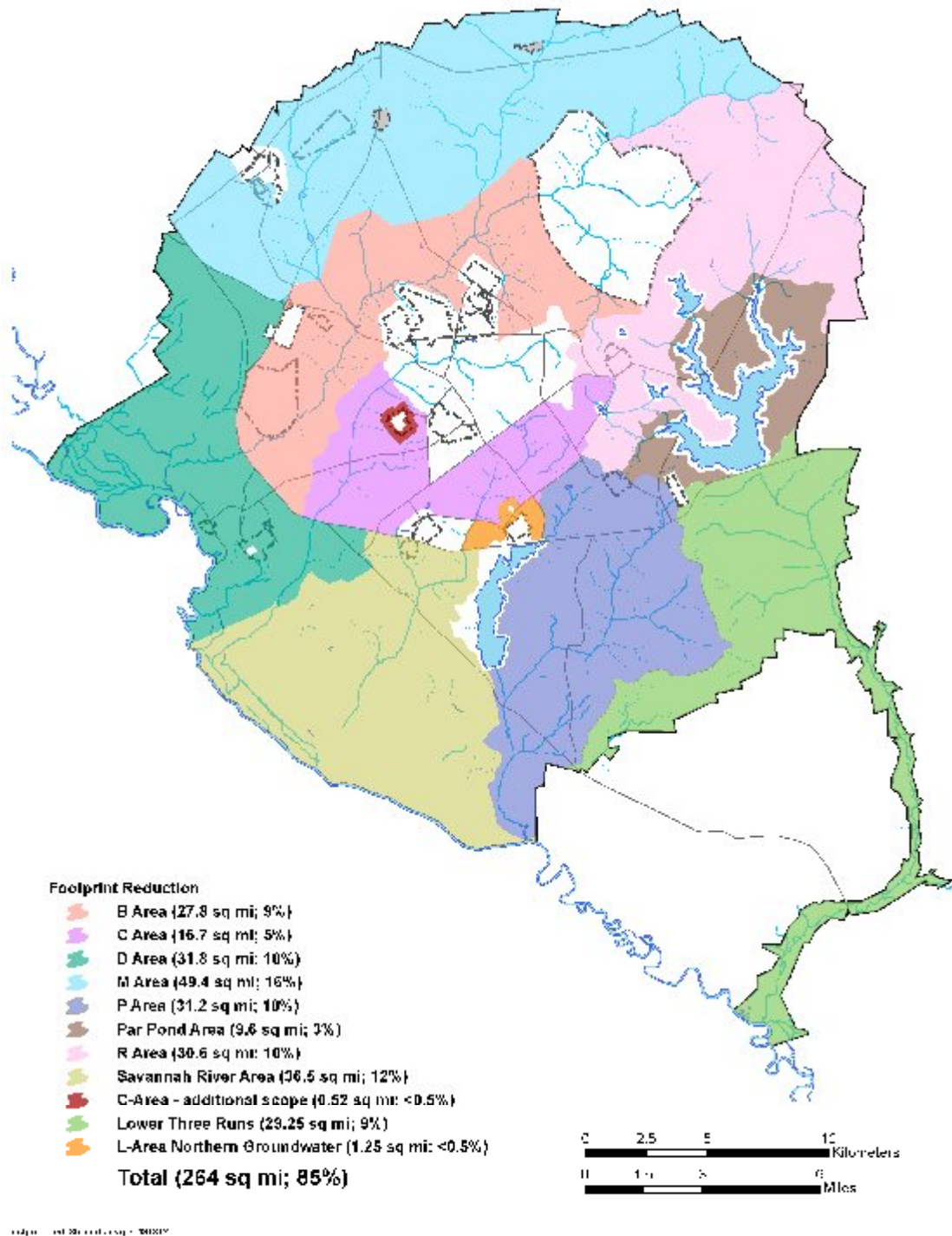


Figure 1 - Recovery Act Footprint Reduction Map (264 sq mi or 684 square - kilometers)

FOOTPRINT REDUCTION METRIC AND MEASUREMENT

At the start of the ARRA Program, DOE established a High Priority Performance Goal (HPPG) with the Office of Management and Budget (OMB) and monthly progress reports communicated SRS's footprint reduction progress. Square miles were tracked on the cleanup and disposition of waste units and facilities as they were mechanically completed.

Mechanical completion was the point in the project where field activities were completed to achieve the project end state. Mechanical completion occurred upon completion of construction and/or demolition activities, and a walkdown of the completed project with a formally documented inspection and acceptance agreement between project representatives from DOE-SR and SRNS (the M&O Contractor). Upon agreement that the waste unit remediation or D&D'd facility was mechanically complete, DOE-SR declared that footprint reduction had been achieved and progress against the schedule and HPPG metric was reported to the OMB.

CONCLUSION

The SRS completed numerous projects during the American Recovery and Reinvestment Act clean-up era at the Savannah River Site resulting in a declaration that the majority of the site, more than 684 square-kilometers, now meets industrial environmental clean-up standards. This important achievement uniquely positions SRS to potentially support many new missions, economically impacting the Central Savannah River Area.

A key to the successful completion of the Recovery Act footprint reduction was utilization of the Core Team concept. This relationship between representatives from EPA-4, SCDHEC, DOE-SR and SRNS paved the way for expedited document approvals and field completion acceptance. Strong working relationships among the Core Team continued to thrive through open and frequent communications, and proved very effective in streamlining decision documents to accelerate clean-up activities under ARRA.

SRNS safely and successfully decommissioned three nuclear reactors, characterized and remediated 75 waste units and deactivated and decommissioned 27 other excess facilities.