



SRNS-STI-2013-00279

**Savannah River Nuclear Solutions, LLC
Savannah River Site
Aiken, South Carolina**

Savannah River Site Environmental Report Summary for 2012

Front Cover - David Scott of the Savannah River Ecology Laboratory (SREL) provided this year's cover photo. The photo was taken in the Mixed Swamp Forest Set-Aside, which is part of the Savannah River swamp. This Set-Aside is one of the original ten SREL habitat reserve areas selected in 1968 to represent a diversity of bottomland hardwood/floodplain forest communities of a southern river swamp system. Represented are aquatic, semi-aquatic, and terrestrial habitats associated with cypress-tupelo ponds, mixed hardwood sloughs, and mixed hardwood ridges. This Set-Aside is important because seasonally flooded hardwood forests are becoming increasingly rare habitats that are particularly vulnerable to habitat destruction and/or alteration due to drainage, water control projects, industrial or urban waste discharge, or power plant cooling effluents. The flower in the foreground is called Lizard's Tail (Latin name *Saururus cernuus*). It grows in a variety of aquatic habitats, but on SRS it can be particularly abundant in some of the swamp forests.

The *Savannah River Site Environmental Report for 2012* (SRNS-STI-2013-00024) is prepared for the U.S. Department of Energy (DOE) according to requirements of DOE Order 231.1B, “Environmental, Safety and Health Reporting.”

The Savannah River Site (SRS) has produced the annual SRS environmental report for more than 50 years. Copies are distributed each year to government officials, universities, public libraries, environmental and civic groups, news media, and interested individuals. The report is available in electronic form at <http://www.srs.gov/general/pubs/ERsum/index.html>. The report’s purpose is to:

- Present summary environmental data that characterize Site environmental management performance,
- Describe compliance status with respect to environmental standards and requirements, and
- Highlight significant programs and efforts.

Environmental monitoring is conducted extensively with a 2,000-square-mile network extending 25 miles from SRS, with some monitoring performed as far as 100 miles from the Site. The area includes neighboring cities, towns, and counties in Georgia (GA) and South Carolina (SC). Thousands of samples of air, rainwater, surface water, drinking water, groundwater, food products, wildlife, soil, sediment, and vegetation are collected by SRS and analyzed for the presence of radioactive and nonradioactive contaminants.

During 2012, SRS accomplished several significant milestones while maintaining its record of environmental excellence, as its operations continued to result in minimal impact to the public and the environment. The Site’s radioactive and chemical discharges to air and water were well below regulatory standards for environmental and public health protection; its air and water quality met applicable requirements; and the potential radiation dose to the public was well below the DOE public dose limit.

The largest radiation dose that an offsite, hypothetical, representative person could have received from SRS operations during 2012 was estimated to be 0.26 millirem (mrem) – 0.027 mrem from air pathways plus 0.10 mrem from liquid pathways other than irrigation, and 0.13 from irrigation pathways (mrem is a standard unit of measure for radiation exposure). The 2012 SRS dose is 0.26 percent of the DOE all-pathway dose standard of 100 mrem per year, and far less than the natural average dose of approximately 300 mrem per year (according to Report No. 160 of the National Council of Radiation Protection and Measurements) to people in the United States.

SRS’s exceptional compliance record demonstrates our commitment to protect the environment. During 2012, SRS successfully managed more than 500 environmental permits, each containing numerous compliance requirements and conditions. SRS received one Notice of Violation (NOV) from the South Carolina Department of Health and Environmental Control (SCDHEC) for copper exceedances at one National Pollutant Discharge Elimination System (NPDES) outfall. SRS voluntarily implemented extensive corrective actions to address the violation, and SCDHEC did not assess any penalties. Discussion of the exceedance and the corrective actions can be found in Chapter 3, “Compliance Summary,” of the *Savannah River Site Environmental Report for 2012*.

This document was prepared in conjunction with work accomplished under Contract No. DE-AC09-08SR22470 with the U.S. Department of Energy. This work was conducted under an agreement with, and funded by, the U.S. Government. Neither the U.S. Government nor its employees, nor any of its contractors or subcontractors or their employees, makes any expressed or implied (1) warranty or assumes any legal liability for the accuracy or completeness—or for the use or results of such use—of any information, product, or process disclosed; or (2) representation that such use or results of such use would not infringe on privately owned rights; or (3) endorsement or recommendation of any specifically identified commercial process, or service. Any views and opinions of authors expressed in this document do not necessarily state or reflect those of the U.S. Government, or of its contractors or subcontractors.

The Savannah River Site

SRS covers 198,344 acres, or 310 square miles, encompassing parts of Aiken, Barnwell and Allendale counties in SC, bordering the Savannah River. The U.S. Atomic Energy Commission, a DOE predecessor agency, established SRS in the early 1950s, with its primary mission to produce nuclear materials used in the production of nuclear weapons. Five Special Nuclear Material (SNM) production reactors, along with support facilities to separate and purify the reactor products, were constructed and operated until 1988. With the end of the Cold War in 1991, waste management, environmental restoration, plutonium disposition, and decontamination and deactivation activities became the primary missions for SRS.

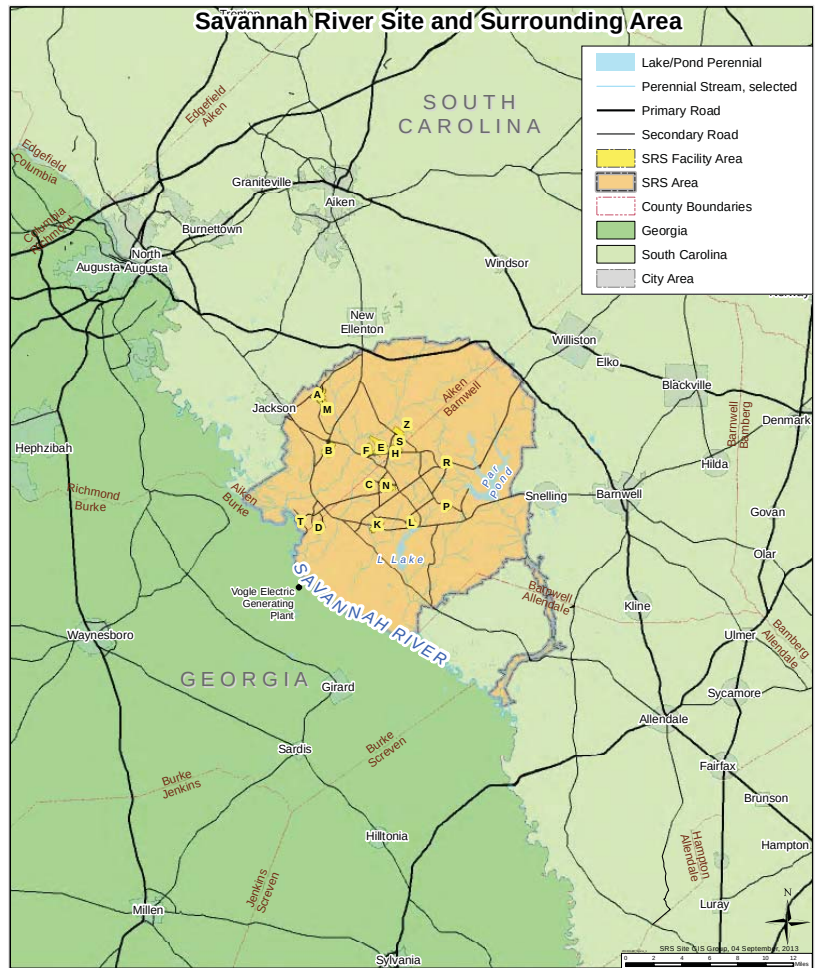
1950	President Harry S. Truman asks DuPont to design, construct, and manage the Savannah River Plant	Construction of P Reactor	
1953	First SRS Reactor goes critical		
1954	First delivery of plutonium product		
1972	Atomic Energy Commission designates SRS a National Environmental Research Park		
1988	All production reactors shut down	Defense Waste Processing Facility	
1989	SRS placed on the national Priorities List, becomes regulated by the Environmental Protection Agency; Savannah River Plant becomes Savannah River Site, reflecting mission change		
1991	End of Cold War		
1996	The Defense Waste Processing Facility processes first legacy radioactive waste		
1997	First radioactive liquid waste tank closed	Closure of P Reactor	
2000	SRS selected for new missions: Mixed Oxide Fuel Fabrication Facility, Pit Disassembly and Conversion Facility, and Plutonium Immobilization Facility		
2004	Savannah River Technology Center receives National Laboratory designation		
2009	Accelerated cleanup efforts initiated under American Recovery and Reinvestment Act (ARRA)		
2011	Enterprise SRS is launched, to use the assets of the SRS and its nuclear knowledge to benefit the CSRA and the nation	H Canyon	
2012	Accelerated cleanup efforts under ARRA are complete resulting in a footprint reduction of 85%; two radioactive liquid waste tanks are closed		

The majority of SRS is undeveloped; only about 10 percent of the total land area is developed or used for mission-oriented activities. 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 SRS work force population is approximately 12,000 personnel. 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. 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.

Missions

The mission of SRS is to safely and efficiently operate SRS facilities to protect the public health and the environment while supporting the nation's nuclear deterrent and the transformation of the Site for future use. Activities at SRS are organized around primary mission areas to support the DOE Environmental Management (EM) program, National Nuclear Security Administration (NNSA), and the needs of the nation. While current missions remain the highest priority, SRS leadership places great importance on developing broader future missions for SRS that use its unique capabilities in order to address critical national needs in environmental stewardship, clean energy, and national security.



Enterprise SRS Missions and Programs

National Security

- Meet the needs of the United States nuclear weapons stockpile
- Treat, store, and dispose of excess nuclear materials safely and securely
- Support the nation's response to any nuclear or radiological incident within the United States
- Provide operational planning and training to counter domestic nuclear terrorism

Environmental Stewardship

- Treat and dispose of legacy radioactive liquid waste from the Cold War Era
- Clean up environmental contamination from previous operations

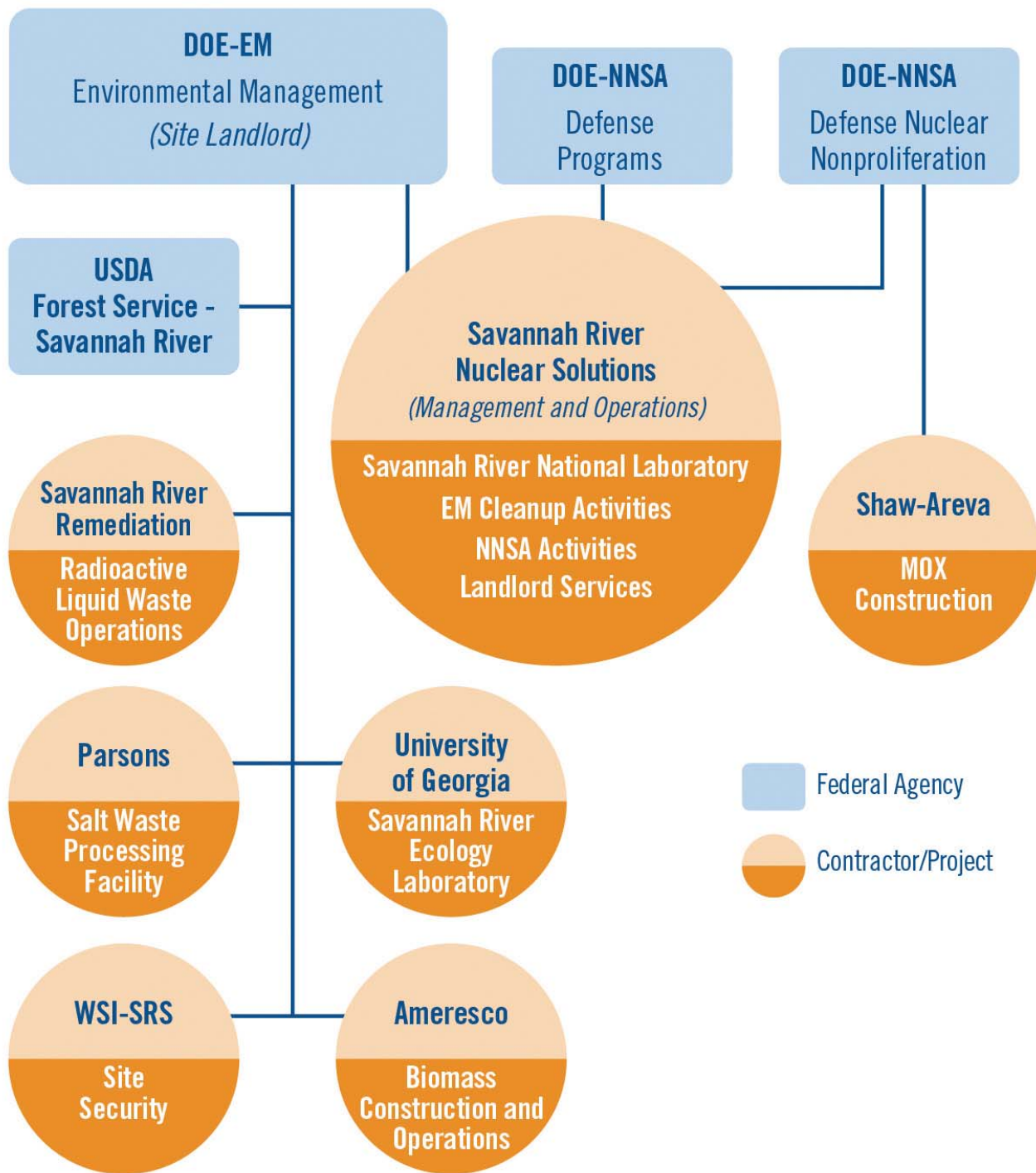
Clean Energy

- Develop alternative energy technology



Key Organizations

Multiple federal and contractor entities contribute to the execution of DOE’s mission at SRS. The relationship of these contractors with DOE is shown below.





The DOE Savannah River Operations Office (DOE-SR) is responsible for oversight of Environmental Management operations and landlord services at SRS. More information can be obtained by viewing the DOE-SR website at <http://sro.srs.gov/>.



Three NNSA offices, the Savannah River Field Office (NNSA-SRFO), the Office of Fissile Materials Disposition (NA-26), and the Office of Acquisition and Project Management (NA-APM) oversee the NNSA missions and projects at SRS. These organizations are responsible for management of key program areas including Defense Programs, Nuclear Nonproliferation, National Security, emergency operations related to SRS tritium facility operations and DOE/NNSA Radiological Emergency Response assets.



Savannah River Nuclear Solutions, LLC (SRNS), a joint venture of Fluor Corporation, Newport News Nuclear, and Honeywell International, Inc., is the SRS Management and Operations (M&O) contractor. SRNS operates the Savannah River National Laboratory (SRNL), nuclear materials and used nuclear fuel facilities, solid waste management facilities, tritium facilities, site infrastructure, and waste site remediation and closure projects. More information can be obtained by viewing the SRNS website at <http://www.savannahrivernuclearsolutions.com/>.



Operated by SRNS, the Savannah River National Laboratory (SRNL) is SRS's and DOE-EM's applied research and development laboratory. SRNL creates and implements practical, high-value, cost-effective technology solutions in the areas of environmental stewardship, national security, and clean energy. SRNL also 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 Remediation LLC (SRR) is the liquid waste contractor for DOE-SR. SRR treats, stores, and disposes of radioactive liquid waste. SRR is composed of a team of companies led by URS Corporation with partners Bechtel National, CH2M Hill, and Babcock & Wilcox. Critical subcontractors for the contract are AREVA, Energy Solutions, and URS Safety Management Solutions. More information can be obtained by viewing the SRR website at <http://www.srremediation.com/>.



Ameresco Federal Solutions, Inc. constructed and now operates biomass steam generating plants in K and L Areas and the steam and electricity cogeneration plant near F Area. DOE has contracted Ameresco to supply steam and electricity to SRS. The biomass steam generating and steam and electricity cogeneration plants data is not included in the Annual Environmental Report because the facilities operate under environmental permits issued directly to Ameresco by SCDHEC. More information concerning Ameresco can be obtained by viewing their website at http://www.ameresco.com/sites/default/files/cs_savriver_v5.pdf.

SRS NOW - ORGANIZATION

Shaw Areva MOX Services, LLC is under contract with NNSA and is responsible for the design, construction, startup, and operation of the SRS Mixed Oxide (MOX) Fuel Fabrication Facility. More information can be obtained by viewing the Shaw Areva MOX Services website at <http://www.moxproject.com/>.



Parsons Government Services, Inc. is under contract with DOE-SR to design, build, startup, and operate the Salt Waste Processing Facility. More information can be obtained by viewing the Parsons website at <http://www.parsons.com/projects/Pages/salt-waste-processing-facility.aspx>.



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-SR. More information can be obtained by viewing the laboratory's website at <http://www.srel.edu/>.



Under an Interagency Agreement with DOE-SR, the United States Department of Agriculture (USDA) Forest Service-Savannah River (USFS-SR) contributes to environmental stewardship at SRS by: managing the Site's natural resources, including 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 wild-land fires; and evaluating the effects of its management practices on the environment. More information can be obtained by viewing the USFS-SR website at <http://www.fs.usda.gov/savannahriver>.



Wackenhut Services, Inc. (WSI-SRS) is contracted by DOE-SR to provide a protective force that fulfills security requirements and executes emergency contingency plans that protect special nuclear materials, government assets, Site employees, and surrounding communities from security threats. More information can be obtained by viewing the corporate website at <http://www.g4sgs.com/>.



The Savannah River Archaeological Research Program (SRARP) is a research unit of the University of South Carolina that provides the technical expertise to support DOE management of SRS cultural resources. SRARP responsibilities include identifying, evaluating, and protecting SRS archaeological sites and artifacts, conducting compliance based research, offering public outreach programs, and preparing documents and reports for state and federal regulators. More information can be obtained by viewing the SRARP website at <http://www.srarp.org/>.



DOE Environmental Management Program

The environmental management mission includes management and disposition of waste materials, remediation of waste sites, and environmental research.

Waste Management

Treatment and disposal of legacy waste from the Cold War Era continued as part of the environmental stewardship mission in the F- and H-Area Tank Farms, the Defense Waste Processing Facility (DWPF), the Salt Disposition Processing (SDP) facilities, which includes the Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit (ARP/MCU) and Saltstone facilities. Other major activities include the management of radiological and nonradiological waste in E Area, soil and groundwater cleanup, and deactivation and decommissioning of facilities.

SRS manages large volumes of radiological and nonradiological waste created by previous operations of the nuclear reactors and their support facilities, as well as newly generated waste created by ongoing Site operations. Specific waste management initiatives are described below.

Radioactive Liquid Waste Management

Radioactive liquid waste is generated at SRS as by-products from the processing of nuclear materials for national defense, research, and medical programs. The waste consists of a sludge that settles on the bottom of the tank, and a liquid (salt), known as supernate, that occupies the area above the sludge. It is stored in underground tanks in the F- and H-Area Tank Farms. Currently, approximately 37 million gallons of high activity radioactive liquid waste is stored in 47 large, shielded, underground tanks grouped into two tank farms.

Processing of salt and sludge waste streams are performed in the SDP facility, the Saltstone facility, and the DWPF. SDP removes nearly all the radioactivity from the salt waste prior to its transfer to the Saltstone facilities, which safely stabilizes and disposes the waste in disposal units (vaults) made from concrete, known as Saltstone Disposal Units (SDUs). Processing of salt waste will continue through the SDP facilities until the Saltwater Processing Facility (SWPF), which is currently under construction, becomes operational. More information can be obtained by viewing the Radioactive Liquid Waste Disposition page on SRS's website at <http://www.srs.gov/general/programs/liquidwaste/index.htm> and the Waste Solidification page at <http://www.srs.gov/general/programs/solidification/index.htm>.

In 2012, SRS met a major compliance milestone with the final closure of Tanks 18F and 19F. SRS completed this milestone three months ahead of the required operational closure date. Successful closure of these tanks signifies the most substantial environmental risk reduction achievement for the State of South Carolina since 1997, when SRS closed the first two waste

2012 Radioactive Liquid Waste Program Highlights

- Two radioactive liquid waste tanks were closed, Tanks 18 and 19 in the F-Area Tank Farm.
- DWPF, the largest radioactive waste glassification plant in the nation, utilized new technology to accelerate canister production and produced 275 canisters filled with glassified waste, which is a form suitable for long-term storage. The 275 canisters filled exceed the previous record of 267 poured in 2011.
- The Saltstone facilities surpassed 11.5 million gallons of decontaminated salt solution being processed since initiating operations in June 1990.
- The Salt Disposition Processing facilities set records for monthly production.
- Construction of newly designed SDUs 2A and 2B was completed and each successfully underwent watertight testing. Disposal operations began in 2012.

tanks in the nation. Both tanks underwent an extensive waste removal process that included bulk waste removal, specialized mechanical cleaning, and isolation of the tanks from all external systems. These activities culminated in regulatory confirmation that the tanks were ready for stabilization. SRS operationally closed Tanks 18F and 19F in September 2012, following 2,080 cement trucks pouring more than 3.3 million gallons of specially formulated cement-like grout into the tanks.

SRS waste tanks have provided more than 50 years of safe storage for radioactive liquid waste. Removing waste from the tanks will allow for closure of the radioactive liquid waste tanks systems, a high priority for DOE and a commitment under the Federal Facility Agreement (FFA). More information can be obtained by viewing the Radioactive Liquid Waste Operational Closures of Tanks fact sheet on SRS's website at <http://www.srs.gov/general/news/factsheets/inwtc.pdf>.



Senior DOE Officials, State of South Carolina, and SC Congressional Leadership Gather to Commemorate Another Historic Cleanup Milestone

Solid Waste Management

All wastes generated at SRS are treated, stored, and disposed to meet environmental and regulatory requirements. SRS also emphasizes waste minimization and recycling as a way to reduce the volume of waste that must be managed. Solid wastes managed at SRS include the following types:

- Low-level radioactive solid waste (LLW), which includes items such as protective clothing, tools, and equipment that have become contaminated with small amounts of radioactive material;
- Transuranic (TRU) waste, which contains alpha-emitting isotope with an atomic number greater than uranium;
- Hazardous waste, 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; and
- Sanitary waste, which, like ordinary municipal waste, is neither radioactive nor hazardous.

More information can be obtained by viewing the Solid Waste Management page on SRS's website at <http://www.srs.gov/general/programs/solidwaste/index.htm>.



Three Transuranic (TRU) Shipments Using Three Different Shipping Containers Depart SRS

2012 Solid Waste Management Project Highlights

Hazardous Waste

- Shipped 322 containers of hazardous waste (70 cubic meters) to offsite treatment and disposal.

Low Level Waste

- Safely disposed of 14,900 cubic meters of LLW at its facilities.

Mixed Waste

- Shipped 226 containers of mixed waste offsite (320 cubic meters) for treatment and disposal.

Transuranic Waste

- Set a record for best annual performance to date – characterizing, repackaging, and shipping more than 1,600 cubic meters of legacy TRU waste to the Waste Isolation Pilot Plant.

Area Completion

Past operations at SRS resulted in the release of hazardous and radioactive substances to soil and groundwater. The Area Completion program deactivates and decommissions contaminated facilities and remediates (if necessary) soil, groundwater, surface water, and sediment to levels that are protective of human health and the environment.

Two major federal laws drive environmental cleanup: the Resource Conservation and Recovery Act (RCRA), which establishes a system for tracking and managing hazardous wastes from generation to disposal; and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), or Superfund, which addresses the protection and cleanup of the environment from known release of hazardous substances. SRS is meeting the integrated requirements of these two laws through the FFA between DOE, the Environmental Protection Agency (EPA), and SCDHEC, which specifies how DOE will address known or potential contamination at SRS waste units.

The following sections describe two of Area Completion projects implemented in 2012, the Lower Three Runs Remediation and C-Reactor Disassembly Basin Projects. More information can be obtained by viewing the Area Completion Projects page on SRS's website at <http://www.srs.gov/general/programs/soil/extpage.html>.

2012 Area Completion Project Highlights

- Completed soil removal activities and implementation of additional access controls along Lower Three Runs.
- Completed in-situ decommissioning of the C-Reactor Disassembly Basin.
- Completed 123 FFA milestones; continuing a perfect compliance record since 1991.
- Operated 39 remediation systems to cleanup and contain contamination.
- Completed disposition of 49 excess reactor heat exchangers.



Heat Exchangers Transported for Disposal

Lower Three Runs Remediation

Twenty miles long, Lower Three Runs leaves the main body of SRS and runs through parts of Barnwell and Allendale Counties until it flows into the Savannah River.

Based on data collected during 2009 and 2010, SRS, EPA, and SCDHEC determined that three small areas along the creek presented a risk to human health that warranted cleanup to reduce the risk. In response, SRS excavated and disposed of over five million pounds of contaminated soil from three specific sites along the stream, erected several miles of fence, and installed over 2,000 signs to inform people of the potential presence of radioactive or hazardous material along Lower Three Runs and ensure that the valuable water resources remain protected. Government property on both sides of the stream acts as a buffer as it runs between privately owned property.



Workers Package Material for Disposal

Because low levels of contaminants remain in soils and sediments, fishing or public access is not allowed in this area. Testing of the water in Lower Three Runs has shown it to be safe, with contaminant levels below EPA standards.

C-Reactor Disassembly Basin Project

In 2004, DOE recognized the 105-C Reactor Facility, which operated from 1950 through 1989, as a historic property due to its significance in supporting the SRS Cold War mission. The reactor facility consists of five primary areas, including a 68,000 square foot disassembly basin. For decades, this water-filled basin was used to temporarily store irradiated reactor fuel prior to shipment to onsite chemical separations facilities.

Data indicated the presence of over 830 curies of radioactivity associated with the basin sediments and the 2.4 million gallons of contaminated water, activated reactor equipment, scrap metal, and debris on the basin floor. In 2012, DOE, EPA, and SCDHEC identified the need to reduce risks to personnel in the facility and to eliminate the possible release of contaminants into the environment.



**Construction of the Evaporator Building
at C Reactor**

EPA, SCDHEC, DOE, and the SC Historical Preservation Office agreed on in-situ decommissioning (ISD) of the 105-C Disassembly Basin. ISD consisted of evaporating the basin water and filling the basin with grout to stabilize the sediment and isolate activated reactor equipment and scrap metal. The grout provides a low permeability barrier to minimize any potential transport of contaminants. The roof over the disassembly basin was preserved for historical significance and to prevent the infiltration of precipitation.

SRS initiated construction in August 2011. Evaporator operations commenced in January 2012 and ended in July 2012 with over two million gallons of water treated/removed. Over 11,150 cubic yards of grout was placed by the time the project completed in August 2012.



Completed Grouting Activities in C-Reactor Disassembly Basin

Nuclear Materials Stabilization

SRS has two primary separations facilities, called “canyons” where nuclear materials are chemically recovered and purified. F Canyon was deactivated in 2006 while H Canyon continues to operate. During 2012, SRS continued to use H Canyon to prepare surplus plutonium materials for disposition at the Waste Isolation Pilot Plant (WIPP) in New Mexico. More information can be obtained by viewing SRS’s website at <http://www.srs.gov/general/programs/harea/index.htm>.

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. With the implementation of Enterprise•SRS, H Canyon was selected to support several initiatives. While many of the new campaigns are in the planning phase, H Canyon begun dissolving and purifying SRS excess plutonium to provide the initial feed material to the Mixed Oxide Fuel Fabrication Facility (MFFF). H Canyon is also dissolving and disposing of vulnerable sodium experimental reactor fuel, while conducting tests to support NNSA’s Next Generation Safeguards Initiative.



H Canyon

2012 Nuclear Materials Stabilization Program Highlights

- H Canyon completed the Tennessee Valley Authority Blending Program Agreement for delivery of 301 tons of low enriched uranium solution.
- H Canyon initiated dissolution of used nuclear fuel as part of the Sodium Reactor Experimental Fuel program.
- Shipped 33 containers of down-blended plutonium oxide to the WIPP.
- L Area processed 13 shipping casks containing 205 assemblies of six types of fuel.

Nuclear Materials Consolidation and Storage

SRS provides for the handling and interim storage of our nation's excess plutonium and other SNM and fulfills the United States' commitment to international nonproliferation efforts in a safe and environmentally sound manner. The K-Area Complex is DOE's only SNM storage facility designated for interim safe storage of plutonium. The principal operations building formerly housed K Reactor, which produced nuclear materials to support the United States during the Cold War for nearly four decades. DOE has revitalized this very robust structure to safely store nuclear materials. More information can be obtained by viewing the Nuclear Materials Management page on SRS's website at <http://www.srs.gov/general/programs/nmm/index.htm>.



K-Area Storage Facility



**Used Nuclear Fuel Storage Activities
in the L-Area Complex**

Used Nuclear Fuel Storage

The mission of the Used Nuclear Fuel (UNF) program is to support the Global Threat Reduction Initiative and research reactor programs by safely and cost effectively receiving and storing used fuel elements from foreign and domestic research reactors, pending disposition. Currently, UNF is stored at the L-Area Complex. More information can be obtained by viewing the L-Area Complex fact sheet on SRS's website at http://www.srs.gov/general/news/factsheets/esrs_lac.pdf.

DOE National Nuclear Security Administration

Tritium Processing

Tritium is a radioactive form of hydrogen gas that is a vital component of nuclear weapons. Tritium has a half-life of 12.3 years and must be periodically replenished. SRS is the nation's only facility for extracting, recycling, purifying, and reloading tritium. Tritium is replenished by recycling tritium from existing warheads and by extracting tritium from target rods irradiated in nuclear reactors operated by the Tennessee Valley Authority. Recycled and extracted gases are purified to produce tritium suitable for use. SRS Tritium facilities are part of the NNSA's Defense Programs operations at SRS. More information can be obtained by viewing the Defense Programs page on SRS's website at <http://www.srs.gov/general/programs/dp/index.htm>.



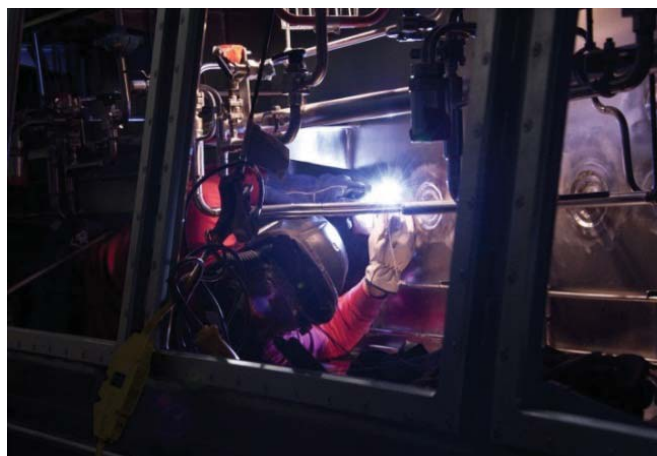
SRS Tritium Extraction Facility

Defense Nuclear Nonproliferation

SRS is one of the primary DOE sites with missions to address issues of national security and nonproliferation, including legacy material disposition. Currently under construction, the Mixed Oxide Fuel Fabrication Facility will convert excess weapons-usable plutonium to a form that can be used in commercial power reactors. Once irradiated, the plutonium can no longer be readily used for nuclear weapons. This critical facility, along with the associated Waste Solidification Building (WSB), is essential to the nation's plans to consolidate and dispose of surplus U.S. weapon-grade plutonium. More information can be obtained by viewing the MOX project website at <http://www.moxproject.com>.



Construction of the Mixed Oxide Fuel Fabrication Facility Progresses



Workers Installing Equipment in the Waste Solidification Building

Education Outreach

The Educational Outreach Programs (EOP) sponsored by DOE-SR, provides science and literacy outreach programs focused on enhancing interest in science, mathematics, engineering, and technology. In FY 2012, EOP reached out to Central Savannah River Area (CSRA) students through various programs and events mostly aimed at reaching a diverse population of students and teachers, and increasing their knowledge in science, mathematics, engineering, and technology. Approximately 28,000 students and teachers benefited from EOP through presentations, contests, and community events.



Students from the Science and Technology Enrichment Program (STEP) Gaining Hands-on Experience

Community Outreach

SRS continues to support community outreach initiatives focused on fostering a climate of trust and partnership on a variety of Site related issues. Community outreach initiatives include business and community development and outreach; contributions to community-based and national organizations (both corporate contributions and volunteer hours); mission-related and public Site tours; and public involvement activities such as the SRS Environmental Bulletin, special public meetings, and hearings or events.



Surplus Plutonium Disposition Public Comment Meeting

Environmental Justice

Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Funded by DOE since 1995 and the EPA since 2003, the Environmental Justice (EJ) program (coordinated through a grant with Savannah State University (SSU) in Savannah, Georgia) includes the following:

- Coordinating meetings in the communities of Augusta and Waynesboro, Georgia; and North Augusta, Edgefield, Aiken, Blackville, Barnwell, and Allendale, South Carolina to address environmental justice concerns, job training initiatives, grant resource availability, capacity building, environmental monitoring, and emergency response;
- Organizing the Teaching Radiation, Energy, and Technology (TREAT) Workshop to provide opportunities for local school teachers and members of the public to learn about environmental radiation;
- Continuing to upgrade cutting edge environmental analytical laboratory equipment for the SSU Environmental Science students, and mentoring the Environmental Scholars Program; and
- Providing student internships for environmental contaminant analysis research projects, hands-on training, and the opportunity to work with local communities on Environmental Justice components.



Teaching Radiation, Energy, and Technology (TREAT) Workshops

For more information about the SRS EJ program contact de'Lisa Carrico at (803) 952-8607.

Citizens Advisory Board

The SRS Citizens Advisory Board (CAB), is one of eight Environmental Management Site-Specific Advisory Boards funded by DOE. These boards provide advice and recommendations to DOE, at its request, on environmental remediation, waste management, and related issues. Agency liaisons from DOE, EPA, and SCDHEC were represented at CAB meetings in 2012.

The SRS CAB, nationally recognized as one of the most productive site-specific advisory boards in the DOE complex, provided 20 recommendations to DOE in 2012.

An element of the SRS CAB mission is to improve communication with communities potentially impacted by the Site, and to ensure that stakeholders have opportunities to become involved in decisions made at the Site. A speaker's bureau is available to provide information about the SRS CAB and its activities at civic organizations and club meetings.



CAB Members Tour SRS Facilities

More information about the CAB and its recommendations may be obtained by calling the CAB administrator at 1-800-249-8155, e-mailing the board at srscitizensadvisoryboard@srs.gov, or visiting the CAB website at <http://cab.srs.gov>. A schedule of the SRS CAB meetings, including online meetings, is available on the website. Membership applications, also available on the website, are accepted year-round and selected annually from stakeholders in Georgia and South Carolina.

Public Involvement in SRS Cleanup Decisions

DOE has conducted a range of community involvement activities at SRS to solicit community input and to ensure that the public remains informed about Site activities throughout the cleanup process. Outreach activities have included public notices and information meetings on cleanup progress and activities. The *Savannah River Site Federal Facility Agreement Community Involvement Plan* (http://www.srs.gov/general/programs/soil/ffa/CIP_2011.pdf) outlines the public participation processes used by DOE and outlines ways the public can be involved in SRS cleanup decision-making processes and serves as the overall guidance document for public participation and outreach activities at SRS. In cooperation with SCDHEC and EPA, and in consultation with the NRC, DOE seeks public involvement by participating in workshops, public meetings, and public comment periods on radioactive liquid waste tank closure documents so that the concerns of all affected people can be addressed. Additional information can be found at the NRC Public Meetings and Involvement webpage at <http://www.nrc.gov/edgesuite.net/public-involve.html> or the SCDHEC Public Involvement webpage at <http://www.scdhec.gov/environment/publicparticipation/>.



COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

Federal and state regulations and statutes provide specific requirements and standards to protect the environment and maintain environmental quality. EPA and SCDHEC are the principal administrative authorities for these laws. SRS is also subject to DOE requirements for the control of radionuclides, as authorized by the Atomic Energy Act. Additional information can be found in Chapter 3, "Compliance Summary," of the *Savannah River Site Environmental Report for 2012*.



Regulatory Program Description	2012 Status
Clean Air Act (CAA) regulates the release of air pollutants through permits and air quality limits. Emissions of airborne radionuclides are regulated by EPA via National Emissions Standards for Hazardous Air Pollutants (NESHAP) authorizations.	SRS operated in accordance with permits issued under the CAA.
Clean Water Act (CWA) seeks to improve surface water quality by establishing standards and a system of permits. National Pollutant Discharge Elimination System (NPDES) permits issued by SCDHEC regulate wastewater discharges.	SRS had six permit limit exceptions during 2012, and received one Notice of Violation for an NPDES exceedance of copper limits. SRS voluntarily implemented extensive corrective actions to address the violation, and SCDHEC did not assess any penalties.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides the regulatory framework for remediation of (1) releases of hazardous substances and (2) inactive hazardous waste disposal sites.	399 waste units were complete and 12 were in remediation out of 515 total waste units.
DOE Order 231.1B, Environment, Safety and Health Reporting ensures the timely collection, reporting, and analysis, and dissemination of information on environment, safety, and health issues.	The <i>SRS Environmental Report for 2011</i> was posted on the SRS external website on September 27, 2012.
DOE Order 435.1, Change 1, Radioactive Waste Management is implemented to ensure that all DOE radioactive waste is managed in a manner, that protects workers, public health and safety, and the environment.	Annual review of Performance Assessment (PA) and Composite Analysis (CA) showed that low-level waste operations were well within the performance envelope analyzed by the PA, Special Analyses (SA), and the CA.
DOE Order 436.1, Departmental Sustainability defines requirements and responsibilities to ensure DOE carries out its missions in a sustainable manner.	- Completed successful startup of the Biomass Cogeneration Facility. - Continued operation of three satellite biomass plants. - Increased use of alternative fuels and alternative-fuel vehicles. - Obtained Leadership in Energy and Environmental Design (LEED) certification for new buildings. - Continued implementation of recycling programs.
DOE Order 458.1, Radiation Protection of the Public and the Environment establishes the requirements for protection of the public and the environment against undue risks from radiation associated with radiological activities at DOE sites.	The highest potential dose to the representative from all pathways in 2012 was 0.26 mrem, 0.26% of the 100-mrem/year dose standard.
Emergency Planning and Community Right-to-Know Act (EPCRA) also referred to as the Superfund Amendment Reauthorization Act (SARA), Title III, requires the reporting of emergency planning information, hazardous chemical inventories, and environmental releases of certain toxic chemicals to federal, state, and local authorities.	SRS submitted the chemical inventory reports (Tier II) in February, 2012 and the Toxic Release Inventory (Form R) for 2011 on June 28, 2012.

COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

Regulatory Program Description	2012 Status
Endangered Species Act (ESA) and Migratory Bird Treaty Act (MBTA) provide protection of rare species of plants and animals and their habitats.	- Four biological evaluations conducted indicate that Site activities have no adverse impacts on threatened or endangered species. - Nests covered under MBTA found at SRS were protected until hatchlings fledged or the nests were determined to no longer be viable.
Federal Facility Compliance Act (FFCA) requires the development of schedules by DOE for treatment of mixed waste to meet Land Disposal Restrictions under Resource Conservation and Recovery Act (RCRA).	SRS and SCDHEC held the annual Site Treatment Plan (STP) update meeting in June 2012. No concerns were identified that required submittal of a 2012 STP update.
Federal Facility Agreement for Savannah River Site, WSRC-OS-94-42 Section IX High-Level Radioactive Waste Tank System establishes requirements for remediation of high-level radioactive waste tank systems that are removed from service.	Completed operational closure of two tanks, initiated bulk waste removal efforts on one tank, residual sampling and analyses were completed on two tanks and preparations for introducing grout was initiated on two tanks.
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) regulates the storage and use of pesticide.	SRS operated in compliance with FIFRA.
National Defense Authorization Act (NDAA) Section 3116 provides an avenue for DOE, in consultation with the Nuclear Regulatory Commission, to dispose certain waste materials as low-level waste.	After completion of the consultation process with the Nuclear Regulatory Commission (NRC), the Secretary of Energy signed the "Section 3116 Determination for Closure of the F-Tank Farm" in March 2012, which supports closure of all tanks in F-Tank Farm.
National Environmental Policy Act (NEPA) requires (1) consideration of how federal actions may impact the environment and (2) examination of alternatives to the actions. NEPA also requires that decisions include public input and involvement through the scoping and review of NEPA documents.	413 SRS-related NEPA reviews were conducted. 304 categorical exclusion determinations were posted on the SRS external website.
National Historic Preservation Act (NHPA) protects the nation's historical resources by establishing a comprehensive national historic preservation policy.	887 acres were surveyed, resulting in 29 new archeological sites. 17,060 artifacts were curated in FY 2012.
Resource Conservation and Recovery Act (RCRA) governs the generation, management, and disposal of hazardous waste. RCRA also regulates underground storage tanks containing petroleum and hazardous substances, universal waste, and recyclable used oil.	- SRS operated in accordance with RCRA permits. - The Site received the annual compliance certificate for 19 underground storage tanks after SCDHEC conducted an annual inspection.
Safe Drinking Water Act (SDWA) establishes minimum drinking water standards and monitoring requirements.	The drinking water systems sampled at SRS met the SDWA standards.
Toxic Substances Control Act (TSCA) regulates the manufacture, use, and distribution of many hazardous chemicals, including asbestos and polychlorinated biphenyls (PCBs).	- In April 2012, EPA visited the Dynamic Underground Stripping (DUS) project in advance of the formal request from SRS to modify the existing TSCA risk-based disposal approval. SRS received approval in November 2012. - SRS completed 87 shipments of polychlorinated biphenyl/transuranic waste.

ENVIRONMENTAL MANAGEMENT SYSTEM

SRS Environmental Management System (EMS) Implementation

SRS implements an EMS to ensure protection of the employees, the public, and the environment. The EMS is a business management practice that incorporates concern for environmental performance throughout an organization, with the ultimate goal being continual reduction of the organization's impact on the environment. Operations with a potential environmental impact are identified and EMS is implemented to minimize or eliminate any impacts. SRS determines the EMS objectives and targets implemented each fiscal year. Additional information can be found in Chapter 2 "Environmental Management System," of the *Savannah River Site Environmental Report for 2012*.

Water Efficiency and Management

- Water intensity was reduced 10.9% below the FY 2007 baseline.
- Installation of low flow toilet fixtures and faucets continues to reduce potable water intensity.



Renewable Energy



- The Biomass Cogeneration Facility began full time operation producing steam and electricity for use at SRS. The facility will generate a minimum of 77,500 mega-watt hours of electricity for onsite consumption during the first year of operation.
- Last of the coal fired boilers at SRS were shut-down in 2012 coinciding with the startup of the cogeneration facility.
- Greenhouse gases (GHG) reduced 29.7% since 2008 primarily due to switching to a biobased fuel source for steam and electricity.
- GHG as emissions reduced by 100,000 tons per year, significantly decreasing the carbon footprint of SRS.
- Communities also receive health and environmental benefits associated with the reduction in GHGs.

High Performance Sustainable Buildings



- MOX applied for Leadership in Energy and Environmental Design (LEED) Gold certification for its new Technical Services Building. This will be the second building in the MOX complex to attain LEED certification.
- Energy audits and building commissioning evaluations were conducted in approximately 540,000 square feet as part of sustainable building efforts.
- Energy Independence & Security Act of 2007 (EISA) audits were conducted in approximately 2.4 million square feet.
- Electric meters have been installed on selected building to monitor usage.

Energy Efficiency

- SRS has attained a 43.2% energy intensity decrease since 2003.
- Over 31,000 square feet of "cool roof" (solar reflective/thermal resistant) technology was installed in 2012.
- All computer monitors and laptops meet the Electronic Product Environmental Assessment Tool (EPEAT) standards for energy efficiency.



Fleet Management



- Fleet petroleum usage has been reduced by 19% since 2005.
- Approximately 80% of vehicles utilize E85 fuel or are hybrids. Over 300,000 gallons of E85 fuel was used.
- SRS exceeded its 2012 goal for vehicle reductions and is on track to meet the DOE 2014 goals.
- Recognition was received from the Georgia Clean Air Campaign for taking actions to improve air quality in Georgia and reduce traffic congestion on the roads.
- Work began to obtain a plug-in electric vehicle and charging station under a pilot program with the General Services Administration.

Pollution Prevention



- Over 35,900 pounds of chemicals were distributed for reuse.
- 43% of non-hazardous solid wastes generated at SRS (730 metric tons) were diverted from landfills through recycling.
- Other materials during the year that were recycled included:
 - 14 metric tons of shredded wood waste,
 - 465 metric tons of scrap metal,
 - 69 metric tons of scrap electronics, and
 - 130 metric tons of scrap furniture.
- Implementation of Pollution Prevention projects resulted in the avoidance or diversion of 3,822 cubic meters of hazardous and radioactive waste.

Sustainability Campaign



This program targets specific items of sustainability and environmental stewardship that promote individual action by connecting SRS employees to information, tools, and programs that make a difference to our environment. In 2012, the campaign focused on:

- *Reusable shopping bags*
- *Turning off lights when not in use*
- *Energy efficient light bulbs*
- *Programmable thermostats*
- *Water Usage*
- *Waste recycling*

Sustainability Awards

SRS was recognized in 2012 with three national “DOE Sustainability Awards.”

- The Ameresco Biomass Cogeneration project utilized the nation’s largest Energy Savings Performance Contract (ESPC) to design, build, and operate three energy-efficient, biomass-fueled, renewable energy steam/cogeneration plants at SRS. Cost savings are projected to be approximately \$34 million with GHG emissions reduced by 100,000 tons per year.
- SRS developed an innovative approach for the identification of elemental mercury in sediments and soils beneath former industrial facilities. The process uses commercial equipment developed for subsurface detection of volatile organic contaminants, expanding its application for use in the definitive detection of elemental mercury.
- SRS successfully developed a process to degrade a chlorinated solvent groundwater plume with edible oil injection. This project has enhanced attenuation (EA) of the plume and received regulatory support to achieve a final shutdown of an active pump and treat system.

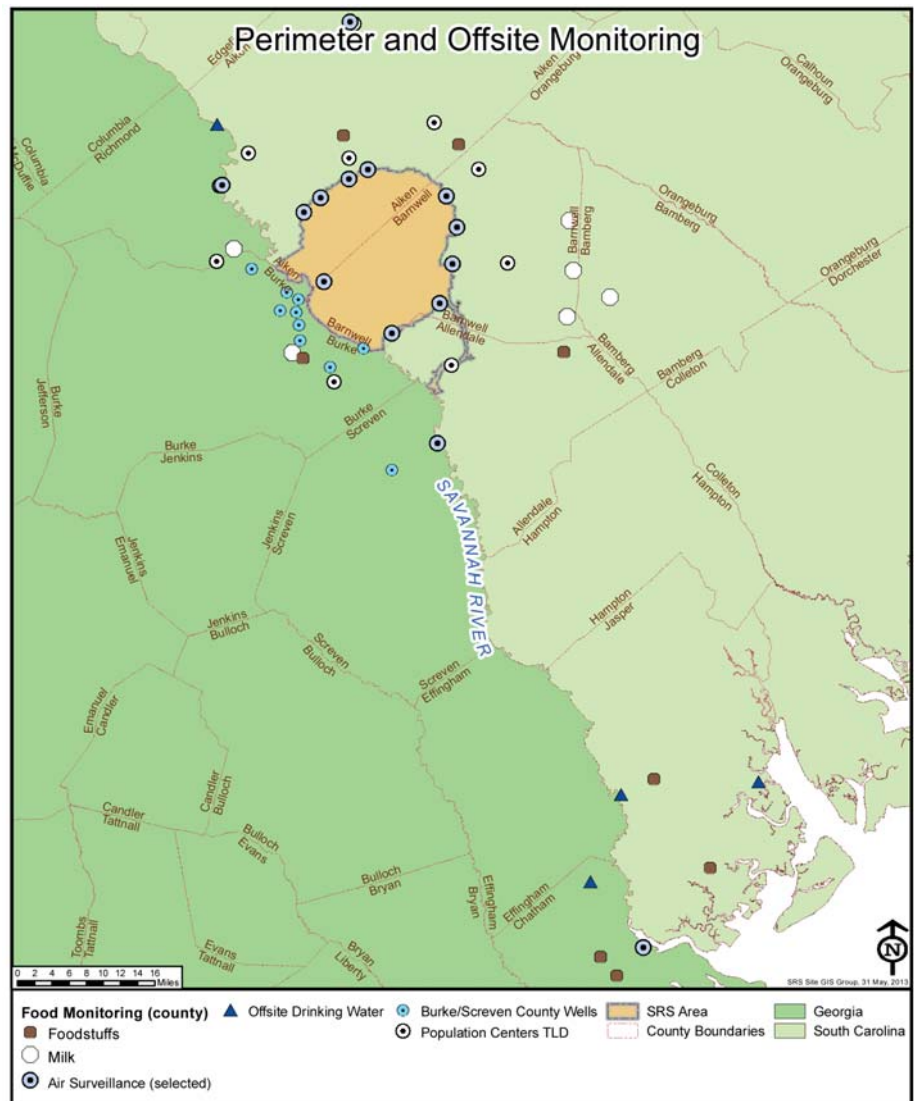


SRS Environmental Monitoring Program

Releases to the environment of radioactive and nonradioactive materials come from past SRS operations and potentially from ongoing Site operations. SRS closely monitors these discharges to verify they are maintained within authorized limits established in Site operating permits, environmental regulations, and DOE orders.

Offsite Georgia & South Carolina Environmental Monitoring

SRS collects environmental monitoring samples beyond the SRS perimeter in Georgia (GA) and South Carolina (SC) at designated sampling points, which are representative of the distribution of radionuclide liquid and airborne pathways into the environment. Environmental monitoring is also performed offsite in SC and GA to assess exposures to the public from SRS operations involving radioactive and nonradioactive material and to monitor any effects of SRS operations on the environment. The monitoring involves collecting and analyzing samples of air, river water, soil, sediment, vegetation, milk, food products, fish, and other media from many locations 25 miles from SRS and from some locations as far as 100 miles from SRS.



2012 Offsite Sample Collection		
	Samples	Locations
Georgia	477	38
South Carolina	319	24

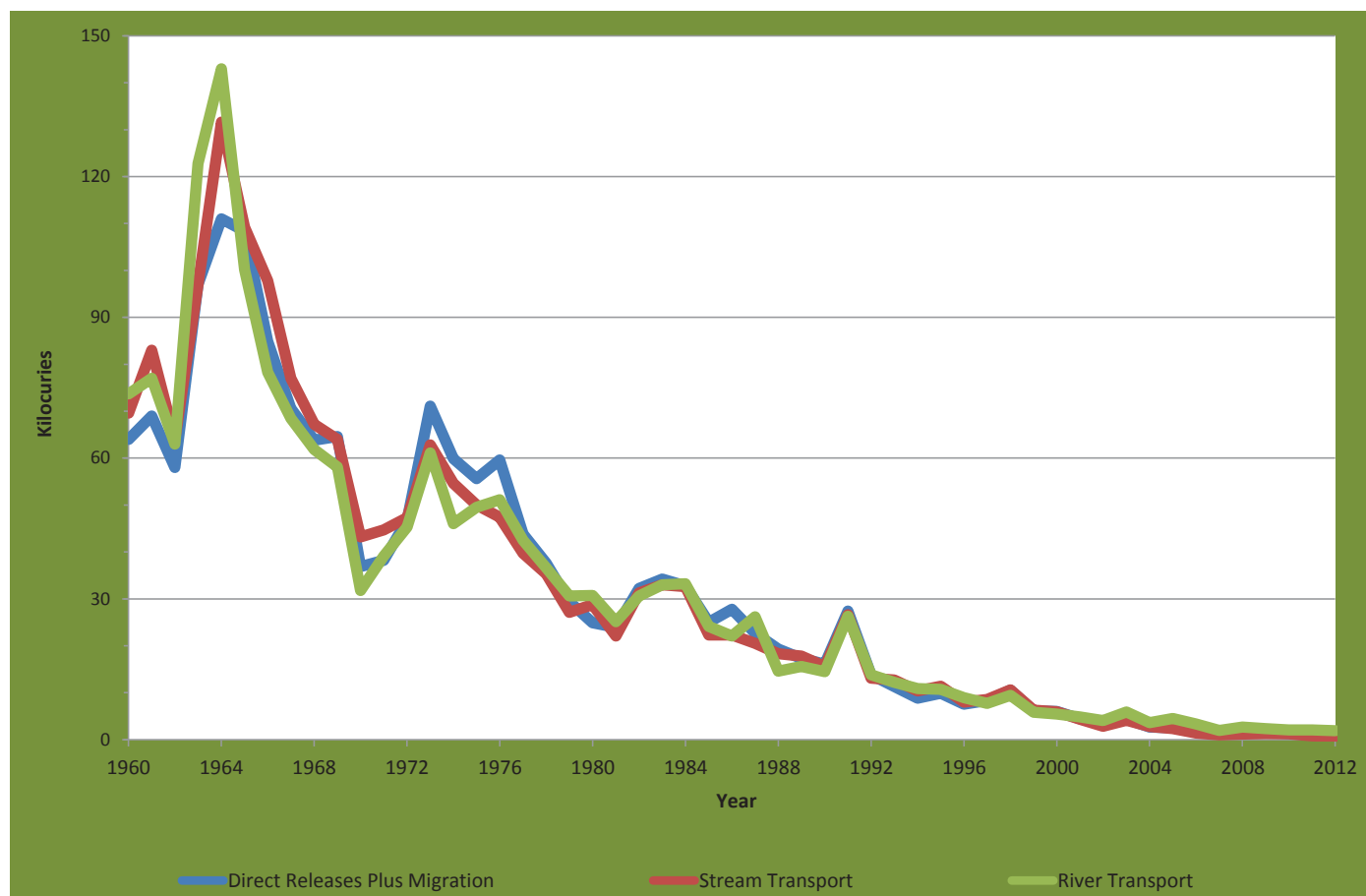
Radiological Monitoring

SRS collects and analyzes thousands of samples annually to determine the presence of radiological contaminants from Site operations. Samples are taken at the points where materials are released from the facilities (air at stacks and water at outfalls), and in the environment (air, rainwater, Site streams, the Savannah River, drinking water, meat, fruit, green vegetables, milk, fish, wildlife, soil, sediment, grassy vegetation, and groundwater). The analytical data are used to determine the level of exposure of the public to SRS contaminants, both at the SRS and beyond its boundary.



**Field Technician Takes Readings
at an Air Surveillance Station**

Tritium (a radioactive form of hydrogen) is the radionuclide of greatest abundance in SRS releases. Overall, the Site has reduced tritium releases to the lowest levels since its early operations. The maximum annual tritium release of 2.4 million curies (Ci) occurred during 1958. In 2012, 16,796 Ci of tritium were released to the atmosphere and Site streams (16,700 Ci to the atmosphere and 96 Ci to Site streams), and 650 Ci migrated from seepage basins and disposal facilities.



SRS Tritium Transport 1960 - 2012

MONITORING RELEASES TO THE ENVIRONMENT

Summary of SRS Radiological Environmental Monitoring Activities and Results for 2012

	What Was Monitored?	Results Summary	Area(s) Monitored
Air	SRS radiological air effluent sources are monitored in accordance with the 40 CFR 61 Subpart H (National Emission Standards for Hazardous Air Pollutants (NESHAP). The SRS NESHAP program was established using the four tiers Potential Impact Categories provided in the American National Standards Institute N13.1-1999. The frequency of sampling under this program is based on potential to release. Two sources at SRS are required to be sampled continuously. SRS conducted atmospheric air and rainwater monitoring at 15 locations on and offsite. Wet and dry deposits from rainfall are collected from 7 of the 15 locations. The sampling stations are in the center of the Site, in a ring around the Site on the perimeter, and in population centers at 25 and 100 miles from SRS. Ambient environmental gamma exposure rates are measured using thermoluminescent dosimeters (TLDs) at locations onsite and offsite to determine any impact SRS operations might have on the gamma exposure in the environment and to evaluate trends in environmental exposure levels. Other uses include support of routine and emergency-response dose calculations.	Emissions for 2012 were well below the amounts that would cause any member of the public to receive a total effective dose of 10 millirem per year (mrem/yr). More than 65 percent of the total radioactivity released to the atmosphere from SRS operations in 2012 is attributed to tritium. SRS released about 16,700 curies (Ci) of tritium in 2012, compared with approximately 28,100 Ci in 2011. The reduction in tritium releases in 2012 is primarily due to the relocation of the helium-3 recovery process from a 1966-vintage facility into a more modern and efficient facility. All measurements of radioactive material in air and rainwater around SRS and offsite were below DOE standards. In 2012, ambient gamma exposure rates varied between 61.6 mrem/yr and 118 mrem/yr.	SRS SC GA
Soil	SRS collected soil samples from 21 sampling locations (five onsite, 12 at the perimeter, and four offsite) to perform long term trending of radioactive material in the environment.	In 2012, radionuclides detected in the soil samples from all locations are consistent with historical trends. No soil concentrations at the SRS perimeter or offsite exceeded the limit for SRS Soil Contamination Area posting of 150 picocuries per gram (pCi/g) total beta.	SRS SC GA
Food Products	The terrestrial food products surveillance program consists of radiological analyses of food product samples typically found in the CSRA. Samples of milk, beef, fruit, and vegetables were collected from 14 locations surrounding SRS.	Results for tritium in fruit and beef, uranium-234 in greens and soybeans, and uranium-238 in soybeans showed concentrations at a five-year high. Review of the results of the sampling of SRS air sources indicates no abnormal trends. Uranium-234 and uranium-238 are naturally occurring isotopes in soil and are not necessarily from SRS operations.	SC GA

MONITORING RELEASES TO THE ENVIRONMENT

Summary of SRS Radiological Environmental Monitoring Activities and Results for 2012 (Continued)

	What Was Monitored?	Results Summary	Area(s) Monitored
Water	SRS has designed the radiological liquid effluent monitoring program to directly monitor effluents and/or collect and analyze samples from all site process outfalls that have the potential to release contaminants. The monitoring of radioactive liquid effluents is performed at the point of discharge and prior to dilution in the receiving surface waters. SRS continuously monitors surface water downstream of several process areas to detect and quantify levels of radioactivity transported to the Savannah River by effluents and shallow groundwater migration into Site streams. Site streams that flow into the Savannah River are sampled three times per week for tritium to provide notification of tritium concentrations to downstream users of Savannah River water. Trigger levels are set at each stream location for advanced notification of administrative control level exceedances at River Mile 118.8 (U.S. Highway 301 Georgia Welcome Center). In addition, the River Mile 118.8 is sampled once per week to report any conditions that exceed the downstream water consumers administrative control level of 5,000 pCi/L. SRS personnel collected drinking water samples from 13 locations at SRS and at four water treatment facilities that use Savannah River water.	Results from the outfall monitoring shows tritium as the dominant radionuclide released from the site processes. Tritium along with other radionuclides released has been trending down and offers a limited contribution to offsite dose. Sample results from the Site streams identified tritium present above background at levels consistent with historical releases in all Site streams. Other radionuclides were detected in some of the samples; however, these were at levels below EPA standards, consistent with previous years' monitoring data. Tritium also was monitored in 2012 to quantify migration from onsite seepage basins at waste disposal facilities. Migration releases have declined over the past 10 years, from more than 2,000 Ci in 2002 to 650 Ci in 2012. SRS reports tritium concentrations to downstream water users weekly. All results were well below each stream trigger level and the 5,000 picocuries per liter (pCi/L) administrative control level at River Mile 118.8. No drinking water exceeded EPA's 15 pCi/L alpha activity limit, 50 pCi/L beta activity limit, 20,000 pCi/L EPA tritium limit or the 8 pCi/L strontium-89, 90 maximum contaminant level (MCL).	SRS SC GA
Sediment	Sediment samples were collected at eight Savannah River locations and 21 onsite stream and basin locations. Radiological monitoring of sediment measures the movement, deposition, and accumulation of long-lived radionuclides in streambeds and in the Savannah River bed.	Cesium-137, plutonium-238, plutonium-239, americium-241, strontium-89, strontium-90, uranium-234, uranium-235, and uranium-238 were observed in river and stream sediment samples during 2012. Differences observed when these data are compared to those of previous years are most likely attributable to the effects of resuspension and deposition in the natural streambed environment.	SRS SC GA

MONITORING RELEASES TO THE ENVIRONMENT

Summary of SRS Radiological Environmental Monitoring Activities and Results for 2012 (Continued)

	What Was Monitored?	Results Summary	Area(s) Monitored
Groundwater	SRS conducts extensive onsite and specific GA groundwater monitoring to ensure that contamination is not transported from the Site by groundwater flow. A network of hundreds of onsite monitoring wells is used to monitor waste sites, operating facilities, and Site boundaries.	Monitoring well data show that contaminated groundwater from the Site has not migrated offsite. Of the 39 samples collected in 2012 in GA, 37 had non-detectable results for tritium. Tritium was detected in two samples, in both cases below 1 pCi/mL, which is below the MCL of 20 picocuries per milliliter (pCi/mL) for tritium.	SRS GA
Fish and Shellfish	SRS monitors a variety of fish (freshwater and saltwater) and shellfish from the Savannah River and surrounding freshwater bodies to evaluate radionuclide concentrations.	Results of fish analyses, in general, are consistent with historical trends. The exception is cesium-137 in bass at the mouth of Four-mile Branch. In 2012, SRS collected and analyzed 468 fish from 11 locations including Site streams, the Savannah River, and the Edisto River. Average and maximum concentrations of cesium-137 for both panfish and catfish are within historical trends. Cesium-137 was detected above the Minimal Detectable Concentration (MDC) in 31 percent of the freshwater fish composites. Cesium-137 concentrations for bass at the mouth of Fourmile Branch are greater than results for the previous four years. This may be a result of increased cesium-137 migration into Fourmile Branch.	SRS SC GA
Wildlife	Field monitoring of onsite deer, feral hogs, turkey, and coyotes was performed during Site sponsored controlled hunts. Deer and hog samples (bone and tissue) were also collected during the hunts for radiological testing.	Radiological results from wildlife monitoring were consistent with those of previous years. Cesium-137 was measured in the field with an average of 0.88 pCi/g. This contributes minimally to the administrative dose for the consumption of game animals, which SRS has established at 22 mrem/year.	SRS
Vegetation	Grassy vegetation samples were collected from 17 locations (one onsite, 12 at the perimeter, and four offsite). Those locations are monitored for trends in radionuclide mobility and uptake by plants.	SRS detected radionuclides in the grassy vegetation samples collected during 2012 in all 17 locations. No levels were detectable for neptunium-237, plutonium-238, plutonium-239, americium-241, curium-244, or uranium-235. Average tritium results show a slight increase from 2011 to 2012 with levels ranging from below the MDC to 2.12 (+/- 0.03) pCi/g at the onsite location. Results for the other radionuclides are within the statistical trends of the previous five years.	SRS SC GA

Nonradiological Monitoring

Air Monitoring

The release of air pollutants is regulated at SRS under two Clean Air Act (CAA) operating permits. In compliance with these permits, SRS released an estimated 1,684 tons of criteria air pollutants in 2012. The majority of the emissions were sulfur dioxide and nitrogen oxides. The total air emissions of lead, also a criteria pollutant, were 0.00064 tons. No emission limits for any air pollutants were exceeded in 2012.

As part of a stratospheric ozone protection program, SRS is phasing out its use of halon and closely monitoring air conditioning/chiller systems to minimize Freon releases. Both products are ozone-depleting substances. Incidental discharges from refrigerant sources at SRS during 2012 totaled 11,119 pounds.

Estimated Quantity of Pollutants Released into the Air from SRS Operations in 2012*	
Criteria Air Pollutants	Tons
Particulate Matter (<10 microns)	18
Carbon monoxide	52
Nitrogen oxides	621
Sulfur dioxide	953
Volatile organic compounds	40
Lead	0.00064
*No emissions limits were exceeded in 2012	

Water Monitoring

Releases of storm water, industrial wastewater, utility water, and sanitary wastewater to Site ponds and streams are regulated at SRS under a series of discharge permits. Discharge limits established in these permits ensure that water quality is not adversely impacted. SRS performs routine monitoring to ensure that discharges are within established limits.

In 2012, SRS discharged water into SRS streams under five NPDES permits. The SRS NPDES industrial wastewater program maintained a 99.89% compliance rate. SRS received one Notice of Violation from SCDHEC for exceedance of copper limits at one outfall. SRS voluntarily implemented extensive corrective actions to address the violation, and SCDHEC did not assess any fines. SRS monitored all NPDES industrial stormwater outfalls per the requirements of the permit with no exceedances. Stormwater runoff from construction activities and general utility water sampling was not required in 2012.

MONITORING RELEASES TO THE ENVIRONMENT

SRS water treatment plants in A Area and D Area supply most of the drinking water at SRS. SRS also has 14 small drinking water facilities, each of which serves populations of fewer than 25 people. All samples collected from these systems in 2012 complied with SCDHEC and EPA nonradiological water quality standards.

SRS monitors the Savannah River and Site streams for nonradiological contaminants. Samples collected in 2012 demonstrate that the classifications specified by SCDHEC for water use were met.

Sediment sampling is conducted onsite to quantify the accumulation of nonradiological contaminants in stream systems. No pesticides or herbicides were found in 2012 sediment samples; this is consistent with results from the previous five years. No mercury was detected at any of the locations during 2012. Metals analysis showed some metals with levels greater than the Practical Quantitation Limit for 2012 but were consistent with those seen in soil samples and comparable to those of the previous five years.



Fish Sample Collection on Savannah River

Fish

SRS monitors fish from the Savannah River and surrounding freshwater bodies for metals. Beginning in 2009, there is a decreasing trend in mercury at most locations. The mercury results for fish are within or below the levels for SCDHEC issued fish species advisories for the Savannah River and Edisto River.

Additional monitoring information can be found in Chapter 4 “Effluent Monitoring,” Chapter 5 “Environmental Surveillance,” Chapter 7 “Groundwater,” and Chapter 9 “Special Studies,” of the *Savannah River Site Environmental Report for 2012*.

SCDHEC Environmental Surveillance Oversight Program

Through a grant with DOE-SR, SCDHEC has established the Environmental Surveillance Oversight Program (ESOP). The activities of the ESOP are designed to provide the public with an independent source of information on the effectiveness of the DOE-SR’s monitoring activities. To accomplish this, ESOP collects data through an independent monitoring network around the Site. Additional information on this program can be found on the SCDHEC website at <http://www.scdhec.gov/environment/behs/ESOP>.

What is a Dose?

Dose is the amount of energy absorbed by the human body as a result of a radioactive source; it is measured in rem or mrem (millirem), which is one-thousandth of a rem, and is the unit typically used in this report.

Humans, plants, and animals potentially receive radiation doses from natural and man-made occurrences. The average annual total effective “background” dose for Americans is 625 mrem; this includes an average “natural” background dose of 311 mrem from naturally occurring radionuclides found in our bodies and in the earth, and from cosmic radiation. It also includes 300 mrem from medical procedures, 13 mrem from consumer products, and less than 1 mrem from industrial and occupational exposures.

DOE has established dose limits to the public so that DOE operations will not contribute significantly to this average annual exposure.

Dose estimates are performed using 1) effluent release data, 2) environmental surveillance data, 3) assumed exposure conditions that tend to conservatively estimate the calculated total effective doses, and 4) environmental transport and dosimetry codes that calculate the potential doses.

Public Dose Limits for SRS Operations

10 mrem/yr – the dose limit to the public (above natural background) from the air transport pathway, as specified by the National Emissions Standards for Hazardous Air Pollutants.

100 mrem/yr – the dose to the public (above natural background) from all pathways combined, as specified by DOE Order 458.1, “Radiation Protection of the Public and the Environment.”

Forms of Ionizing Radiation

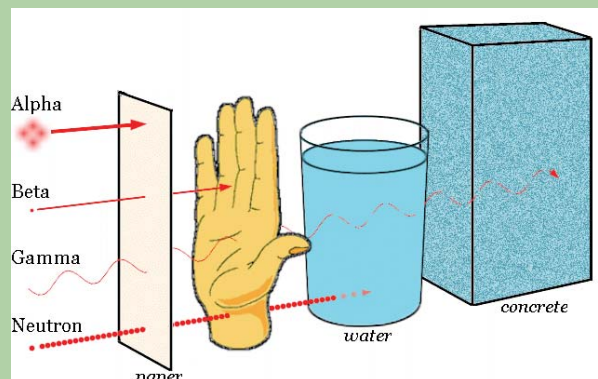
Alpha particles are heavy, positively charged particles given off by some decaying atoms. Alpha particles can be blocked by a sheet of paper or skin. Atoms emitting alpha particles are hazardous only if swallowed or inhaled, or enter the body through an open wound.

Beta particles are electrons or positrons (positively charged electrons) ejected from the nucleus of a decaying atom. More penetrating than alpha, beta particles can pass through several millimeters of skin. A sheet of aluminum only a fraction of an inch thick will also stop beta radiation. Beta particles can damage skin but are most hazardous if the beta-emitting atoms are swallowed or inhaled.

Gamma rays are waves of pure energy similar to X-rays, light, microwaves, and radio waves. Gamma rays are emitted by certain radionuclides when their nuclei transition from a higher to a lower energy state and can readily pass into the human body. Gamma rays can be almost completely blocked by about 40 inches of concrete, 40 feet of water, or a few inches of lead. Gamma rays can be both an external and internal hazard.

X-rays are a more familiar form of electromagnetic radiation, usually with a limited penetrating power, typically used in medical or dental examinations. Television sets give off soft (low-energy) X-rays; thus, shielding is provided to reduce the risk of radiation exposure.

Neutrons are uncharged heavy particles contained in the nucleus of every atom heavier than an ordinary hydrogen atom. They induce ionization only indirectly in atoms that they strike. Neutrons readily pass through most material but interact enough to cause biological damage. Neutrons are released, for example, during the fission (splitting) of uranium atoms in the fuel of nuclear power plants. In general, materials containing hydrogen, such as water or concrete, can provide efficient shielding against neutrons. Like gamma rays, neutrons are both an external and internal hazard.

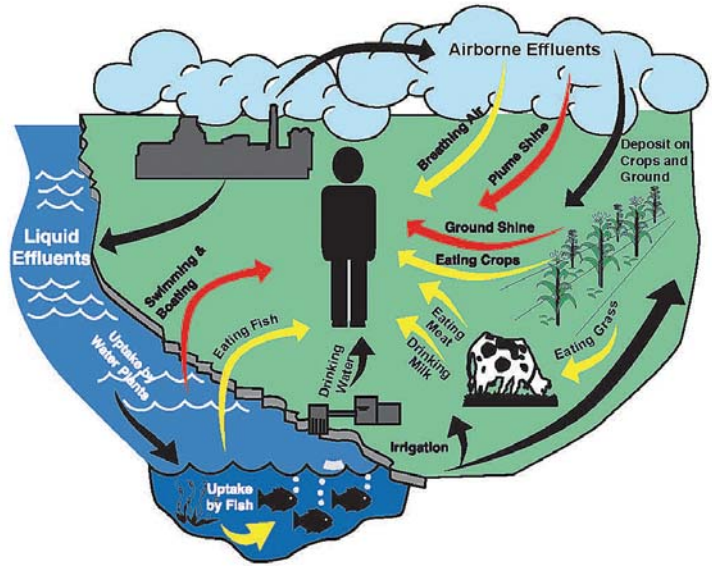


ESTIMATED DOSE TO THE PUBLIC FROM SRS OPERATIONS

To monitor the dose the public is exposed to, SRS calculates the dose to the representative person.

DOE Order 458.1 states that compliance with the DOE annual dose limit of 100 mrem to a member of the public may be demonstrated by calculating dose to the maximally exposed individual (MEI) or to a representative person. Historically, the MEI concept was used for dose compliance at SRS using adult dose coefficients and adult male usage parameters. Beginning in 2012, SRS now uses the representative person concept for dose compliance.

The representative person hypothetically lived at the SRS boundary; consumed milk, meat, and vegetables produced at that location; consumed water and fish from the Savannah River; and spent time on or near the river every day. The total dose to this individual from SRS liquid and airborne releases was estimated at 0.26 mrem. It is well below the dose limit of 100 mrem/yr established by DOE Order 458.1 for radiation exposure to the public from all pathways combined. This total dose estimate is indistinguishable from natural background radiation experienced by the public residing in communities near SRS, and is even further below the annual average radiation dose for Americans of 625 mrem. Chapter 6 “Radiological Dose Assessments” of the *Savannah River Site Environmental Report for 2012* provides additional details.

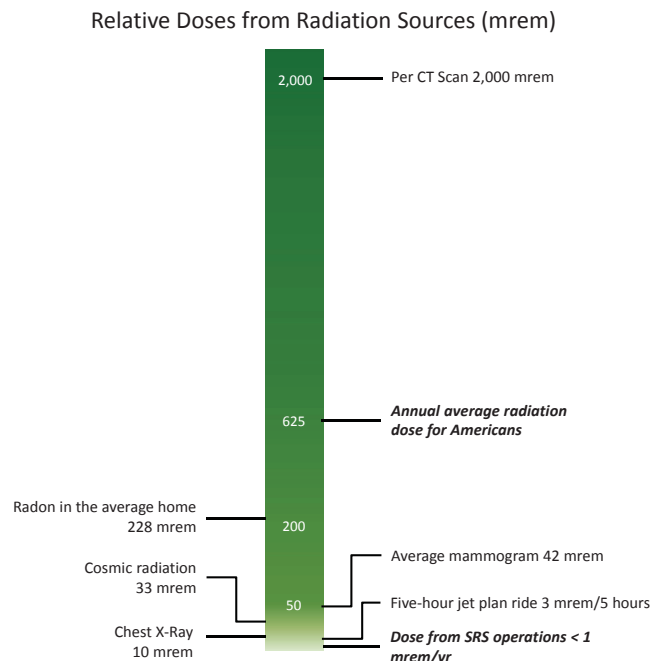


Potential Pathways of Exposure to the Representative Person

What is a Representative Person?

An individual receiving a dose that is representative of the more highly exposed individuals in the population.

The representative person dose is based on reference person usage parameters (at the 95th percentile of national and regional data) developed specifically for SRS. The reference person is a sex and age weighted-average hypothetical person.



Report Available on the Web

Readers can find the SRS Environmental Report Summary for 2012 on the World Wide Web at the following address:

<http://www.srs.gov/general/pubs/ERsum/index.html>

For more information about this report, or to obtain additional copies, contact:

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Can SRS Make This Report More Useful to You?

SRS wants to make the *Savannah River Site Environmental Report* more useful to its readers. Please take a few minutes to let us know if the report meets your needs. Then fold and tape this page so the postage-paid notation and the mailing address are visible, and place it in the mail.

1. How do you use the *Savannah River Site Environmental Report*?

- ☐ to learn general information about the Savannah River Site
- ☐ to learn about doses received for the current year
- ☐ to learn about site compliance information
- ☐ to gather effluent data
- ☐ to gather environmental surveillance data
- ☐ other _____

2. What part(s) of this report do you use?

- ☐ main report
- ☐ data tables
- ☐ summary

3. Does the *Savannah River Site Environmental Report* contain:

- ☐ enough detail?
- ☐ too much detail? For example, _____
- ☐ too little detail? For example, _____

4. Is this report

- ☐ too technical?
- ☐ about right technically?
- ☐ not technical enough?

5. If you could change this report to make it more readable and useful to you, what would you change?

6. What is your affiliation?

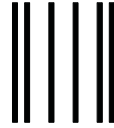
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7. To help us identify our audience, please indicate your educational background.

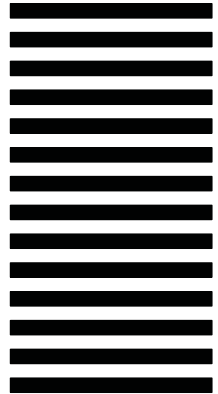
- ☐ graduate degree in scientific field
- ☐ graduate degree in nonscientific field
- ☐ undergraduate degree in scientific field
- ☐ undergraduate degree in nonscientific field
- ☐ experience with science outside college setting
- ☐ little or no scientific background

If you are interested in attending a workshop to critique the 2012 report, please provide your name, address, and telephone number.

For more information, please call Amy Meyer, at (803) 952-8660, or send an e-mail message to Amy.meyer@srs.gov.



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