WSRC–TR–97–0171

Savannah River Site Environmental Report for 1996

Environmental Monitoring Section
Environmental Protection Department

Westinghouse Savannah River Company
Savannah River Site
Aiken, SC 29808

Front Cover—*Nelumbo lutea*, the water lotus, is a coastal plain wetlands plant found in South Carolina and other Southeastern states. A member of one of the oldest groups of flowering plants on earth, the water lotus produces hard, durable seeds that remain dormant until their outer coats are worn away and that provide excellent food for waterfowl. The seed pods often are used in ornamental displays, such as dried floral arrangements. At the Savannah River Site, the plants have been thriving along the shores of PAR Pond (where the cover photograph was made) since at least the mid-1960s. Savannah River Ecology Laboratory personnel in 1987 transplanted 25 of the plants to L-Lake, where they since have spread to cover approximately 20 acres along the shoreline. The photograph was taken by Al Mamatey of the Westinghouse Savannah River Company's Environmental Monitoring Section. The cover was designed by Eleanor Justice of the company's Multimedia/Network Publishing group.

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Savannah River Site
Environmental Report for 1996

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Westinghouse Savannah River Company
Savannah River Site, Aiken, SC 29808

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Preface

The Savannah River Site (SRS) conducts effluent monitoring and environmental surveillance to ensure the safety of the public and the well-being of the environment. U.S. Department of Energy (DOE) Order 5400.1, "General Environmental Protection Program," requires that SRS submit an environmental report documenting the impact of facility operations on public health and on the environment. The report's purpose is to present summary environmental data that characterize site environmental management performance, confirm compliance with environmental standards and requirements, and highlight significant programs and efforts.

SRS has had an extensive environmental surveillance program in place since 1951 (before site startup). At that time, data generated by the onsite surveillance program were reported in site documents. Beginning in 1959, data from offsite environmental monitoring activities were presented in reports issued for public dissemination. SRS reported onsite and offsite environmental monitoring activities separately until 1985, when data from both surveillance programs were merged into one public document.

The *Savannah River Site Environmental Report for 1996* is an overview of effluent monitoring and environmental surveillance activities conducted on and in the vicinity of SRS from January 1 through December 31, 1996. It is prepared by the Environmental Monitoring Section (EMS) of Westinghouse Savannah River Company (WSRC). The "SRS Environmental Monitoring Plan" (WSRC–3Q1–2–1000) and the "SRS Environmental Monitoring Program" (WSRC–3Q1–2–1100) provide complete program descriptions and document the rationale and design criteria for the monitoring program, the frequency of monitoring and analysis, the specific analytical and sampling procedures, and the quality assurance requirements.

Variations in the environmental report's data content from year to year reflect changes in the routine program or difficulties encountered in obtaining or analyzing some samples. Examples of such problems include adverse environmental conditions (such as flooding or drought), sampling or analytical equipment malfunctions, and compromise of the samples in the preparation laboratories or counting room.

Unless otherwise indicated, the figures and tables in this report are generated using results from the regular monitoring program. No attempt has been made to include all data from environmental research programs. A more complete listing of data can be found in *Savannah River Site Environmental Data for 1996* (WSRC–TR–97–0077).

The following information should aid the reader in interpreting data in this report:

- Analytical results and their corresponding uncertainty terms generally are reported with up to three significant figures. The last significant figure of a result is determined by the quantification of the uncertainty term. EMS attempts to report the appropriate confidence in the result with the correct number of significant figures.
- The reported uncertainty of a single measurement reflects only the counting error—not other components of random and systematic error in the measurement process—so some results may imply a greater confidence than the determination would suggest.
- An uncertainty quoted with means represents the standard deviation of measurements about the mean value. This number is calculated from the results themselves and is not weighted by the uncertainties of the individual results.
- All values represent the weighted average of all acceptable analyses of a sample for a particular analyte. Samples may have undergone multiple analyses for quality assurance purposes or to determine if radionuclides are present. Concentrations may be below the minimum detectable activity of an analysis, in which case they are presented to satisfy DOE reporting requirements.
- The generic term "dose," as used in the report, refers to the committed effective dose equivalent (50-year committed dose) from internal deposition of radionuclides and to the effective dose equivalent attributable to penetrating radiation from sources external to the body.

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Acronyms and Abbreviations

A

ALARA – As low as reasonably achievable

ANSP – Academy of Natural Sciences of Philadelphia

B

BTU – British thermal unit

BSRI – Bechtel Savannah River, Inc.

C

CAA – Clean Air Act

CAAA – Clean Air Act Amendments of 1990

CAB – Citizens Advisory Board

CDC –Centers for Disease Control and Prevention

CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)

CFC – Chlorofluorocarbon

CFR – Code of Federal Regulations

CIF – Consolidated Incineration Facility

CMP – Chemicals, metals, and pesticides

CSRA – Central Savannah River Area

CSWTF – Central Sanitary Wastewater Treatment Facility

CWA – Clean Water Act

CX – Categorical exclusion

D

D&D – Decontamination and decommissioning

DCG – Derived concentration guide

DNC – Department National Environmental Policy Act Coordinator

DOE – U.S. Department of Energy

DOE–HQ – U.S. Department of Energy-Headquarters

DOE–SR – U.S. Department of Energy-Savannah River Operations Office

DWPF – Defense Waste Processing Facility

DWS – Drinking water standards

E

EA – Environmental Assessment

ECD – Environmental Compliance Division of the U.S. Department of Energy-Savannah River Operations Office

EIS – Environmental Impact Statement

EMCAP – Environmental Monitoring Computer Automation Project

EMS – Environmental Monitoring Section of the Environmental Protection Department (of Westinghouse Savannah River Company)

EPA – U.S. Environmental Protection Agency

EPCRA – Emergency Planning and Community Right-to-Know Act

EPD – Environmental Protection Department (of Westinghouse Savannah River Company)

ERDA – Education, Research and Development Association of Georgia Universities

ETF – Effluent Treatment Facility

F

FAC – Forced activity concentrations

FDA – U.S. Food and Drug Administration

FFA – Federal Facility Agreement

FFCA – Federal Facility Compliance Agreement

FFCAct – Federal Facility Compliance Act

FONSI – Finding of No Significant Impact

G

GDNR – Georgia Department of Natural Resources

GOCO – Government-owned, contractor-operated

H

HBFC – Hydrobromofluorocarbon

HCFC – Hydrochlorofluorocarbon

HVAC – Heating, ventilation, and air conditioning

I

ICRP – International Commission on Radiological Protection

ITP – In-Tank Precipitation Facility

L

LDR – Land disposal restrictions

LETF – Liquid Effluent Treatment Facility

LLD – Lower limit of detection

LLRWDF – Low-Level Radioactive Waste Disposal Facility

M

MAP – Mitigation Action Plan

MDA – Minimum detectable activity

MDL – Minimum detectable limit

MRD – Mean relative difference

MWMF – Mixed Waste Management Facility

N

NASA – National Aeronautics and Space Administration

NCRP – National Council on Radiation Protection and Measurements

NEPA – National Environmental Policy Act

NESHAP – National Emission Standards for Hazardous Air Pollutants

NOV – Notice of Violation

NPDES – National Pollutant Discharge Elimination System

NRC – U.S. Nuclear Regulatory Commission

O

ODS – Ozone-depleting substances

P

PAR Pond – Pond constructed at Savannah River Site in 1958 to provide cooling water for P-Reactor and R-Reactor (P and R; hence, PAR)

PCB – Polychlorinated biphenyl

PEIS – Programmatic Environmental Impact Statement

pH – Measure of the hydrogen ion concentration in an aqueous solution (acidic solutions, pH from 0–6; basic solutions, pH > 7; and neutral solutions, pH = 7

PVC – Polyvinyl chloride

Q

QA – Quality assurance

QAD – Quality Assurance Division (Environmental Protection Agency)

QAP – Quality Assurance Program (Department of Energy)

QA/QC – Quality assurance/quality control

QC – Quality control (in environmental monitoring, the routine application of procedures to obtain the required standards of performance in monitoring and measurement processes)

R

RBOF – Receiving Basin for Offsite Fuel

RCO – Radiological Control Operations

RCRA – Resource Conservation and Recovery Act

RFI/RI – RCRA Facility Investigation/Remedial Investigation

ROD – Record of Decision

RQ – Reportable quantity

RTF – Replacement Tritium Facility

S

SARA – Superfund Amendments and Reauthorization Act

SCDHEC – South Carolina Department of Health and Environmental Control

SCUREF – South Carolina Universities Research and Education Foundation

SDWA – Safe Drinking Water Act

SEA – Special Environmental Analysis

SEIS – Supplemental Environmental Impact Statement

SIRIM – Site Item Reportability and Issues Management

SRARP – Savannah River Archaeological Research Program

SREL – Savannah River Ecology Laboratory (University of Georgia)

SRFS – Savannah River Forest Station (U.S. Department of Agriculture Forest Service)

SRP – Savannah River Plant

SRS – Savannah River Site

SRTC – Savannah River Technology Center

SVEU – Soil Vapor Extraction Unit

SWDF – Solid Waste Disposal Facility

T

TLD – Thermoluminescent dosimeter

TRAC – Tracking Radioactive Atmospheric Contaminants

TRI – Toxic Release Inventory

TSCA – Toxic Substances Control Act

U

USGS – U.S. Geological Survey

UV – Ultraviolet

W

WIND – Weather Information and Display

WSI – Wackenhut Services Inc.

WSRC – Westinghouse Savannah River Company

Sampling Location Abbreviations

Abbreviation	Location Name/Other Applicable Information
4M	Four Mile
4MC	Four Mile Creek
681–5G	Georgia Department of Natural Resources and Environmental Monitoring Section sampling location
BDC	Beaver Dam Creek
BG	Burial Ground
FM	Four Mile
FMC	Four Mile Creek (Fourmile Branch)
HP	HP (sampling location designation only; not an actual abbreviation)
IBG	Indian Burial Ground
IGB	Indian Grave Branch
L3R	Lower Three Runs
LTR	Lower Three Runs
PB	Pen Branch
PMR	Patterson Mill Road
RM	River Mile
SC	Steel Creek
TB	Tims Branch
TCR	Tabernacle Church Road
TNX	Multipurpose Pilot Plant Campus
U3R	Upper Three Runs
UTR	Upper Three Runs

Sample Locations Known By More Than One Abbreviation
Beaver Dam Creek; 400–D
Four Mile Creek–6; FM–6; 4MC–6; Four Mile Creek at Leigh Road
Four Mile Creek at Road A7; FM–A7; 4M–A7
Lower Three Runs–2; L3R–2; L3R Creek and Patterson Mill
River Mile 120; RM–120; River 10; R–10
River Mile 140; RM–140; R–8A
River Mile 160; RM–160; River 2; R–2
Steel Creek–4; SC–4; Steel Creek–4 at Road A; SC and Highway 125
Tinker Creek at Kennedy Pond; TC/KP; TC–1
Upper Three Runs–4 at Road A; U3R–4; U3R–Rd A
Vogtle Discharge; River 3B; R–3B

Executive Summary

THE mission at the Savannah River Site (SRS) has changed from the production of nuclear weapons materials for national defense to the management of site-generated waste, restoration of the surrounding environment, and the development of industry in and around the site. However, SRS—through its prime operating contractor, Westinghouse Savannah River Company (WSRC)—continues to maintain a comprehensive environmental monitoring program.

In 1996, effluent monitoring and environmental surveillance were conducted within a 31,000-square-mile area in and around SRS that includes neighboring cities, towns, and counties in Georgia and South Carolina and extends up to 100 miles from the site. Though the environmental monitoring program was streamlined in 1996—to improve its cost-effectiveness without compromising data quality or reducing its overall ability to produce critical information—thousands of samples of air, surface water, groundwater, food products, drinking water, wildlife, rainwater, soil, sediment, and vegetation were collected and analyzed for radioactive and nonradioactive contaminants.

Potential Radiation Doses

Table 1 shows the 1996 potential radiation doses from SRS releases compared with the applicable federal dose standards and with estimated doses from naturally occurring background radiation. Materials released from SRS reach the environment and people in a variety of ways. The routes that materials follow to get from an SRS facility to the environment and then to people are called exposure pathways. All potential radiation doses attributed to SRS in 1996 were below applicable regulatory standards.

Potential Liquid Pathway Dose

The potential dose to the maximally exposed individual from liquid releases of radioactivity to the Savannah River was estimated to be 0.14 mrem (0.0014 mSv), which was the same as the 1995 maximum potential dose. The dose remained the same—even though the amount of tritium oxide released from SRS during 1996 was about 21 percent less than during 1995 (8,950 Ci in 1996 versus 11,400 Ci in 1995)—because of decreased dilution in the Savannah River due to a 10-percent increase in river flow during 1996.

Approximately 43 percent of this potential dose resulted from the ingestion of cesium-137 in Savannah River fish, and about 41 percent resulted from the ingestion (via drinking river water) of tritium oxide.

The 1996 collective dose from liquid releases was estimated to be 2.2 person-rem (0.022 person-Sv).

Potential Drinking Water Pathway Dose

Offsite doses were calculated for persons consuming drinking water from two water treatment plants located downriver of SRS near Beaufort, South Carolina, and Port Wentworth, Georgia. The maximum doses were 0.06 mrem (0.0006 mSv) at Beaufort and at Port Wentworth. These doses are 1.5 percent of the drinking water standard of 4 mrem per year (0.04 mSv per year). Tritium oxide in the drinking water represents about 74 percent of the dose.

Potential Airborne Pathway Dose

For 1996, the potential dose to the maximally exposed individual from airborne releases of radioactive materials was 0.05 mrem (0.0005 mSv). This dose is 0.5 percent of the 10-mrem per year (0.1-mSv per year) limit for exposure to airborne releases from a U.S. Department of Energy (DOE) facility. The 1996 dose was approximately 17 percent lower than the 1995 dose of 0.06 mrem (0.0006 mSv)—primarily because of a 26-percent decrease in tritium oxide releases from 1995 to 1996.

Tritium oxide comprised approximately 68 percent of the potential airborne pathway dose.

The collective dose (population dose) to the 620,100 persons living within 80 kilometers (50 miles) of the center of the site was estimated to be 2.8 person-rem (0.028 person-Sv), which is less than 0.01 percent of the collective dose received from naturally occurring sources of radiation (about 186,000 person-rem).

Potential All-Pathway Dose

To demonstrate compliance with the DOE Order 5400.5 all-pathway dose standard of 100 mrem per year (1.0 mSv per year), SRS conservatively combines the maximally exposed individual airborne pathway and liquid pathway dose estimates, even though the two doses are calculated for hypothetical individuals residing at different geographic locations.

Table 1 1996 Potential Radiation Doses from SRS Releases Compared with Applicable Dose Standards and Estimated Doses from Naturally Occurring Radiation

Exposure Pathway	Maximum Potential Dose from 1996 Releases[a]	Applicable Dose Standard[b]	Percent of Standard	Percent of Natural[c]
Maximally Exposed Individual Doses				
Airborne Releases				
Total Airborne	0.05 mrem	10 mrem[d]	0.50	0.02
Liquid Releases				
Total Liquid	0.14 mrem	None[e]	N/A[e]	0.05
All Pathways[f]	**0.19 mrem**	100 mrem	0.19	0.06
Treated Drinking Water				
Beaufort-Jasper	0.06 mrem	4 mrem[g]	1.5	0.02
Port Wentworth	0.06 mrem	4 mrem[g]	1.5	0.02
Special-Case Exposure Scenarios				
Sportsman Dose				
Deer and hog consumption				
Onsite hunter	21.0 mrem	100 mrem	21.0	6.7
Offsite hunter	14.0 mrem	100 mrem	14.0	4.7
Fish consumption				
Steel Creek fish	1.7 mrem	100 mrem	1.7	0.6
Goat Milk Consumption Dose				
Max. individual	0.06 mrem	10 mrem	0.6	0.02
Irrigation Pathway Dose				
Max. individual	0.11 mrem	100 mrem	0.11	0.04
Population (Collective) Doses				
Airborne Releases				
Total Airborne	2.8 person-rem	None[e]	N/A[e]	0.01
Liquid Releases				
Total Liquid	2.2 person-rem	None[e]	N/A[e]	0.01

a Committed effective dose equivalent.

b All the standards listed are given in DOE Order 5400.5, February 8, 1990, "Radiation Protection of the Public and the Environment."

c Estimate of average dose received from naturally occurring radiation is 300 mrem per year [NCRP, 1987]. The population (collective) dose due to naturally occurring radiation is estimated to be about 186,000 person-rem.

d The standard for airborne effluents applies to the sum of the doses from all airborne pathways: inhalation, submersion in a plume, exposure to radionuclides deposited on the ground surface, and consumption of foods contaminated as a result of the deposition of radionuclides.

e There is no separate standard for population dose or for all liquid pathways alone; liquid releases are included in the 100-mrem standard for all pathways.

f The total airborne and liquid exposure pathways are added in order to compare maximum calculated doses from SRS releases with the DOE "all pathways" standard. This total includes the maximum airborne pathway dose of 0.05 mrem (0.0005 mSv) and the maximum liquid pathway dose of 0.14 mrem (0.0014 mSv).

g The drinking water standard applies to public drinking water systems and to drinking water supplies operated by DOE or DOE contractors.

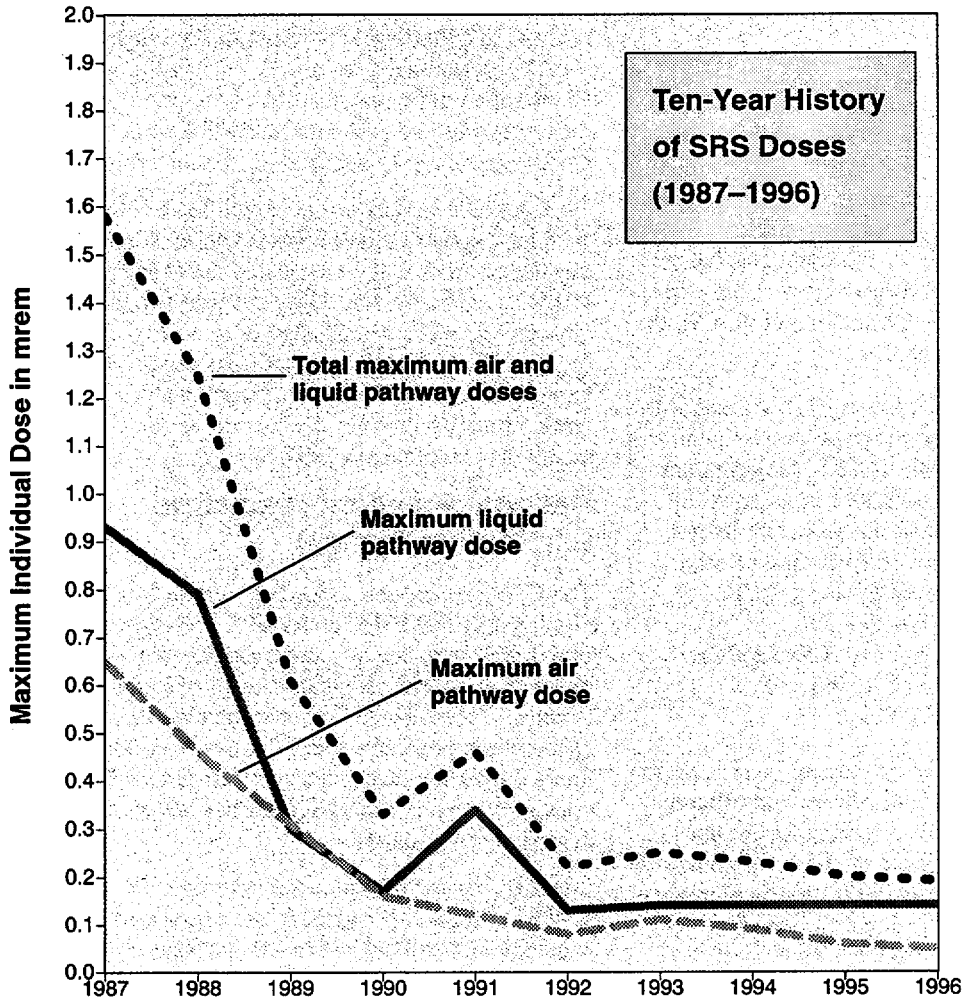

Figure 1 SRS Maximum Potential Doses to the Maximally Exposed Individual

lleaf Graphic

For 1996, the potential maximally exposed individual all-pathway dose was 0.19 mrem (0.0019 mSv) (0.05 mrem from airborne pathway plus 0.14 mrem from liquid pathway). This dose is about 5 percent lower than the 1995 all-pathway dose of 0.20 mrem (0.0020 mSv), mainly because of the decrease in atmospheric tritium oxide releases during 1996. A history (since 1983) of SRS maximum potential all-pathway doses to the maximally exposed individual is depicted in figure 1.

Potential Sportsman Dose

In 1996, the maximum potential dose to an actual onsite hunter was 21 mrem (0.21 mSv), which is 21 percent of DOE's 100-mrem all-pathway dose standard. During the onsite deer hunts, this individual harvested 6 animals—the edible portion totaled about 111 kilograms (245 pounds)—and was assumed to have eaten all the meat himself.

If a hypothetical offsite hunter living near the site boundary consumed 81 kg (179 pounds) of meat—the annual maximum adult consumption rate for meat—taken from deer living on site prior to being harvested, the individual's maximum dose could have been 14 mrem (0.14 mSv). This dose was based on the gross average concentration of cesium-137 (4.5 pCi/g) measured in animals harvested at SRS during 1996.

The potential maximum dose for a recreational fisherman was based on the consumption of 19 kg (42 pounds)—the maximum adult consumption rate for fish—of Savannah River fish having the highest measured concentrations of radionuclides. In 1996, bass caught at the mouth of Steel Creek had the highest concentrations. Consumption of these bass could have resulted in a dose of 1.7 mrem (0.017 mSv).

Compliance Activities

A major goal at SRS continues to be positive environmental stewardship and full regulatory compliance, with zero violations. The site's employees maintained progress toward achievement of this goal in 1996, as a vast majority of their efforts were successful. For example, under the Clean Water Act (CWA), the site's National Pollutant Discharge Elimination System (NPDES) compliance rate was 99.8 percent, and under the Clean Air Act (CAA), the compliance rate was 100 percent.

Compliance with environmental regulations and with DOE orders related to environmental protection is an integral part of the operations at SRS. Management of the environmental programs at SRS is a significant activity, and assurance that onsite processes do not impact the environment adversely is a top priority. All site activities are overseen by one or more regulatory agencies, including the U.S. Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC).

A systematic effort is in place to identify and address all evolving regulatory responsibilities that concern SRS. As part of the process, communications are maintained with all appropriate regulatory agencies to emphasize the site's commitment to environmental compliance. SRS did not receive a Notice of Violation (NOV) from SCDHEC in 1996.

SRS operations in 1996 continued to involve a wide variety of processes and chemicals subject to compliance with an increasing number of environmental statutes, regulations, policies, and permits. (For example, SRS had 668 construction and operating permits in 1996 that specified operating levels for each permitted source.) Compliance with all requirements helps to ensure that the site, the public, and the surrounding environment are protected from adverse effects that could result from SRS operations. This section offers an overview of some of the environmental compliance issues with which the site was involved during 1996.

High-Level Waste Tank Closure

The mission of SRS high-level waste tank closure at the F-Area and H-Area tank systems is to close out tanks in a way that ensures protection of human health and the environment, and in a technically and economically prudent manner. The "Industrial Wastewater Closure Plan for F- and H-Area High-Level Waste Tanks" outlines the SRS/regulator protocol for closing all 51 high-level waste tanks on site. An Environmental Assessment (EA), which resulted in a Finding of No Significant Impact (FONSI), was issued in July 1996 to fulfill National Environmental Policy Act (NEPA) requirements for the closure action. EPA and SCDHEC approved the closure plan July 23 and July 31, respectively.

Tank-specific closure modules will be developed for each tank system. These modules apply the general closure methodology to a specific tank system. Modules are being drafted for the first two tanks to be closed (17F and 20F). Closure of these two tanks will involve filling them; a layer of reducing grout will be topped with controlled, low-strength material. Field work, already begun for the closure of the two tanks, should be completed in 1997.

National Pollutant Discharge Elimination System

The CWA created the NPDES program, which is regulated by SCDHEC under EPA authority. The program is designed to protect surface waters by limiting all nonradiological releases of effluents into streams, reservoirs, and other wetlands. (Radiological effluents are covered under other acts.) Discharge limits are set for each facility to ensure that SRS operations do not impact aquatic life adversely or degrade water quality.

SCDHEC issued SRS a new NPDES permit August 6, 1996 to replace the expired but administratively extended SC0000175 and SC0044903 permits. The new permit recognizes 37 active outfalls and requires the analysis each year of approximately 5,800 parameters to demonstrate compliance. All monitoring was reported to SCDHEC in the monthly Discharge Monitoring Reports, as required by the permit [SRS Data, 1997].

CAA – Title V Operating Program

The CAA provides the basis for protecting and maintaining air quality. Some types of SRS air emissions, such as radioactive sources and ozone-depleting substances (ODS), are regulated by EPA, but most are regulated by SCDHEC, which must ensure that its air pollution regulations are at least as stringent as the CAA's. This is accomplished through SCDHEC Regulation 61–62, "Air Pollution Control Regulations and Standards."

The primary purpose of the Title V permitting program is to establish federally enforceable operating permits for major sources of air emissions. The implementation plan for this program, submitted to EPA in 1993 by the State of South Carolina and subsequently approved by EPA in June 1995, required that SRS submit an extensive application

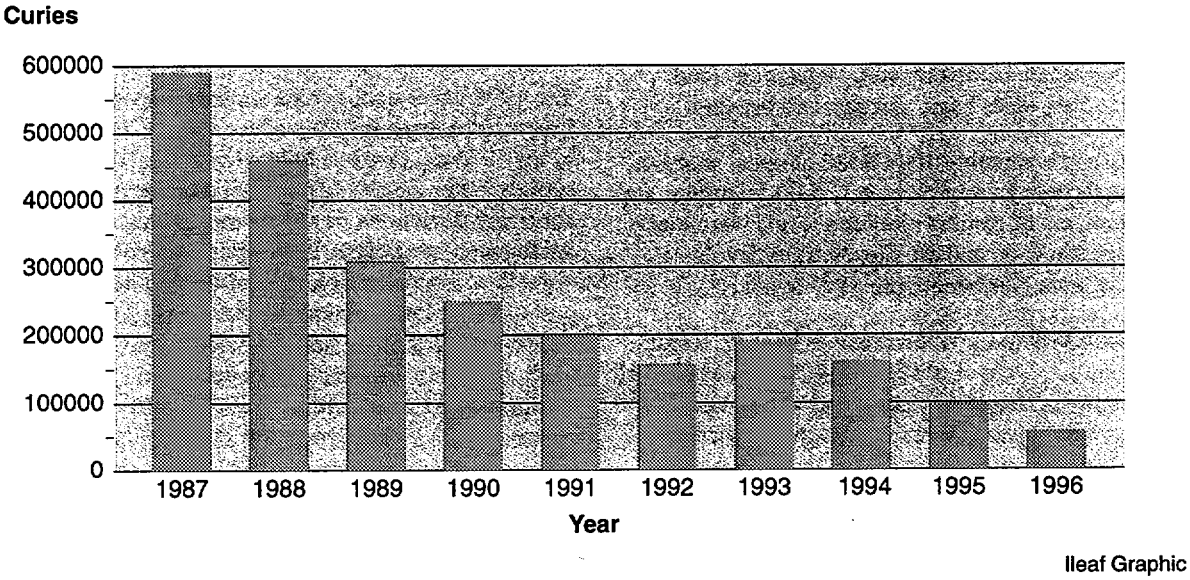

Figure 2 Ten-Year History of SRS Annual Atmospheric Tritium Releases

package for air emission sources at the site by March 15, 1996; SRS submitted the Title V permit application before the deadline.

CAA – NESHAP Asbestos Removal Program

The site implemented an asbestos removal program in 1988. Asbestos is removed during maintenance and renovations of equipment and buildings. During 1996, SRS removed 12,547 square feet of transite panel, which contains asbestos. Also removed were 4,283 linear feet and 2,481 square feet of asbestos pipe and surface insulation. This compares with 9,253 square feet of transite panel and 3,486 linear feet and 1,678 square feet of asbestos pipe and surface insulation removed during 1995. Estimates of the percentage of total friable asbestos (a form that can be crumbled or pulverized with hand pressure when dry) removed from SRS cannot be accurately determined because it is not known exactly how much exists on site. SRS will continue to identify and remove such asbestos according to state (SCDHEC R.61–86.1) and federal (40 CFR 61, Subpart M) regulations and "best management practices."

Radiological Effluent Monitoring

During 1996, SRS collected and analyzed more than 4,400 effluent samples to quantify radiological releases to the environment from site operations. Tritium again was the major contributor to air and liquid releases, accounting for more than 90 percent of the total radioactivity released in 1996.

Airborne Emissions

Tritium was the primary radionuclide released to the atmosphere in 1996; approximately 55,700 curies (2.1E+15 Bq) were released. This compares with 96,700 Ci (3.6E+15 Bq) released in 1995. The sharp (42 percent) decrease is attributed to (1) reduced throughput in the tritium facilities and (2) continued improvement in operations at the Replacement Tritium Facility (RTF). Figure 2 shows a 10-year history (1987–1996) of SRS tritium releases.

Liquid Discharges

Tritium constitutes more than 99 percent of the radioactivity released to the Savannah River from direct, seepage basin, and Solid Waste Disposal Facility (SWDF) migration discharges. In 1996, about 7,560 Ci (2.8E+14 Bq) of tritium was released in liquid discharges from SRS, based on point-of-release concentrations and flow rates, compared to about 9,900 Ci (3.7E+14 Bq) in 1995. The total amount of tritium released directly from process areas (i.e., reactor, separations, heavy water rework) to site streams during 1996 was 950 Ci (3.5E+13 Bq), which was 29 percent less than the 1995 total of 1,340 Ci (5.0E+13 Bq).

Radiological Environmental Surveillance

The radiological environmental surveillance program at SRS surveys and quantifies any effects routine and nonroutine operations may have had on the site, the surrounding area, and those populations living in or

near the site. Sampled media include air, seepage basins, site streams, the Savannah River, drinking water, rainwater, sediment, soil, vegetation, food products, fish, deer, hogs, turkeys, and beavers.

In 1996, approximately 10,000 radiological analyses were performed on approximately 5,000 samples, and measurements of gamma radiation levels were made at 131 locations on and off site. Activity levels generally were consistent with 1995 levels.

Radionuclide activity levels, such as tritium, cesium, and strontium, were at or slightly above their nominal lower limits of detection (LLD) and were consistent with observed historical levels in sampled media. In air and surface water, some onsite activity levels were, as expected, slightly higher than observed in offsite media. Because of production slowdown, most tritium transport in site streams, which has been decreasing in recent years, was attributed to contaminated groundwater—from retired seepage basins—outcropping at stream banks. No samples collected exceeded EPA drinking water standards.

As part of an overall comprehensive review of the environmental monitoring program, a number of changes were implemented during 1996, including reductions in radiological environmental surveillance programs covering ambient gamma, soil, vegetation, and water.

Nonradiological Effluent Monitoring

Nonradioactive airborne emissions of sulfur dioxide, oxides of nitrogen, carbon monoxide, and total particulate matter less than 10 microns released from SRS stacks were within applicable (SCDHEC) standards.

SRS maintained its NPDES compliance rating for liquid releases above 99 percent for the 11th straight year. Results from only 14 of the 5,737 analyses performed in 1996 exceeded permit limits. This resulted in a compliance rating of 99.8 percent—higher than the DOE-mandated rate of 98 percent.

Nonradiological Environmental Surveillance

The nonradiological environmental surveillance program at SRS involves sampling and analyzing surface waters (site streams and the Savannah River), drinking water, sediment, groundwater, and fish. In 1996, more than 8,600 analyses for specific chemicals and metals were performed on more than 1,800 samples, not including groundwater.

The 1996 water quality data showed normal fluctuations expected for surface water. Comparison of the 1996 data with published historical data for site surface water monitoring did not indicate any abnormal deviations from past monitoring data. Analysis for pesticides, herbicides, and volatile organic compounds yielded positive results for a pesticide (dieldrin) at one location (Four Mile Creek–A7). All other analyses results were below the LLD. Coliform analysis results exceeded recommended standards 20 times in 1996 (17 in site streams and 3 in the river). The 20 exceedances represented a decrease from 1995, when site streams analysis results exceeded guides 36 times and river analysis results exceeded guides 13 times.

All SRS drinking water systems complied with SCDHEC chemical, bacteriological, lead and copper, chemical, synthetic organic, and volatile organic water quality standards in 1996.

In Savannah River and site stream sediment samples, no pesticides or herbicides were found to be above the practical quantitation limits in 1996. All sample results were below the LLD of the EPA analytical procedures used.

The mercury concentrations in fish analyzed from onsite waters ranged from a high of 1.70 μg Hg/g in PAR Pond and Pond B bass to lows below the LLD at several locations. Mercury concentrations in offsite fish ranged from a high of 1.67 μg Hg/g in a bass from the Stokes Bluff Landing area to lows below the LLD at several locations.

Groundwater

SRS monitors groundwater for radioactive and nonradioactive constituents to identify contamination that may have occurred because of site operations. Groundwater beneath 5 to 10 percent of the site has been contaminated by industrial solvents, tritium, metals, or other constituents used or generated by SRS operations. This report describes groundwater monitoring results for approximately 1,600 wells in 101 locations within designated areas at SRS. In 1996, approximately 49,000 radiological analyses and 328,000 nonradiological analyses were performed on groundwater samples.

Eight new sites were monitored during the year, and additional wells were installed at several more sites to improve detection monitoring and plume definition. Also, numerous wells were abandoned to accommodate closure activities in and around the

Sanitary Landfill and the F-Area, H-Area, K-Area, and P-Area acid/caustic basins.

Special Surveys

Savannah River Swamp

During the 1960s, an area of the Savannah River Swamp was contaminated with approximately 25 Ci of cesium-137 and 1 Ci of cobalt-60. The contamination resulted from failed fuel elements that leaked radioactivity into the P-Area storage basin; occasionally, this water was discharged to Steel Creek. Periodic radiological surveys of the swamp have been conducted since 1974 to characterize the amount and movement of this activity. A comprehensive survey scheduled for 1995 was delayed until 1996 because of safety concerns resulting from high water levels in the swamp.

The survey's results generally followed trends noted in previous surveys. Some changes with time in the spatial distribution of activity throughout the swamp were observed, which indicates the possibility of some localized movement of activity. However, results from sampling trails located at the downstream end of the swamp have changed little, indicating that activity is not migrating out of the identified contaminated area. Overall, the results show that, although some spatial and vertical migration of activity may be occurring, the activity has remained in the swamp area.

Academy of Natural Sciences of Philadelphia River Quality Surveys

The Environmental Research Division of the Academy of Natural Sciences of Philadelphia (ANSP) has been conducting biological and water quality surveys of the Savannah River since 1951. These surveys are designed to assess potential effects of SRS contaminants and warm water discharges on the general health of the river and its tributaries.

Results of the 1996 ANSP studies on the Savannah River have been delayed pending finalization of a new contract based on recommendations of the 1996 "Rock Hill Initiative #2" review. It is expected that results of analyses of the 1996 data will be compiled after the new contract is placed—and that both 1996 and 1997 results will be reported in the *SRS Environmental Report for 1997.*

Chapter 1

Introduction

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Environmental Protection Department

To Read About . . . **See Page . . .**

THE Savannah River Site (SRS), one of several facilities in the U.S. Department of Energy (DOE) complex, encompasses approximately 310 square miles in South Carolina, adjacent to the Savannah River.

The site was established by the U.S. Atomic Energy Commission (AEC) in 1950 to produce plutonium and tritium for national defense and additional special nuclear materials for other government uses and for civilian purposes. Production of these materials continued for more than 40 years, and the site became an integral financial and cultural part of the surrounding area and the state of South Carolina.

When the Cold War ended in 1991, DOE responded to changing world conditions and national policies by refocusing its missions. The site's priorities shifted toward waste management, environmental restoration, technology transfer, and economic development.

This chapter includes general information on the site's history; location, demographics, and environmental setting; mission; and areas and operations.

Site History

Responding to a 1950 directive from President Harry S. Truman to the AEC, E.I. du Pont de Nemours and Company and the commission negotiated a contract whereby Du Pont would design, construct, and operate what was to become the Savannah River Plant (SRP).

On November 22 of that year, the AEC approved the present site and purchased the land for approximately $19 million. By February 1, 1951, construction had begun. The first facility to begin operating, the heavy water plant, started up August 17, 1952, and the first of five production reactors achieved criticality December 28, 1953. All five reactors had achieved criticality by March 1955. [Bebbington, 1990].

Until it was disbanded by the Energy Reorganization Act of 1974, the AEC oversaw and regulated site activities. In 1975, its functions were transferred to two newly established agencies: the Energy Research and Development Administration, overseeing government operations, and the Nuclear Regulatory Commission, overseeing commercial operations. By 1977, the Energy Research and Development Administration had evolved into DOE, which has overseen all facility activities since that time.

Du Pont operated SRP until March 31, 1989. On April 1, 1989, Westinghouse Savannah River Company (WSRC) became the prime operating contractor, and SRP became SRS.

Beginning October 1, 1996, the site was operated under a new contract by an integrated team led by WSRC. Under this contract, WSRC is responsible for the site's nuclear facility operations; Savannah River Technology Center (SRTC; more about SRTC can be found on page 9); environment, safety, health, and quality assurance; and all the site's administrative functions. Bechtel Savannah River, Inc. (whose parent company is Bechtel National, Inc.) is responsible for environmental restoration, project management, engineering, and construction activities. Babcock & Wilcox Savannah River Company (whose parent company is Babcock & Wilcox Government Group) is responsible for facility decontamination and decommissioning, and British Nuclear Fuels Savannah River Corporation (whose parent company is British Nuclear Fuels, Inc.) is responsible for the site's solid waste program [Fact Sheet, 1996a]. Wackenhut Services, Inc., provides security support services for SRS.

Site Locale

In 1950, the site was selected by applying the criteria developed to select the most suitable location in the country to carry out President Truman's directive:

- a large land area for safety and security
- a buffer zone large enough to provide land around each operating facility for protection of human health and the environment
- land somewhat isolated yet near communities that could handle construction and operations personnel
- access to adequate transportation

- land not subject to floods and major storms
- the availability of millions of gallons of water, low in mineral content, for cooling and process use
- suitable terrain and topography

Du Pont, the AEC, and the U.S. Army Corps of Engineers considered 114 sites in 18 states before recommending the current site, which met all the established criteria.

Location

SRS covers 198,344 acres in Aiken, Allendale, and Barnwell counties of South Carolina and borders the Savannah River. The site is approximately 25 miles southeast of Augusta, Georgia, and 12 miles south of Aiken, South Carolina (figure 1–1). The average population density in the counties surrounding SRS is 85 people per square mile, with the largest concentration in the Augusta metropolitan area. Based on 1990 U.S. Census Bureau data, the population within a 50-mile radius of SRS is approximately 620,100.

About 70 percent of the site's employees live in South Carolina—primarily Aiken County—and 30 percent in Georgia.

SRS is included in the Central Savannah River Area, which is comprised of 18 counties surrounding Augusta. The counties are Aiken, Edgefield, Allendale, Barnwell, and McCormick in South Carolina and Richmond, Columbia, McDuffie, Burke, Emanuel, Glascock, Jenkins, Jefferson, Lincoln, Screven, Taliaferro, Warren, and Wilkes in Georgia.

Typical Climate at SRS

- **Summer**
  Hot and humid
  Temperatures reach upper 90s (°F)
  33 percent of annual rainfall
- **Fall**
  Cool mornings, warm afternoons
  Temperatures range from 50 to 76 °F
  19 percent of annual rainfall
- **Winter**
  Mild; lasting November through March
  Temperatures normally above 32 °F
  21 percent of annual rainfall
- **Spring**
  Most variable; cold snap often in March
  Temperatures average 65 °F
  27 percent of annual rainfall

Various industrial, manufacturing, medical, and farming operations are conducted near the site. Major industrial and manufacturing facilities in the area include textile mills, polystyrene foam and paper products plants, chemical processing facilities, and a commercial nuclear power plant. Farming is diversified and includes crops such as cotton, soybeans, corn, and small grains.

Climate

SRS has a relatively mild climate, with an average frost-free season of approximately 246 days. The average annual rainfall, about 48 inches, is fairly evenly distributed throughout the year. There is no strong prevailing wind direction; however, there is a relatively high frequency of east-through-northeast winds during the summer and fall and of south-through-northwest winds during the late fall, winter, and spring [Hunter, 1990]. Except for the Savannah River, no unusual topographic features significantly influence the general climate.

Geology and Hydrology

SRS is on the Upper Coastal Plain of South Carolina. Coastal Plain deposits at SRS consist of 500 to 1,400 feet of sands, clays, and limestones of Tertiary and Cretaceous age. These sediments are underlain by sandstones of Triassic age and by older metamorphic and igneous rocks.

The sandy sediments of the Coastal Plain contain several productive aquifers, separated by clay-rich units, that drain into the Savannah River, its tributaries, and the Savannah River Swamp. The older, underlying rocks are nearly impermeable and are not a major water source.

Water Resources

SRS, bounded on its southwestern border by the Savannah River for about 35 river miles (as measured from the upriver boundary of the site, near Jackson, South Carolina, to the Lower Three Runs Creek corridor), is approximately 160 river miles from the Atlantic Ocean. Five major SRS streams feed into the river: Upper Three Runs Creek, Four Mile Creek (also referred to as Fourmile Branch), Pen Branch, Steel Creek, and Lower Three Runs Creek. These streams, which receive effluents from various onsite operations, are not commercial water sources.

The two main bodies of water on site, PAR Pond and L-Lake, are manmade. PAR Pond, constructed in 1958 to provide cooling water for P-Reactor and R-Reactor (hence the name PAR Pond), covers 2,640 acres and is approximately 60 feet deep. The 1,000-acre L-Lake was constructed in 1985 to receive heated cooling water from L-Reactor.

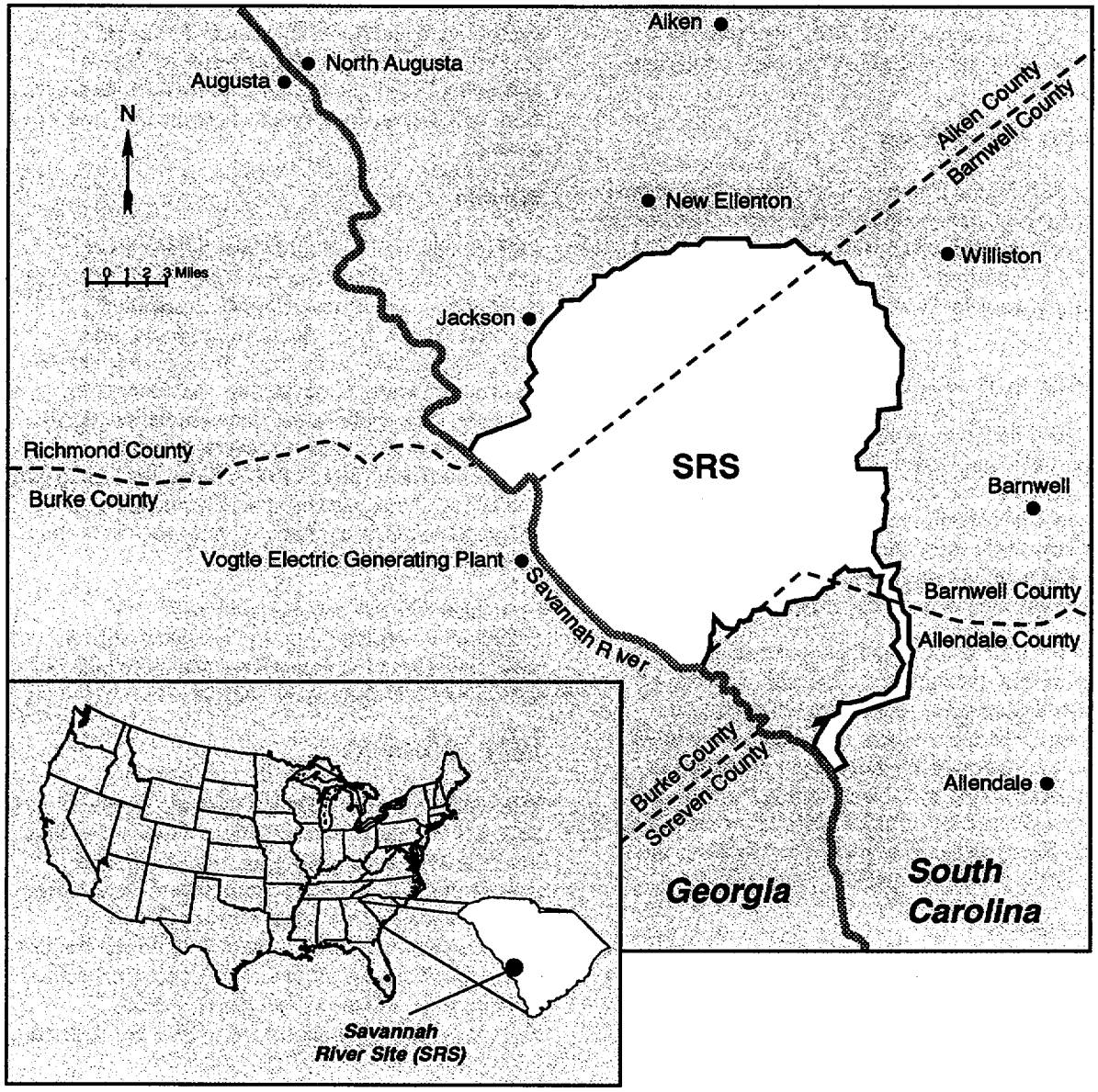

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Figure 1–1 Regional Location of SRS

SRS is about 25 miles southeast of Augusta, Georgia, and 12 miles south of Aiken, South Carolina. The site, approximately 310 square miles in area, covers about 1 percent of the state of South Carolina.

The Savannah River is used as a drinking water supply for approximately 56,000 residents downriver of SRS in Port Wentworth, Georgia, and near Beaufort, South Carolina (Beaufort and Jasper counties) [Fledderman, 1995]. The City of Savannah Industrial and Domestic Water Supply Plant intake, at Port Wentworth, is approximately 130 river miles from SRS; the Beaufort-Jasper Water Treatment Plant intake, near Beaufort, is approximately 120 river miles from SRS. The Savannah River also is used for commercial and sport fishing, boating, and other recreational activities. There is no known use of the river for irrigation by farming operations downriver of the site [Hamby, 1991]. SRS uses water from the river for some of its operations.

Approximately 200 Carolina bays exist on SRS, ranging in size from about 0.2 acre to 125 acres. Carolina bays are unique, naturally occurring wetlands found only on the southeastern Coastal Plain. They are elliptical in shape and oriented northwest to southeast along their long axes; their

origin is unknown. Carolina bays are shallow and may dry up seasonally. At SRS, they provide important habitat and refuge for many plants and animals.

Land Resources

The SRS region is part of the Southern Bottomland Hardwood Swamp region, which extends south from Virginia to Florida and west along the Gulf of Mexico to the Mississippi River drainage basin. The main features are river swamps, rarely more than 5 miles wide.

Plant and Animal Life

In 1972, SRS was designated as the first National Environmental Research Park. These parks are used by government and university-related scientists as outdoor laboratories to study the impact of human activity on the environment. This designation has created a unique environment for preserving and studying vegetation and wildlife.

The site provides refuge for approximately 50 endangered, threatened, and sensitive species of plants and animals, such as the red-cockaded woodpecker, the southern bald eagle, the smooth purple coneflower, the Bachman's sparrow, the American alligator, the wood stork, the shortnose sturgeon, and the bog spice bush. Many site research projects are designed to protect and increase the populations of these species.

Vegetation

Most of the site's environs are rural. Approximately 40 percent of the countryside is forested with longleaf and loblolly pines and sweet gum, maple, birch, and various oak-hickory hardwood trees.

Major plant communities at SRS include cypress-gum and lowland hardwood swamps, sandhills, and old agricultural fields, as well as aquatic and semiaquatic areas. These habitats range from very sandy, dry hilltops to continually flooded swamps.

Wildlife

SRS is populated with more than 50 species of mammals, including deer, feral hogs (hogs that have reverted to the wild state from domestication), beavers, rabbits, foxes, raccoons, bobcats, river otters, and opossums. In 1952, there were fewer than three dozen white-tailed deer on site. Since then, however, the population has increased dramatically, and the site now is home to several thousand white-tailed deer [SRFS, 1982]. Since 1965, managed public deer hunts have been held annually on site to reduce the number of animal-vehicle accidents and to maintain the health of the herd.

More than 100 species of reptiles and amphibians—including turtles, alligators, lizards, snakes, frogs, and salamanders—and more than 200 species of birds also inhabit the site.

Site Mission

While the changing world has caused a downsizing of the site's original defense mission, the future of SRS lies in several areas: managing, stabilizing, and treating nuclear materials; continuing to clean up the site and managing the waste it has produced; transferring environmental technology to government and nongovernment entities; and forming economic and industrial alliances [Fact Sheet, 1996a]. Environmental activities related to SRS missions are introduced briefly in the following section.

Savannah River Site: A Unique Outdoor Laboratory

In 1972, the federal government designated SRS as the nation's first National Environmental Research Park. The park provides a unique outdoor laboratory to study the interaction between managed and natural systems. Research activities are conducted through the site environmental organizations described in this chapter.

The Savannah River Swamp is 7,500 acres of natural swampland adjacent to the Savannah River. In the deep water areas of the swamp, two types of trees are dominant: the bald cypress and the water tupelo. These trees cover 50 percent of the swamp. The other 50 percent consists of islands that support bottomland hardwood forests, including oaks, red maples, and sweet gum trees. The swamp also is home to waterfowl and alligators. Studies conducted at the swamp track subtle long-term effects of land use changes on ecosystems.

SRS serves as a refuge for endangered species such as the southern bald eagle, a subspecies of the bald eagle. When fully mature, it is about 40 inches long with dark brown plumage, a white head and tail, and yellow eyes, beak, and feet. Eagles reach full maturity in 3 to 7 years. They are monogamous, mate for life, and tend to use the same nest every year.

Site Areas and Operations

SRS was constructed to produce basic materials used in nuclear weapons, primarily tritium and plutonium-239. Five reactors were built to produce these materials by irradiating target materials with neutrons; also built were support facilities, including two chemical separations plants, a heavy water extraction plant, a nuclear fuel and target fabrication facility, and waste management facilities.

The production process began with the manufacture of fuel and target assemblies produced from a variety of nuclear and other materials such as enriched uranium and aluminum. The assemblies were transported to the reactor, where they were loaded into the reactor core and used to produce series of controlled nuclear reactions. During the reaction, neutrons from the fuel bombarded the target assemblies to produce the desired product.

The irradiated target assemblies and spent fuel assemblies then were moved to one of the chemical separations facilities—known as "canyons"—where the desired products were separated and waste products were processed.

After refinement, nuclear materials were shipped to other DOE sites for incorporating into nuclear weapons. SRS produced about 36 metric tons of plutonium from 1953 to 1988.

SRS has adjusted to meet declining defense requirements. All five reactors are now shut down, a result of the end of the Cold War. However, until fresh supplies of tritium are available, recycling and reloading of tritium to maintain the nation's supply of nuclear weapons is a continuing site mission [Fact Sheet, 1996a].

SRS is divided into several areas, based on production and other functions (figure 1–2):

- reactor materials area (M)
- reactor areas (C, K, L, P, and R)
- heavy water reprocessing area (D)
- separations areas (F and H)
- waste management areas (E, F, H, S, and Z)
- administration area (A)
- other areas (B, N, G, and TNX)

In addition, environmental activities are conducted by SRTC, the Savannah River Ecology Laboratory (SREL), the Savannah River Forest Station (SRFS), and the Savannah River Archaeological Research Program (SRARP).

Reactor Materials Area

The reactor materials area (M-Area) consists of a fuel and target fabrication facility, three analytical laboratories, and the Liquid Effluent Treatment Facility (LETF).

The fuel fabrication facility produced fuel and target assemblies to be used in the reactors. Control rods and other reactor components also were manufactured in the facility.

The LETF treated wastewater generated by various M-Area processes and consolidated low-radioactivity residues from M-Area processes for eventual disposal.

Reactor Areas

Production reactors are in five areas: C, K, L, P, and R. Each area houses one of the site's five heavy water reactors. The basis for the design of the reactors was derived in large part from experience and data generated at the Argonne National Laboratory in Argonne, Illinois. Argonne was the focal point for heavy water reactor research and development, and the facility had built and operated two such reactors by 1950 [Bebbington, 1990].

All five production reactors, (R-Reactor, P-Reactor, L-Reactor, K-Reactor, and C-Reactor) have been placed in cold shutdown.Although the areas are being used, as for moderator and fuel storage, no effort is being expended to maintain reactors.

R-Reactor went critical in December 1953 and has been permanently shut down because of reduced production demands.

P-Reactor was started in February 1954 and was shut down in August 1988 for maintenance. In February 1991, it was placed in cold standby and was to be used to provide spare parts for L-Reactor and K-Reactor. P-Reactor has been permanently shut down.

L-Reactor went critical in August 1954 and was placed in cold standby in 1968. It was restarted in October 1985, after upgrading, and shut down for maintenance and safety upgrades in August 1988. It was placed in warm standby in December 1991 to be put into operation as a backup to K-Reactor, if necessary, but since has been permanently shut down.

C-Reactor went critical in March 1955 and was shut down in 1985 for maintenance. It was placed in cold

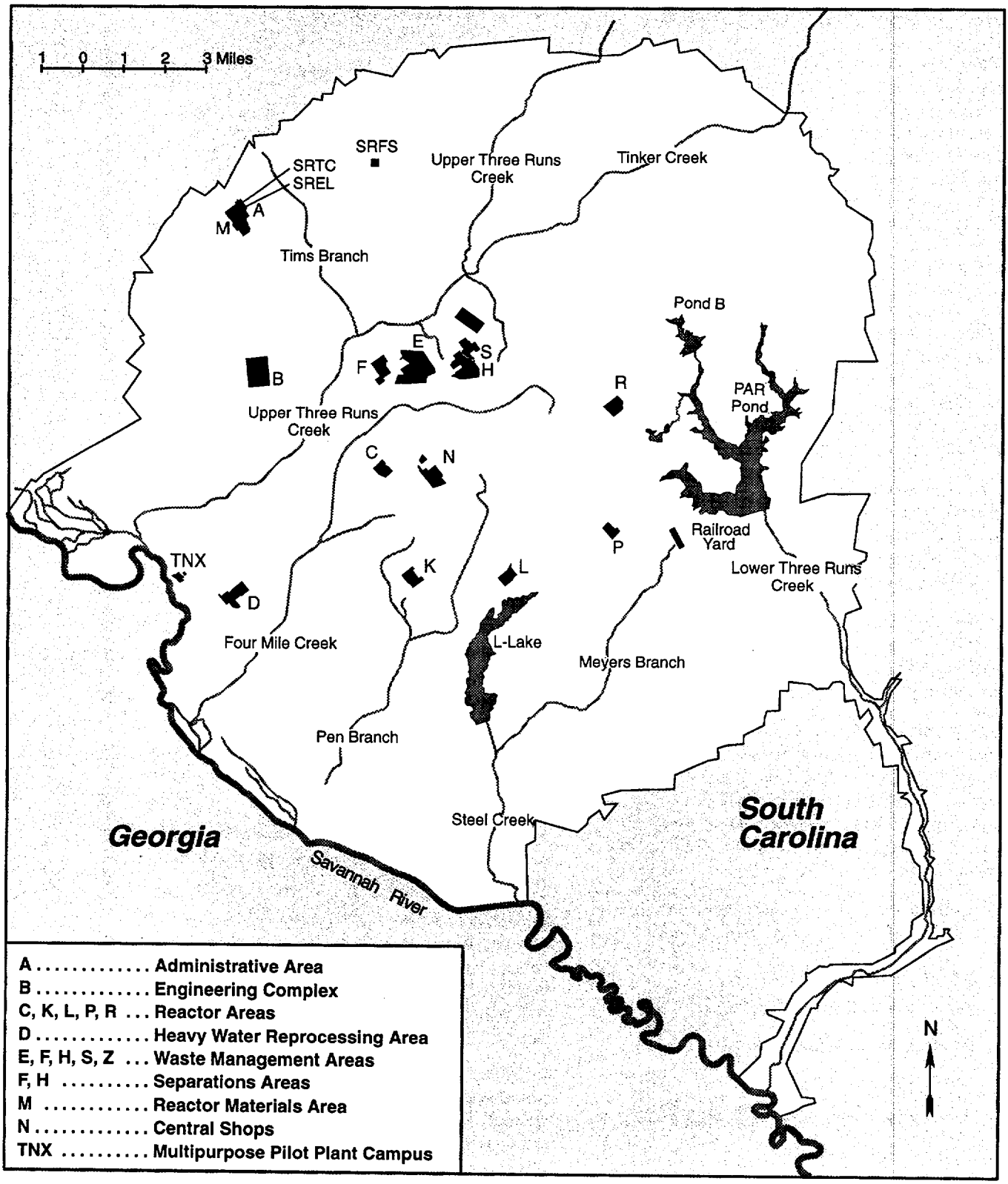

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Figure 1–2 The Savannah River Site

SRS includes nuclear materials production areas, which are primarily in the interior of the site, and several operating areas. The Savannah River Ecology Laboratory (SREL), the Savannah River Forest Station (SRFS), and the Savannah River Technology Center (SRTC) also are located on site.

standby in 1987, when cracking was observed in the reactor vessel. C-Reactor has been permanently shut down.

K-Reactor went critical in October 1954 and was shut down in August 1988 for maintenance. Initial steps to restart K-Reactor began in December 1991. Successful power ascension testing was completed in July 1992. Following ascension testing, the reactor was taken offline to allow for the tie-in of a cooling tower. The tie-in was completed, and the operating permit was issued in December 1992. In 1993, the cooling tower was tested; however, the reactor was never restarted. K-Reactor was placed in cold standby, but the official status was changed in 1996 to cold shutdown.

Heavy Water Reprocessing Area

A heavy water production plant in D-Area began operations in 1953 to produce heavy water to moderate and cool the site's reactors. The plant separated heavy water, present in all water, from Savannah River water. Production was discontinued at the facility in 1981 because of a sufficient supply of heavy water.

Facilities operating in D-Area include a coal-fired power plant (leased by DOE to the South Carolina Electric and Gas Company effective October 1, 1995), a laboratory facility that analyzes process effluent samples, and the Heavy Water Rework Facility. Through normal reactor operations, heavy water became diluted with light (ordinary) water. This degraded heavy water is sent to the Heavy Water Rework Facility, where light water is removed, and the heavy water is reconcentrated to 99.75-percent purity. Funding fluctuations caused decreases in rework operations during 1996. However, moderator purification and consolidation operations are continuing in D-Area.

Separations Areas

Reactor-generated products are processed in the separations facilities in F-Area and H-Area. Operations in the separations areas also include chemical separations, receipt of offsite fuel for processing, and tritium processing. Facilities include the canyon buildings (F-Canyon and H-Canyon), the FB-Line and the HB-Line (located atop the canyons), the Receiving Basin for Offsite Fuel (RBOF), and the Replacement Tritium Facility (RTF).

Nuclear materials historically have been chemically recovered and purified in the canyon buildings, the FB Line, and the HB Line. All processing work in the canyons, so called because of their long, narrow shapes—835 feet long, 122 feet wide, and 66 feet high—is remotely controlled to protect workers from the radioactive materials being processed [Fact Sheet, 1996d].

F-Canyon initiated recovery of plutonium-239 and uranium-238 from spent fuel rods from site reactors and other test and research reactors. Plutonium-239 was produced to support the nuclear weapons stockpile. Depleted uranium-238 was recovered as a by-product and remains stored at SRS [Fact Sheet, 1996d].

FB-Line historically converted plutonium solution produced in F Canyon from irradiated reactor targets to plutonium-239 metal for the support of defense programs [Fact Sheet, 1996e].

H-Canyon historically recovered uranium-235, the fuel source for nuclear reactors, from spent rods from site reactors and other test research reactors. In addition, the canyon was equipped to recover plutonium-238, for use in power systems for deep space exploration, and neptunium-237, used to produce plutonium-238 [Fact Sheet, 1996f].

HB-Line was constructed to support the production of plutonium-238. Plutonium-238 has a unique combination of high heat output and long life, allowing space vehicle designers to keep weight at a minimum and still have a power supply that is effective for many years [Fact Sheet, 1996g]. In 1995, the facility completed a 5-year campaign for the National Aeronautics and Space Administration (NASA) to supply plutonium-238 for the Cassini mission, an unmanned expedition to the planet Saturn.

The canyons and lines did not operate between 1992 and 1995, with the exception of the work mentioned above for NASA. In 1995, analyses showed that resuming processing operations was the best way to stabilize and manage most of the remaining inventory of plutonium-bearing and highly enriched uranium materials at SRS [Fact Sheet, 1996f; Fact Sheet, 1996h].

F-Canyon operations resumed in 1995, and the canyon is scheduled to operate until about 2002 to stabilize SRS materials. Most of these stabilization actions essentially will be the same as historic operations [Fact Sheet, 1996d].

Operations were restarted in 1996 in the FB Line to convert plutonium-bearing solutions into a metal form suitable for long-term storage and management. Stabilization of the approximately 80,000 gallons of

existing plutonium-bearing solutions in F-Area was completed in April [Fact Sheet, 1996e].

H-Canyon may be used to stabilize a number of plutonium solids currently stored in vaults. In addition, DOE has determined that H-Canyon should be used to convert a large quantity of weapons-usable highly enriched uranium to low-enriched material—no longer weapons-usable, but suitable as fuel in commercial power reactors [Fact Sheet, 1996f].

Decisions announced between December 1995 and July 1996 by DOE concluded that HB Line should be used to stabilize plutonium-242 solution and may be used to stabilize other plutonium materials. The plutonium-242 campaign is in progress [Fact Sheet, 1996g].

Offsite fuel to be processed in the H-Area canyon building is stored and packaged in the RBOF. This facility receives and stores spent fuel from offsite research reactors, pending recovery operations or disposition.

Tritium, one of the materials produced by the site for national defense, has a half-life of 12.5 years and must be replenished. SRS is the nation's only facility for recycling tritium from nuclear weapons reservoirs returned from service. This recycling allows the United States to use its tritium supplies efficiently.

The SRS tritium facilities in H-Area consist of four main process buildings designed and operated to process tritium. The newest building is the one-acre-sized underground RTF. The main mission of the tritium facilities is to purify and maintain existing inventories of tritium for defense purposes.

With the SRS production reactors shut down, DOE began a search for a new source for tritium. The department is evaluating two options for tritium production: using an existing commercial reactor and constructing a linear accelerator. The more promising of the alternatives is expected to be selected in 1998 and designated the primary method of tritium production.

If the linear accelerator is selected, it will be constructed at SRS to take advantage of the site's long-standing expertise and capabilities in handling tritium. In either case, tritium extraction and loading will continue to be a site mission [Fact Sheet, 1996a].

Waste Management Areas

Waste management activities are conducted in the following areas: E, F, H, S, and Z. E-Area, between F-Area and H-Area, eventually will include all the site's disposal and storage facilities.

Weapons material production at SRS has generated unusable byproducts, such as highly radioactive waste. About 34 million gallons of this high-level radioactive waste is stored in tanks on site [Fact Sheet, 1996a]. In addition, other wastes at the site include low-level solid and liquid radioactive wastes; transuranic waste (which contains alpha-emitting isotopes that have decay rates and concentrations exceeding specified levels); 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 is neither radioactive nor hazardous). How the site manages this waste is discussed in chapter 4, "Environmental Restoration and Waste Management."

Facilities in waste management areas are designed to store or treat the waste generated from onsite operations. These facilities include the Solid Waste Disposal Facility (SWDF)—formerly the Radioactive Waste Burial Grounds; the E-Area Vaults; the ETF; the high-level waste storage tanks in F-Area and H-Area ("tank farms"); the Extended Sludge Processing Facility; the In-Tank Precipitation Facility; the Defense Waste Processing Facility (DWPF); the Saltstone Facility; and the Consolidated Incineration Facility (CIF).

SWDF was a burial site for such items as protective clothing, tools, and equipment contaminated with small amounts of radioactive material. Such solid low-level waste now is disposed of permanently in the engineered concrete E-Area Vaults and thus is significantly more isolated from the environment.

Historically, seepage basins were used to dispose of wastewater from the separations facilities in F-Area and H-Area. The ETF, located in H-Area, treats the low-level radioactive wastewater formerly sent to the seepage basins. The ETF removes radioactive and nonradioactive contaminants, except tritium, from process effluents and allows the water to discharge to Upper Three Runs Creek.

The F-Area and H-Area waste tank farms consist of large underground storage tanks that hold high-level liquid radioactive waste. The waste is contained in 29 tanks in H-Area and 22 tanks in F-Area. Sludge (which has settled to the bottom of the tanks) and saltcake must be removed from the tanks so the wastes can be processed for ultimate disposal.

The Extended Sludge Processing Facility washes the sludge to remove excess aluminum and salts before

the sludge is ready to be fed to the DWPF. The In-Tank Precipitation Facility in H-Area separates the highly radioactive portion ("precipitate") of the saltcake from the low-level radioactive portion ("filtrate").

The DWPF, located in S-Area, immobilizes the high-level waste sludge and the precipitate by "vitrifying" it into a solid glass waste form. A component of the DWPF, the Saltstone Facility, treats and disposes of the filtrate by stabilizing it in a solid, cement-based waste form [Fact Sheet, 1996c]. The DWPF began radioactive operations in March.

The CIF, located adjacent to H-Area, is designed to safely burn certain hazardous, low-level radioactive, and mixed (both hazardous and radioactive) wastes. The CIF still is undergoing testing; operations are expected to begin in 1997.

Administration Area

The administration area (A-Area) contains organizations that provide direct support for SRS operations. DOE's Savannah River Operations Office and WSRC's administrative offices are located in A-Area, as are SRTC and SREL.

Other Areas

Other onsite and offsite facilities support SRS operations. Onsite areas include an engineering complex (B-Area); Central Shops (N-Area); and TNX (now called the Multipurpose Pilot Plant Campus), a research and development area. Locations not within areas designated for specific purposes are called G-Area, or general area. Activities conducted off site are administrative and do not involve radioactive or hazardous materials.

Spent Fuel

Beginning in the 1950s, as part of the "Atoms for Peace" program, the United States provided nuclear technology to foreign nations for peaceful applications in exchange for their promise to forego development of nuclear weapons. A major element of this program was the provision of research reactor technology and the highly enriched uranium needed in the early years to fuel the research reactors. Research reactors play a vital role in important medical, agricultural, and industrial applications. Nevertheless, the uranium initially used in the fuel elements for these reactors also can be used in nuclear weapons. Therefore,the used fuel elements ("spent nuclear fuel") were transported to the United States, where they were chemically separated to extract the uranium still remaining in the fuel. In this way, the United States maintained control over disposition of the highly enriched uranium that it provided to other nations.

For years, it was routine for the foreign researchers to return this U.S.-origin spent fuel to the United States under bilateral agreements and, from 1964 until 1988, the "Off-Site Fuels Policy." This policy expired in 1988, and shipments no longer were accepted by the United States. The decision to return to this practice was made in 1996 [DOE, 1996], and the first shipment arrived on site in September from foreign research reactors [Fact Sheet, 1996a].

Spent nuclear fuel is managed in several locations at the site. Most of the spent nuclear fuel remaining from SRS reactor operations is in water-filled concrete storage basins, which originally were intended as an interim storage area. Fuel from domestic and foreign research reactors is stored in the RBOF (discussed on page 7). Interim storage will be a major issue for fuels that are not processed or that arrive after SRS reprocessing facilities are phased out. Many of the original storage facilities were not designed for the long interim storage period that may be required pending disposition. DOE is continuing with its integrated, long-term spent fuel management program, which addresses storage and treatment of all spent fuel until an ultimate disposition is determined.

Environmental Restoration

In 1981, SRS began inventorying waste sites (referred to as "units" for eventual restoration; there are about 460 inactive waste units included in the site's environmental restoration program. Waste sites range in size from a few square or cubic feet to tens of acres and include basins, pits, piles, burial grounds, landfills, tanks, and groundwater contamination areas.

To date, 90 acres of land have been remediated (assessed and cleaned up). Also, several billion gallons of groundwater have been treated, with hundreds of thousands of pounds of solvents removed. Even though the site has had success in cleaning up some areas, a tremendous amount of environmental restoration work remains [Fact Sheet, 1996a]. More about environmental restoration can be found in chapter 4, "Environmental Restoration and Waste Management."

Research and Development

SRTC is an applied research and development organization that provides technical support for the missions of SRS while working in partnership with site operations and interfacing with other government and private research organizations. SRTC is active in

transferring technology to American industry, establishing industrial and academic partnerships and cooperative ventures, and supporting education programs.

The SRTC complex is comprised of 33 permanent buildings. Used in the past for nuclear materials production process development, the facilities now focus on developing, testing, and demonstrating equipment and techniques for nuclear materials processing, environmental remediation, environmental protection, waste processing, decontamination and decommissioning, and industrial uses of SRS technology.

Information about SRTC's outreach program can be found in chapter 3, "Environmental Program Information."

Environment

Environmental Monitoring

Onsite and offsite radiological and nonradiological environmental monitoring is conducted by the Environmental Monitoring Section (EMS) of WSRC's Environmental Protection Department (EPD). The environmental monitoring program is discussed briefly in chapter 3, "Environmental Program Information," and more thoroughly in chapters 5, ("Radiological Effluent Monitoring"), 6 ("Radiological Environmental Surveillance"), 8 ("Nonradiological Effluent Monitoring"), and 9 ("Nonradiological Environmental Surveillance").

Also, the Division of Environmental Research of the Academy of Natural Sciences of Philadelphia has performed biological and water quality surveys of the Savannah River since 1951. More about the academy's surveys can be found in chapter 12 ("Special Surveys and Projects").

Savannah River Ecology Laboratory

SREL is operated by The University of Georgia and funded by DOE to conduct research on the impact of site operations on the environment. Research programs are organized into four main categories—radioecology, environmental chemistry, ecotoxicology, and ecosystem health.

Radioecology research assesses the distribution, fate, and ecological risk associated with radionuclides in the environment, including the genetic effects on flora and fauna at SRS and more contaminated sites such as the Chernobyl site in the Ukraine. Environmental chemistry research addresses the physical, chemical, and biological processes controlling the mobility of organic and inorganic contaminants in the environment, particularly in soils and water of SRS and other DOE sites. Research in ecotoxicology seeks to measure or predict bioaccumulation of contaminants in natural populations of organisms. The program also seeks to evaluate genetic and demographic markers in various species for use as possible indicators of responses to environmental contaminants. Objectives of the ecosystem health research are to identify patterns of biodiversity on the site and to understand the natural and anthropogenic processes that maintain or change them.

Additional studies are conducted on the site's deer herd, fish, reptiles, amphibians, waterfowl, and endangered species, such as the wood stork. Other studies evaluate the potential of various experimental approaches for remediating contaminated soils, Carolina bays, and other habitats.

Information about SREL's outreach program can be found in chapter 3. More information about all programs can be obtained by contacting SREL at 803–725–0156.

Savannah River Forest Station

The area of the site not used for nuclear materials production and production-related activities—about 175,000 acres—has been managed for several decades by SRFS, a unit of the U.S. Department of Agriculture (USDA) Forest Service. Because the site was farmland before it was purchased by the federal government, the Forest Service was asked in 1951 to establish a reforestation and forest management plan, which was written in 1952. In all, the Forest Service has planted more than 134 million trees (mainly pines) since 1953, covering almost 80 percent of the site. SRS maintains a forest management program to contribute to environmental protection and research.

Although SRFS originally was responsible only for timber management, its scope now includes management of the site's plants and wildlife, especially of threatened and endangered species; maintenance of the primary quality of the site's soil and water; and maintenance of the site's secondary roads and exterior boundaries. SRFS fire crews, which have primary responsibility for fighting wild fires and conducting controlled burns, coordinate their efforts with WSRC firefighters.

Information about SRFS's outreach program can be found in chapter 3. Information about other programs can be obtained by contacting SRFS at 803–725–0237.

Savannah River Archaeological Research Program

SRARP was formed in 1973 under a cooperative agreement with DOE and the South Carolina Institute of Archaeology and Anthropology, University of South Carolina. Its primary purpose is to make compliance recommendations to DOE that will facilitate the management of archaeological resources at SRS. Other functions include compliance activities involving reconnaissance surveys, general intensive watershed surveys, specific intensive surveys, data recovery, coordination with major land users, and reconstruction of the environmental history of the site. More information can be obtained by contacting SRARP at 803–725–3623.

Economic Development

The transfer of technology to private industry moves existing government-developed technologies into the commercial world, helping businesses sharpen their competitive edge and providing American taxpayers a second return on their investment. Through government/industry partnerships for the development of new technologies, the site also benefits from industry expertise in finding the best available solutions to the site's environmental restoration and waste management challenges [Fact Sheet, 1996a].

Chapter 2

Environmental Compliance

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Environmental Protection Department

To Read About . . . **See Page . . .**

SAVANNAH River Site (SRS) operations in 1996 continued to involve a wide variety of processes and chemicals subject to compliance with environmental statutes, regulations, and policies. Such compliance ensures that SRS, the public, and the surrounding environment are protected from any adverse effects generated by site operations. This chapter addresses environmental compliance issues with which the site was involved during 1996.

SRS's goal—and that of the U.S. Department of Energy (DOE)—is positive environmental stewardship and full regulatory compliance, with zero violations. The site's employees maintained progress toward achievement of this goal in 1996, as is shown by examples in this chapter.

A systematic effort is in place to identify and address all evolving regulatory responsibilities that concern SRS. As part of the process, communications are maintained with all appropriate regulatory agencies to emphasize the site's commitment to environmental compliance.

The site's compliance efforts achieved a very high level of success in 1996. For example, under the Clean Water Act (CWA), almost 6,500 analyses were performed during the year to demonstrate compliance with the site's National Pollutant Discharge Elimination System (NPDES) permits; the site's compliance rate was 99.9 percent, calculated by dividing the number of exceedances by the number of parameters analyzed for permit compliance.

Under the Clean Air Act (CAA), the 1996 compliance rate was 100 percent. Other key regulations with which the site must comply—and the compliance status of each—are noted on page 15.

Compliance Activities

Compliance with environmental regulations and with DOE orders related to environmental protection is a critical part of the operations at SRS. Assurance that onsite processes do not impact the environment adversely is a top priority, and management of the environmental programs at SRS is a major activity. All site activities are overseen by one or more regulatory bodies, including the U.S. Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC). Significant effort and funding have been dedicated to ensuring that site facilities and operations comply with all requirements.

Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) was passed in 1976 to address the problem of solid and hazardous waste management. The law requires that EPA regulate the management of solid and hazardous wastes, such as spent solvents, batteries, and many other discarded substances deemed potentially harmful to human health and the environment. Amendments to RCRA regulate nonhazardous solid waste, and some underground storage tanks.

Under RCRA, hazardous waste generators are responsible for controlling every aspect of the generation, treatment, storage, and disposal of the waste; this is referred to as "cradle-to-grave control." Hazardous waste generators, including SRS, must follow specific requirements for handling these wastes. For many waste management activities, RCRA requires that owners and operators of operating or post-closure-care hazardous waste management facilities have a permit.

EPA is responsible for all hazardous waste regulations. However, EPA can delegate this authority

to a state when the state passes laws and regulations that meet or exceed EPA regulations and the state plan is approved by EPA. SCDHEC has been delegated RCRA authority. The Federal Facility Compliance Act (FFCAct) gives the state authority to enforce land disposal restrictions (LDRs)/treatment standards for mixed wastes. Also, SCDHEC has been authorized by the FFCAct to play the key role in the implementation of FFCAct statutes, and was the lead regulatory agency for implementation of the SRS Site Treatment Plan (STP), which addresses storage and treatment of mixed waste. More information on waste management at SRS can be found in chapter 4, "Environmental Restoration and Waste Management."

Federal Facility Compliance Act

The FFCAct was signed into law in October 1992 as an amendment to the Solid Waste Disposal Act to add provisions concerning the application of certain requirements and sanctions to federal facilities. With respect to federal agencies, the FFCAct waives sovereign immunity from all civil and administrative penalties and fines; this includes waiver for both coercive and punitive sanctions for violations of the Solid Waste Disposal Act. For mixed waste, the FFCAct provided a 3-year delay (until October 1995) in the imposition of fines and penalties so that DOE sites could investigate mixed waste volumes in storage, evaluate treatment capacities, and develop STPs with schedules for mixed waste treatment for approval by their state or federal regulatory agencies.

On March 30, 1995, DOE's Savannah River Operations Office (DOE–SR) submitted a proposed STP—developed with State of South Carolina involvement—that addressed the development of capacities and technologies for treating SRS mixed wastes according to LDRs, as required by the FFCAct. This plan was approved with modifications, and the FFCAct consent order was issued September 29, 1995.

Also in association with the FFCAct, Westinghouse Savannah River Company (WSRC) submitted a mixed waste inventory report January 13, 1993, and DOE Headquarters (DOE–HQ) issued a complexwide report—*U.S. Department of Energy Interim Mixed Waste Inventory Report: Waste Streams, Treatment Capacities, and Technologies*—April 21, 1993, to state governors and to regulatory agencies in states that host DOE sites. This was followed by a comment period for the regulators and states. DOE–HQ provided an update to the mixed waste inventory report in April 1994. DOE–HQ and SRS will prepare regular updates of the mixed waste inventory report every September to support the STP.

Land Disposal Restrictions

The 1984 RCRA amendments established LDRs, often referred to as "land ban." LDRs do not allow storage of restricted hazardous wastes, except for the purpose of accumulating such quantities as are necessary to facilitate proper recovery, treatment, or disposal. The amendments require that, prior to land disposal, all wastes meet treatment standards based on the "best demonstrated available technology."

The same restrictions apply to mixed wastes, which are composed of a mixture of radioactive and hazardous wastes. Because SRS did not have the capability to comply with the applicable LDR requirements, a Federal Facility Compliance Agreement (FFCA) was signed in March 1991 between DOE–SR and EPA Region IV (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee). The goal of the FFCA was to address SRS mixed waste compliance with LDRs. Since then, the LDR FFCA has been amended. Commitments made under the amended FFCA allowed for a smooth transition to a new commitment in the STP and in the STP Consent Order, which enforced the STP commitments. The effective date of the STP and the STP Consent Order was September 29, 1995.

As required by the STP Consent Order, SRS issued an annual update to the STP on April 30, 1996. In the update were changes in the mixed waste treatment status, including the addition of new mixed waste streams. Information for STP updates was supplied in part from a Mixed Waste Inventory Report completed in September 1995. Updates of both the STP and Mixed Waste Inventory Report will continue to be produced annually unless the State of South Carolina changes the requirement.

Treatability variances are an option available to facilities for particular waste streams that either cannot be treated at the level specified in regulations—the appropriate treatment technology may not be available—or for which the treatment technology is inappropriate for the waste. SRS has identified some mixed waste streams that are potential candidates for a treatability variance. One variance—for in-tank precipitation filters—was granted in October 1993 by EPA Region IV. The STP references three additional treatability variances for mixed wastes with special problems that prevent treatment according to LDR standards. The three variances are for (1) tritiated water with mercury, (2) silver saddles (silver nitrate-coated berl saddles

Some of the Key Regulations SRS Must Follow

Legislation	What it Requires/SRS Compliance Status
RCRA Resource Conservation and Recovery Act (1976)	♦ The management of hazardous and nonhazardous wastes and of underground storage tanks containing hazardous substances and petroleum products—in compliance
FFCAct Federal Facility Compliance Act (1992)	♦ The development by DOE of schedules for mixed waste treatment to avoid waiver of sovereign immunity and to meet LDR requirements—in compliance
CERCLA; SARA Comprehensive Environmental Response, Compensation, and Liability Act (1980); Superfund Amendments and Reauthorization Act (1986)	♦ The establishment of liability, compensation, cleanup, and emergency response for hazardous substances released to the environment—SRS placed on National Priority List in December 1989
CERCLA/TITLE III (EPCRA) Emergency Planning and Community Right-to-Know Act (1986)	♦ The reporting of hazardous substances used on site (and their releases) to EPA, state, and local planning units—in compliance
NEPA National Environmental Policy Act (1969)	♦ The evaluation of the potential environmental impact of federal activities and alternatives; in 1996, WSRC conducted 309 reviews for new proposed actions—in compliance
SDWA Safe Drinking Water Act (1974)	♦ The protection of public drinking water systems; enacted in 1974, amended in 1980, 1986—in compliance
CWA; NPDES National Pollutant Discharge Elimination System, Clean Water Act (1977);	♦ The regulation of liquid discharges at outfalls (e.g., drains or pipes) that carry effluents to streams—in compliance
CAA; NESHAP National Emission Standards for Hazardous Air Pollutants, Clean Air Act (1970)	♦ The establishment of air quality standards for hazardous air emissions, such as radionuclides and benzene—in compliance
TSCA Toxic Substances Control Act (1976)	♦ The regulation of use and disposal of PCBs—nation has inadequate disposal capacity for radioactive PCBs generated and currently stored at SRS

designed to take up iodine gas), and (3) lead acid batteries. EPA reviews of these variance requests are scheduled for September 1997 for the first two and September 1998 for the third. Schedules are included in the STP for preparation of variance request documents.

Underground Storage Tanks

Underground storage tanks at SRS house petroleum products, such as gasoline and diesel fuel, and hazardous substances (as defined by the Comprehensive Environmental Response, Compensation, and Liability Act, or CERCLA). All such tanks are regulated under Subtitle I of RCRA.

Underground storage tank regulations require that all regulated existing tanks be closed or upgraded to meet or comply with new tank standards by December 22, 1998. In 1996, WSRC closed two tanks by removal, initiated regulatory proceedings to close nine more, and performed tightness tests on 14

tanks and their connective piping. Every tank that was tested passed.

The regulations set standards for upgrading existing tanks based on their age. Existing tanks must be monitored for leaks, and records must be kept for inventory control. In areas where underground tanks are still needed, WSRC will replace single-walled tanks with double-walled tanks that have leak detection systems. During 1996, of the 25 total operational petroleum storage tanks at SRS, 19 met the new tank standards, and the remaining six are to be upgraded, replaced, or abandoned to meet the December 1998 deadline.

High-Level Waste Tank Closure

The mission of the SRS high-level waste tank closure effort at the F-Area and H-Area tank systems is to close out tanks in a way that ensures protection of human health and the environment, and in a technically and economically prudent manner. A general tank closure plan for F-Area and H-Area was developed to outline the protocol for closure. SCDHEC has provided conditional approval of this general plan.

Tank-specific closure modules will be developed for each tank system. These modules apply the general closure methodology to a specific tank system. Module 17F has been drafted; module 20F has been conditionally approved by SCDHEC. In addition, a tank closure plan has been developed and submitted to SCDHEC to meet an annual operating plan milestone. This document is a planning tool for managing high-level tank system closures, and it will be updated at least annually.

Closure for tanks 17F and 20F will involve filling the tanks; a layer of reducing grout inserted initially into the bottom of the tanks will be topped with controlled, low-strength material. Field work has begun for the closure of these two tanks and should be completed in 1997.

Environmental Protection Department (EPD) personnel participated during 1996 in a team effort with High-Level Waste Department personnel as writers/reviewers for the "Industrial Wastewater Closure Plan for F- and H-Area High-Level Waste Tanks." This document outlines the SRS/regulator protocol for closing all 51 high-level waste tanks on site. An Environmental Assessment (EA), which resulted in a Finding of No Significant Impact (FONSI), was issued in July 1996 to fulfill National Environmental Policy Act (NEPA) requirements for the closure action. EPA and SCDHEC approved the closure plan July 23, 1996, and July 31, 1996, respectively. EPD will continue to participate in this process as individual tank system closure modules are developed for closure of operational groupings of the SRS tank systems.

RCRA 3004(u) Program

The hazardous waste permit issued to SRS in September 1987 requires that the site institute a program for investigating and, if necessary, performing corrective action at solid waste management units under RCRA 3004(u). The RCRA 3004(u) requirements have been integrated with the CERCLA requirements because SRS is on the National Priority List—also known as the Superfund List. The integration of RCRA and CERCLA regulatory requirements will provide a more cost-effective and focused investigation and remediation process. The RCRA/CERCLA program status is detailed under the CERCLA section of this chapter.

Waste Minimization Program

The SRS Waste Minimization Program, a comprehensive plan to prevent pollution and minimize waste from all SRS operations, is designed to meet the requirements of RCRA, of DOE orders, and of applicable executive orders. The program focuses mainly on source reduction, on recycling, and on increasing employee awareness of and participation in pollution prevention. Since SRS initiated its formal Waste Minimization Program in 1991, the solid radioactive and hazardous waste generation volumes have decreased by about 70 percent. In addition, the types of materials collected for recycling and sale as salvageable materials have increased significantly, with more than 3,270 tons of scrap materials being diverted into the recycling market, versus disposal, during fiscal year 1996, and more than 95,000 pounds of excess chemicals being disbursed from the SRS Chemical Commodity Management Center for reuse. For more information on this program, refer to chapter 3, "Environmental Program Information," and chapter 4.

Notice of Violation (RCRA)

SCDHEC issued a Notice of Violation (NOV) to SRS October 14, 1993, alleging storage and disposal of mixed waste without a RCRA permit. The NOV was based on information reported to SCDHEC by SRS in September 1993, and—after continued discussions—the issue was resolved August 5, 1996, when SCDHEC executed Consent Order 96–30–HW. No NOV was issued to SRS under RCRA in 1996.

Comprehensive Environmental Response, Compensation, and Liability Act

SRS was placed on the National Priority List in December 1989, thereby making the site subject to CERCLA (Public Law 96–510), as amended by the Superfund Amendments and Reauthorization Act (SARA, Public Law 99–499). CERCLA assigns liability and provides for compensation, cleanup, and emergency response for hazardous substances released to the environment.

In accordance with Section 120 of CERCLA, DOE, EPA Region IV, and SCDHEC entered into a Federal Facility Agreement (FFA), which became effective August 16, 1993. Declaration of the effective date results in the FFA being an enforceable agreement. The FFA, which sets the milestones for environmental remediation at SRS, consolidates site cleanup activities into one comprehensive strategy.

Releases or potential releases from RCRA/CERCLA waste management units are evaluated under the FFA. Work plans detailing the proposed investigations for the RCRA/CERCLA units must be approved by both EPA and SCDHEC prior to implementation. During 1996, six investigations were initiated according to approved work plans and the schedule in Appendix D of the FFA.

Remediation under CERCLA imposes requirements in addition to existing RCRA requirements. CERCLA requires remedial decisions to be based on the results of a baseline risk assessment, which examines present and future risk to human health and the environment from the waste unit, using conservative, EPA-approved exposure scenarios.

CERCLA also requires public participation in the selection of remediation alternatives. A significant step in this process is the development of a Proposed Plan, which highlights key aspects of the remedial investigation and feasibility study. The plan also provides a brief analysis of remedial alternatives that were considered, identifies the preferred alternative, and tells the public how it can participate in the remedy selection process. After public comment is received, a Record of Decision (ROD) is issued that presents the selected remedy and provides the rationale for that selection. Also included in this process is the establishment of an administrative record file that documents the remediation alternatives and provides for public review of them.

RCRA Facility Investigation/Remedial Investigation (RFI/RI) field starts were initiated in Fiscal Year 1996 on three operable units: K-Area rubble pile, K-Area burning/rubble pit, and a third unit made up of the four SRL seepage basins. The parties issued two Proposed Plans for public comment during Fiscal Year 1996: Old Radioactive Waste Burial Ground Interim Action and Burma Road Rubble Pit. Remedial Actions and Interim Remedial Actions were initiated on three units in Fiscal Year 1996: D-Area Oil Seepage Basin Interim Action, TNX Groundwater Interim Action, and Old Radioactive Waste Burial Ground Interim Action. Interim Remedial Actions were completed on one unit in Fiscal Year 1996: D-Area Oil Seepage Basin Interim Action.

The FFA also identifies more than 300 site evaluation units for which investigations are required. Site evaluation reports for 24 areas were submitted to EPA and SCDHEC during 1996, compared to 24 areas in 1995 and 28 areas in 1994.

RCRA/CERCLA Units

Table 2–9, beginning on page 36, identifies

- examples of the 467 waste units and potential waste units at SRS (by location and building number)
- the 18 units that are RCRA-regulated and for which Interim Action or Final Records of Decision have been issued

Table 2–1 identifies units at SRS that are RCRA-regulated but that are not RCRA/CERCLA units.

Emergency Planning and Community Right-to-Know Act

The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 was enacted as a provision to SARA. EPCRA requires facilities to notify state and local emergency planning units about their hazardous chemical inventories and to report releases of hazardous chemicals.

Under Section 312 of EPCRA, SRS completes an annual Tier II Inventory Report for all hazardous chemicals present at the site in excess of specified quantities during the calendar year. Hazardous chemical storage information is submitted to state and local authorities by March 1 for the previous calendar year.

Under Section 313 of EPCRA, SRS must file an annual Toxic Chemical Release Inventory report by July 1. The site calculates chemical releases to the environment and reports aggregate quantities for each regulated chemical that exceeds established threshold

Table 2–1 Identification and Location of RCRA-Regulated Units at SRS

Site and Location	Building or Identification Number(s)
A-Area and M-Area	
SRL Mixed Waste Storage Tanks	776–A
M-Area Mixed Waste Storage Shed	316–M
M-Area Process Waste Interim Treatment Storage Facility	341–1M
M-Area Waste Storage Pad	315–4M
Metallurgical Laboratory Hazardous Waste Management Facility	904–110G
General Separations and Waste Management Areas (E-, F-, H-, S-, Y-, and Z-)	
Burial Ground Solvent Tanks (S23–S30)	
Consolidated Incineration Facility	261–H
DWPF Organic Waste Storage Facility	430–1S
Experimental TRU Waste Assay Facility/Waste Certification Facility	724–8E
Mixed Waste Tritiated Oil Storage Tank (S–32)	650–32E
Mixed Waste Storage Buildings (including Waste Storage Pads 20–22)	643–29E, –43E
TRU Waste Storage Pads 1–19	660–1E, –5E, –6E, –19E
N-Area (formerly Central Shops)	
Hazardous Waste Storage Facility	645–N, –2N, 4N, –710–B
Other	
Liquid Waste Solvent Tanks (S33–S36)	

amounts. The Pollution Prevention Act of 1990 expanded the Toxic Chemical Release Inventory reports to include source reduction and recycling activities. Pollution prevention information has been reported annually since 1991.

Form R of the Toxic Chemical Release Inventory report for 1995 was submitted to EPA in June 1996. Six chemicals, with releases totaling 60,503 pounds, were reported to EPA for 1995. This compares with eight chemicals (85,658 pounds of releases) reported during 1994. Through 1995, total toxic chemical releases had been reduced by about 98 percent compared to 1988, with the sharpest drop occurring between 1988 and 1989. Figure 2–1 shows the overall reduction in total toxic chemical releases at SRS for the period 1987–1995. Several factors have contributed to this reduction. Pollution prevention programs have exerted downward pressure on the use and release of toxic chemicals, resulting in significant decreases for chemicals such as chlorine, lead, Freon 113, and 1,1,1-trichloroethane. Two primary contributors to the dramatic decline in reported totals during the late 1980s were as follows:

- EPA initially identified chemicals for reporting that did not meet the toxic criteria later developed for EPCRA Section 313. For example, EPA delisted nontoxic chemicals such sodium sulfate; this resulted in a decline in reported releases for SRS.
- DOE curtailed nuclear production operations at SRS in 1989.

A breakdown of the comparison from 1993 through 1995 is presented in table 2–2. Lead represented a significant portion of the 1995 totals, as indicated in the table. Ninety-nine percent of the lead reported that year was sent off site for recycling and was identified as an offsite transfer on Form R. Form R treats offsite transfers as releases, but they actually are transfers of waste to EPA-approved facilities for further treatment or for storage, disposal, or recycling.

33/50 Pollution Prevention Program

In September 1992, DOE became the first federal agency to agree formally to participate in EPA's 33/50 Pollution Prevention Program. Under the agreement, DOE voluntarily adopted the program goals that are expected to reduce the use and release of 17 priority chemicals. The first goal, which called for a 50-percent reduction by the end of 1995, applied to SRS and other contractor-operated facilities that

already were reporting the releases under EPCRA in 1992. The second goal, which calls for a 33-percent reduction by the end of 1997, applies to the other contractor-operated facilities that met the reporting criteria in 1992 but had not previously reported the releases under EPCRA.

By 1993, the DOE complex had met its 50-percent reduction goals. With its achievement of the 33/50 goals, the DOE complex began to focus on reducing all toxic chemical releases, as identified in Executive Order 12856.

Executive Order 12856

Executive Order 12856 requires that all federal facilities comply with right-to-know laws and pollution prevention requirements. The order requires that federal facilities meet EPCRA reporting requirements and develop voluntary goals to reduce releases of toxic chemicals 50 percent on a DOE-wide basis by the end of 1999. SRS complies with the applicable requirements for EPCRA, as indicated in table 2–3, and the site incorporates into its pollution prevention efforts all of the toxic chemicals on the Toxic Chemical Release Inventory report.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) establishes policies and goals for the protection, maintenance, and enhancement of the human environment in the United States. The purpose of NEPA is to provide the federal government with a process for implementing these goals. The Act requires consideration of environmental factors during the planning process for all major federal activities that could significantly affect the quality of the environment. In practice, NEPA provides a means to evaluate the potential environmental impact of such proposed federal actions and to examine alternatives to those actions. Although implemented on site by the Energy Research and Development Administration during the 1970s, a formal management and operation contractor NEPA compliance group was not established at SRS until 1982. The ongoing mission of this group is to make recommendations regarding the level of NEPA review of a site-proposed action and to prepare draft

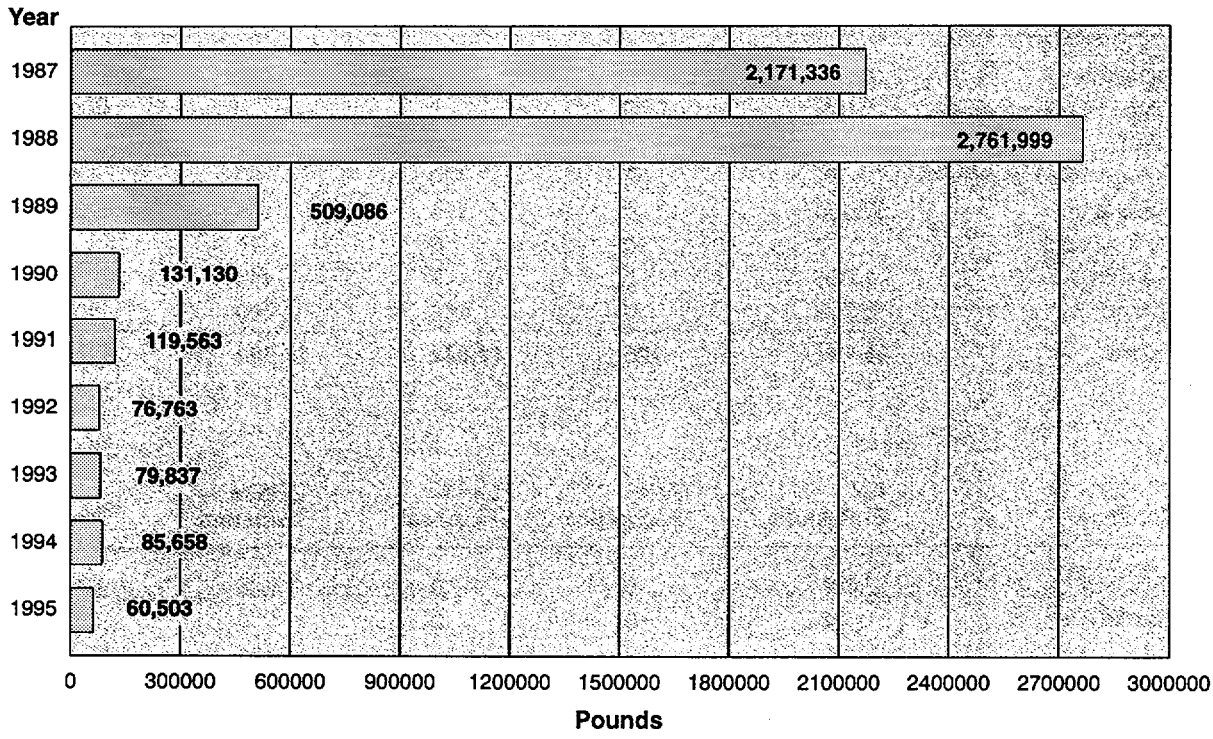

Figure 2–1 Total Toxic Chemical Releases at SRS, 1987–1995

Through 1995, total toxic chemical releases have been reduced by about 98 percent when compared to 1988. The sharpest drop occurred between 1988 and 1989, when EPA delisted nontoxic chemicals that did not meet toxic criteria for EPCRA Section 313.

Table 2–2 Releases of Toxic Chemicals (in Pounds) by SRS During 1993, 1994, and 1995 Reporting Years (Reported Under EPCRA Section 313)

1993

Chemical	Air Emissions	Water Discharges	Land Disposal	Offsite Transfers	Total
Ammonia	11,550	977	0	150	12,677
Chlorine	0	15	0	0	15
Lead	76	9	8,500	66	8,651
Manganese compounds	42	0	1,250	0	1,292
Methyl ethyl ketone	9,735	0	41	0	9,776
Methyl tert-butyl ether	540	0	0	0	540
Nitric acid	37,000	0	0	0	37,000
Sulfuric acid	0	0	0	1	1
Toluene	2,401	0	4	0	2,405
Xylene	7,428	0	52	0	7,480
Totals	**68,772**	**1,001**	**9,847**	**217**	**79,837**

1994

Chemical	Air Emissions	Water Discharges	Land Disposal	Offsite Transfers	Total
Benzene	5,878	0	4	9,276	15,158
Chlorodifluoromethane	19,500	0	5	0	19,505
Lead	8	172	10,000	2	10,182
Manganese compounds	31	53	1,499	23	1,606
Nitric acid	32,050	0	120	168	32,338
Sulfuric acid	0	0	0	15	15
Toluene	1,780	0	7	440	2,227
Xylene	3,950	0	17	660	4,627
Totals	**63,197**	**225**	**11,652**	**10,584**	**85,658**

1995

Chemical	Air Emissions	Water Discharges	Land Disposal	Offsite Transfers	Total
Benzene	7,600	0	0	1,724	9,324
Formic Acid	33	0	0	0	33
Lead	1	13	240	43,426	43,680
Sodium Nitrite	0	0	0	0	0
Nitric acid	224	0	0	0	224
Nitrate Compounds	2	7,240	0	0	7,242
Totals	**7,860**	**7,253**	**240**	**45,150**	**60,503**

Table 2–3 SRS Compliance with Executive Order 12856

EPCRA Citation	Activity Regulated	Applicable Requirement
302–303	Planning Notification	No
304	Extremely Hazardous Substances Release Notification	No
311–312	Material Safety Data Sheet/ Chemical Inventory	Yes
313	Toxic Release Inventory Reporting	Yes

documentation in support of DOE compliance with NEPA at SRS. In 1996, 309 reviews of new proposed actions were conducted at SRS and formally documented through Categorical Exclusions (CXs), Notices of NEPA Approval, or EAs. WSRC also provided technical support to DOE–SR for the preparation of Supplement Analyses (SAs), Environmental Impact Statements (EISs), Supplemental Environmental Impact Statements (SEISs), and Programmatic Environmental Impact Statements (PEISs).

The types and numbers of NEPA activities conducted at SRS during 1996 are presented in table 2–4. Among the specific activities were the following:

- On February 8, DOE issued a second Record of Decision (ROD) related to the Interim Management of Nuclear Materials EIS. This ROD describes the DOE's decision to process Mark-16 and Mark-22 fuels and blend the uranium down to low-enriched uranium using the SRS canyon facilities. DOE also decided to process the other aluminum-clad targets using a canyon facility and to vitrify the resulting solutions to a glass form at the site's Defense Waste Processing Facility (DWPF). A third ROD for this EIS was issued September 6. This more recent document described DOE's decision to stabilize neptunium solutions and targets, as well as the plutonium solutions stored in H-Canyon. The plutonium will be processed into metal, while the neptunium will be vitrified at DWPF.
- The final PEIS on the Proposed Policy for the Acceptance of U.S. Origin Foreign Research Reactor Spent Nuclear Fuel was issued February 16. The ROD for this programmatic document was signed May 13.
- In April, DOE announced that the Notice of Intent to prepare an EIS on a proposed upgrade of the canyon exhaust systems at SRS had been withdrawn. This decision was based on a substantial scope reduction of the proposed upgrade. DOE decided to replace in-kind equipment that has reached the end of its service life or that does not comply with current regulations.
- On June 12, DOE issued a Notice of Intent to prepare an EIS on the proposed shutdown of the SRS river water system. The draft EIS was issued for public review and comment November 8. Public hearings were held in December. The proposed action would result in the cessation of river water input to L-Lake and PAR Pond,

Table 2–4 Types/Numbers of NEPA Activities at SRS During 1996

Type of NEPA Documentation	Number
Categorical Exclusion (CX) Recommendation	3
Sitewide Categorical Exclusion/ Routine Insignificant Actions	294
Tiered by Previous NEPA Documentation	8
Environmental Assessment (EA)	9
Environmental Impact Statement (EIS)	8
Supplement Analysis	3
Supplemental Environmental Impact Statement (SEIS)	1
Programmatic Environmental Impact Statement (PEIS)	5
Total[a]	331

a Includes 309 reviews of new proposed actions in 1996 and 22 activities continued from 1995

formerly used as reactor cooling water reservoirs. More information on the river water system shutdown project can be found on page 34.

- The final EA and FONSI on the Closure of F- and H-Area High-Level Waste Tanks at SRS were issued on July 31. The EA assesses the potential impacts associated with the proposed emptying of 51 tanks holding approximately 34 million gallons of high-level waste. This EA included a preliminary evaluation of five proposed closure alternatives. DOE further developed a tank closure plan in support of the proposed action.

- A supplement analysis of Seismic Activity on F-Canyon was approved August 20. An earlier review of safety documentation indicated that this site facility might not be resistant to seismic activity, as assumed in the F-Canyon Safety Analysis Report. Detailed analyses revealed that the response of the facility to seismic activity would be well within the bounds of the aforementioned Safety Analysis Report and the analysis presented in the F-Canyon Plutonium Solutions EIS. Therefore, DOE determined that a supplemental EIS would not have to be prepared at this time.

- On September 5, DOE issued a Notice of Intent to prepare an EIS on the Accelerator Production of Tritium at SRS. Public scoping meetings in support of this EIS were held in December. The Accelerator Production of Tritium EIS will evaluate the potential impacts associated with the construction and operation of a linear accelerator for the production of tritium for nuclear stockpile purposes.

- A Notice of Intent to prepare an EIS on the construction and operation of a Tritium Extraction Facility at SRS was published in the Federal Register September 5. The Tritium Extraction Facility would extract tritium gas from targets irradiated in a commercial light water reactor or an accelerator. Public scoping meetings were held in December for the EIS.

- A revised FONSI was approved by DOE November 8 to change the scope of the proposed action described in the EA on Domestic Water Supply Upgrades and Consolidation at SRS (DOE/EA–0943). This scope change involved the siting, construction, and operation of a new domestic water line along an existing cleared right-of-way between two of the SRS operations areas.

- The final PEIS on Stockpile Stewardship and Management was distributed to the public November 8. A ROD signed by DOE December 23 appeared in the Federal Register December 26. This PEIS describes and analyzes alternatives to maintain the safety and reliability of the reduced nuclear weapons stockpile in the absence of underground nuclear testing. Based on the decisions described in the ROD, a small amount of stockpile material would be transferred from SRS to the Los Alamos National Laboratory.

- On December 23, DOE signed a Notice of Intent to prepare an EIS on spent nuclear fuel activities at SRS. Initiated by decisions made on the PEIS prepared by DOE on the spent nuclear fuel issue, this site-specific EIS would address alternatives related to SRS facilities to support the management of both domestic and foreign research reactor SN.

Table 2–5 contains a complete list of NEPA documentation activities at SRS during 1996.

The revised SRS sitewide procedure (Environmental Compliance Manual 3Q, Procedure 5.1, "Implementation of the National Environmental Policy Act") was issued at the end of December. Eleven new department NEPA coordinators completed the SRS certification program during 1996. SRS had 31 certified department NEPA coordinators within its various contractor organizations as of December.

SRS has the DOE-approved use of 53 CXs for sitewide routine insignificant actions on site. These CXs require approval only at the department NEPA coordinator level in the field prior to project implementation. SRS was the first site in the DOE complex to be granted such authority within the NEPA compliance process.

The site is continuing to revise its computerized database/tracking system for both completed and ongoing SRS NEPA documentation. This database was developed for reporting and analysis purposes. An SRS NEPA Home Page also was developed and is available to offsite computer users by means of the Internet.

As a result of the DOE NEPA secretarial policy issued in 1994, the site implemented several actions during 1995 that continued through 1996 and resulted in a more streamlined SRS NEPA process. A DOE comparison of EAs prepared throughout the complex indicated that SRS produces these NEPA documents more quickly and cost-effectively than the other DOE sites.

Safe Drinking Water Act

The federal Safe Drinking Water Act (SDWA)—enacted in 1974 to protect public drinking water sys-

Table 2–5 SRS Project NEPA Documentation Activities During 1996

Project Name	Level of NEPA Documentation
Acceptance of U.S. Origin Foreign Research Reactor Spent Nuclear Fuel	PEIS
Disposition of Surplus Highly Enriched Uranium	PEIS
DOE Waste Management	PEIS
Stockpile Stewardship and Management	PEIS
Storage and Disposition of Weapons-Usable Fissile Materials	PEIS
Accelerator Production of Tritium at SRS	EIS
Interim Management of Nuclear Materials	EIS
Shutdown of the SRS River Water System	EIS
SRS Spent Nuclear Fuel	EIS
SRS Waste Management	EIS
Disposition of Rocky Flats Plutonium Scrap	EIS
Tritium Extraction Facility at SRS	EIS
Upgrade of Canyon Exhaust System	EIS
Waste Isolation Pilot Plant	SEIS
Saltstone Disposal Alternative Design	SA
Seismic Activity on F Canyon	SA
Seismic Activity on H Canyon	SA
Closure of F and H Area High-Level Waste Tanks	EA
Commercial Wood Products Facility on SRS	EA
Domestic Water Supply Upgrades and Consolidation	EA
Expansion and Operation of Central Shops Borrow Pit (was "Central Services Works Engineering Borrow Pit" in 1995 Report)	EA
Offsite Processing of Depleted Uranium	EA
SRS Wetland Mitigation Bank Program	EA
Transportation of Radiological Materials	EA
Tritium Extraction Furnace Prototype	EA
Tritium Facility Modernization and Consolidation (was "Tritium Facility Upgrades" in 1995 Report)	EA

Key: *EA — Environmental Assessment*
SA — Supplement Assessment
EIS — Environmental Impact Statement
PEIS —Programmatic Environmental Impact Statement
SEIS — Supplemental Environmental Impact Statement

tems—was amended in 1980, 1986, and 1996. The SRS drinking water supply is from groundwater sources, which support 26 domestic water systems. The number of systems (originally 28) was reduced by two in 1996 by connecting D-Area and TNX Area and shutting down the P-Area water system. Eleven of the systems on site regularly serve more than 25 people each and meet the requirements for nontransient, noncommunity systems, which are regulated by SCDHEC. The remaining 15 systems, each of which serves fewer than 25 people, are classified as "state" systems by SCDHEC and receive a lesser degree of regulatory oversight.

SRS provides drinking water to the majority of its employees through the 11 nontransient,

noncommunity systems, which the site continues to work toward upgrading. Approval of the SRS Domestic Water Consolidation Preliminary Engineering Report was issued by SCDHEC May 24, 1993. The report recommended consolidation of the major site drinking water systems into three systems through the installation of

- three elevated storage tanks
- looped distribution piping
- a centralized water treatment facility

Plans had been to reclassify the L-Area system as a "state" system by September 1997, but because of a new mission in L-Area, this system now must be upgraded and will be tied to the K-Area system in 1997. Drinking water system consolidation, scheduled for completion by September 1997, replaces the upgrade plan submitted to SCDHEC in October 1991.

As of December 1996, the consolidation project was 8 months ahead of schedule. The following projects have been completed as part of system consolidation:

- K-Area water system (elevated storage tank, treatment, piping)
- D-Area water system (wells, elevated storage tank, treatment)
- A-Area Elevated Storage Tank
- D-Area and TNX-Area Connection
- C-Area/N-Area Elevated Storage Tank
- Piping upgrades in the following areas: A, B, C, D, N, Forestry, and TNX

On November 15, 1993, WSRC received analysis results indicating that lead and copper concentrations in the Forestry Area domestic water system exceeded SDWA regulatory action levels. As a result of this exceedance, and in accordance with Lead and Copper Rule requirements, WSRC installed a soda ash feed system (pH adjustment) in May 1995 as a corrosion control measure, although primarily bottled water is consumed in this area. Since the installation of this treatment system, the Forestry Area has received satisfactory samples from two consecutive 6-month monitoring periods and has been approved by SCDHEC to proceed with sampling under a reduced monitoring plan.

During 1996, lead and copper compliance sampling was performed under an SCDHEC-approved reduced-monitoring plan for SRS small domestic water systems in the following areas: B, C, D, F, H, K, L, N, P, S, and TNX. A-Area has been approved for ultrareduced monitoring and is not required to sample until 1998.

None of these systems exceeded the lead and copper action levels in the 90th percentile during 1996. The National Primary Drinking Water Regulations specify that treatment technique requirements are triggered by exceedances of the lead and copper action levels measured in the 90th percentile.

Clean Water Act

NPDES

The CWA of 1972 created the NPDES program, which is administered by SCDHEC under EPA authority. The program is designed to protect surface waters by limiting releases of effluents into streams, reservoirs, and wetlands. Radiological effluents are limited under DOE orders. Discharge limits are set for each facility to ensure that SRS operations do not adversely impact water quality.

SRS had five NPDES permits for most of 1996—two for industrial wastewater discharge (SC0000175 and SC0044903), two for general stormwater discharge (SCR000000 and SCR100000), and one for land application (ND0072125). Permits SC0000175 or SC0044903 regulated 83 active and inactive NPDES outfalls at SRS during much of 1996. Based on repermitting activities that take into account current circumstances at SRS, SCDHEC issued SRS a single new permit August 6 to replace the expired but administratively extended SC0000175 and SC0044903 permits. This new permit recognizes 37 active outfalls and requires the analysis each year of approximately 5,800 parameters to show compliance. All monitoring was reported to SCDHEC in the monthly Discharge Monitoring Reports, as required by the permit. [SRS Data, 1997].

A list of exceedances, including outfall locations, probable causes, and corrective actions, can be found in chapter 8, "Nonradiological Effluent Monitoring."

In October 1996, SCDHEC personnel conducted a 2-week audit in which SRS wastewater facilities were inspected and the permitted NPDES outfalls were sampled. All the facilities passed the operations/maintenance part of the audit. Sample analytical results indicated that the facilities had no problems and that there were two exceedances, which were explained in the October Discharge Monitoring Report.

Because of the new NPDES permit, many of the outfalls covered under the old permit have been reevaluated and now are covered under general stormwater permit SCR000000 for stormwater

discharges associated with industrial activity, excluding construction activity. The permit requires that the stormwater discharges be sampled and that the data generated be compiled and evaluated. Under the old NPDES permit, 11 outfalls were monitored as representative of the 48 stormwater outfalls listed. With the new permit, many of the outfalls that were covered have been reevaluated as being stormwater only and will be covered under the SCR000000 permit. These are being evaluated, and those that qualify will be added to the stormwater program, with representative outfalls to be chosen for sampling. The stormwater outfalls represent a wide range of SRS activities, including

- storage, use, or disposal of EPCRA Section 313 chemicals
- land disposal units
- steam electric generation
- chemical and allied product manufacturing
- borrow pits

As required by the general permit, a pollution prevention plan was developed and implemented in 1993 and updated in 1996 for the identified stormwater outfalls. The plan identifies facility areas where "best management practices" and/or "best available technology" should be implemented to prevent or mitigate the release of pollutants with stormwater runoff.

All construction activity that would result in a land disturbance of 5 or more acres must be permitted. Currently, the 15 land areas associated with industrial activity from construction activity are permitted as required under Permit SCR100000. The pollution prevention plan for this permit also requires a sediment reduction and erosion control plan.

Under the federal Oil Pollution Prevention regulation (40 CFR 112), SRS must report petroleum product discharges of 1,000 gallons or more into or upon the navigable waters of the United States, or petroleum product discharges in harmful quantities that result in oil sheens. No such incidents occurred at the site during 1996.

SRS has an agreement with SCDHEC to report petroleum product discharges of 25 gallons or more to the environment. Two such incidents occurred at the site during 1996.

Dredge and Fill; Rivers and Harbors

The Clean Water Act, Section 404, "Dredge and Fill Permitting," as amended, and the Rivers and Harbors Act, Sections 9 and 10, "Construction Over and Obstruction of Navigable Waters of the United States," protect U.S. waters from dredging and filling and construction activities by permitting of such projects. Through implementation of regulations in 33 CFR and 40 CFR, dredge and fill operations in U.S. waters are defined, permitted, and controlled. In 1996, seven projects were permitted under 33 CFR 330 (a general permit under Section 404) of the nationwide permit (NWP) program. The domestic water upgrade was permitted under NWP 12, "Utility Line Backfill and Bedding." Bridges over Upper Three Runs Creek at Road F and Road 8–1, Fourmile Branch at Road 4, and Lower Three Runs Creek at Road B were permitted under NWP 3, "Maintenance." Also, three erosion control projects of less than one acre each were permitted under NWP 26, "Headwaters and Isolated Waters Discharges." These projects were located near F-Area and Z-Area.

Construction in Navigable Waters

SCDHEC Regulation 19–450, "Permit for Construction in Navigable Waters," protects the state's navigable waters through the permitting of any dredging, filling, construction, or alteration activity in, on, or over state navigable waters, in or on the beds of state navigable waters, or in or on land or waters subject to a public navigational servitude. The only state navigable waters at SRS are Upper Three Runs Creek (through the entire site) and Lower Threes Runs Creek (upstream to the base of the PAR Pond Dam). In 1996, several SRS projects were permitted under Regulation 19–450. On Upper Three Runs, permits were received for the pipe bridge crossing at Road F and the traffic bridges at Roads C, F, 2–1, and 8–1. On Lower Three Runs, a permit was received for construction of the bridge at Road B.

Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act restricts the application of pesticides through a state-administered certification program. SRS's pesticide procedure provides guidelines for pesticide use and requires that applicators be state certified. A pesticide-use task group evaluates planned pesticide programs to ensure that they are acceptable and that appropriate pesticides are used so that any impact on the environment is minimal. The task group also

- maintains records of pest control activities
- assists in communicating information about pesticide use to other site contractors

- contacts offsite utility companies to determine the pesticide applications they plan for right-of-way maintenance on SRS property

SRS pesticide programs typically include such activities as the maintenance of roadways and fence lines through the use of herbicides.

Clean Air Act

Regulation, Delegation, and Permits

The CAA provides the basis for protecting and maintaining air quality. Some types of SRS air emissions, such as radioactive sources and ozone-depleting substances (ODS), are regulated by EPA, but most are regulated by SCDHEC, which must ensure that its air pollution regulations are at least as stringent as the CAA's. This is accomplished through SCDHEC Regulation 61–62, "Air Pollution Control Regulations and Standards."

Under the CAA and as defined in federal regulations, SRS is classified as a "major source" and, as such, is assigned one permit number (0080–0041) by SCDHEC. In this permit, each emission source is identified by the area designation, by a point identification number, and by a source description. SRS holds operating and construction permits from SCDHEC's Bureau of Air Quality Control, which regulates nonradioactive toxic and criteria pollutant emissions from approximately 192 point sources, several of which have specific emission limits. As of May 1994, SCDHEC had completed renewal of all SRS operating permits, which are valid for 5 years. Of the 192 point sources, 155 were in operation in some capacity during 1996. The remaining 37 sources either were under construction or were being maintained in a "cold standby" status.

During 1996, SCDHEC conducted 192 source compliance inspections at SRS, including biennial stack tests, initial operation inspections following completion of construction, and annual compliance inspections. As indicated earlier, the 1996 compliance rate was 100 percent, and the site received no NOVs.

National Emission Standards for Hazardous Air Pollutants

The National Emission Standards for Hazardous Air Pollutants (NESHAP) is a CAA-implementing regulation that sets air quality standards for air emissions containing hazardous air pollutants, such as radionuclides, benzene, and asbestos. The NESHAP regulations found in 40 CFR 61 are divided into subparts based on specific hazardous pollutant categories, such as Subpart H for radionuclides and Subpart M for asbestos. The Clean Air Act Amendments (CAAA) of 1990 revised the original list of hazardous air pollutants. The revised list of 189 air pollutants includes all radionuclides as a single item. Regulation of these pollutants, except for radionuclides, has been delegated to SCDHEC; EPA Region IV regulates radionuclides.

SRS, like most South Carolina industrial complexes, uses a number of chemicals identified by SCDHEC as toxic air pollutants and by EPA as hazardous air pollutants. These include many common consumer products—e.g., off-the-shelf bug sprays, correction fluids, paints, sealers, janitorial cleaning supplies, gasoline for vehicles, etc.—as well as a number of typical industrial chemicals, such as degreasers, solvents, metals, batteries, and diesel fuel. But SRS has at least one category, radionuclides, not found in typical industrial settings. During the course of normal operations, some radionuclides are released to the air.

NESHAP Radionuclide Program The SRS NESHAP radionuclide program continues to change to incorporate sampling, monitoring, and dose assessment practices that meet or exceed the requirements of 40 CFR 61, Subpart H. The radionuclide FFCA was signed October 31, 1991; the first amendment to the FFCA for radionuclide NESHAP was signed by EPA Region IV on August 16, 1993. This amendment provided SRS an extension of the original FFCA through February 10, 1995, to accomplish monitoring equipment upgrades to several additional sources. These upgrades were completed on time, and the FFCA was officially closed by EPA Region IV on May 10, 1995.

During 1996, the maximally exposed individual effective dose equivalent, calculated using the NESHAP-required CAP88 computer code, was estimated to be 0.06 mrem (0.0006 mSv), which is 0.6 percent of the 10-mrem-per-year (0.10-mSv-per-year) EPA standard (chapter 7, "Potential Radiation Doses").

NESHAP Nonradionuclide Program SRS uses many chemicals identified as toxic or hazardous air pollutants, but the majority of these chemicals are not regulated under the CAA or under federal NESHAP regulations. Except for asbestos, SRS facilities and operations do not fall into any of the "categories" listed in the subparts. Under Title III of the federal CAAA of 1990, EPA in December 1993 issued a final list of hazardous air pollutant-emitting source categories potentially subject to maximum achievable control technology standards. These standards are being developed and issued over a 10-year period that will end in the year 2000, based on a schedule arranged according to

- the effects of each pollutant
- the industry group source category
- the abatement technology available

In an attempt to regulate hazardous or toxic air pollutants in South Carolina, SCDHEC established Air Pollution Control Regulation 61–62.5, Standard No. 8, "Toxic Air Pollutants," in June 1991. To demonstrate compliance with this standard, SRS completed and submitted an air emissions inventory and air dispersion modeling data for all site sources in 1993. The submitted data demonstrated compliance by computer modeling the accumulated ambient concentration of individual toxic air pollutants at the boundary line and comparing them to the Standard No. 8 maximum allowable concentrations. To ensure continued compliance with Standard No. 8, new sources of toxic air pollutants must be permitted, which requires submittal of appropriate air permit applications and air dispersion modeling. Sources with emissions below a threshold of 1,000 pounds per month of any single toxic air pollutant may be exempted from permitting requirements. During 1996, seven sources of toxic air pollutants either were issued a construction permit or exempted from permitting requirements.

NESHAP Asbestos Removal Program Asbestos insulation, considered one of the best boiler and piping insulators, can be found in older buildings throughout SRS. This is because people were unaware of the danger of airborne asbestos fibers in the early 1950s, when SRS was constructed. Today, however, it is known that asbestos can cause cancer in humans. The site implemented an asbestos removal program in 1988.

Asbestos is removed during maintenance and renovations of equipment and buildings. During 1996, SRS removed 12,547 square feet of transite panel, which contains asbestos. Also removed were 4,283 linear feet and 2,481 square feet of asbestos pipe and surface insulation. This compares with 9,253 square feet of transite panel and 3,486 linear feet and 1,678 square feet of asbestos pipe and surface insulation removed during 1995. Estimates of the percentage of total friable asbestos (a form that can be crumbled or pulverized with hand pressure when dry) removed from SRS cannot be accurately determined because it is not known exactly how much exists on site. SRS will continue to identify and remove such asbestos according to state (SCDHEC R.61–86.1) and federal (40 CFR 61, Subpart M) regulations and "best management practices."

Other CAA Requirements Only a few of the major sections of the CAA and its 1990 amendments and regulations have had—or are expected to have—a significant impact on SRS sources and facilities. These include Title V, "Operating Permit Program," and Title VI, "Stratospheric Ozone Protection." The other regulations impacting SRS facilities are implemented primarily in SCDHEC Regulation 61–62 and existing operating or construction permits.

Air Emissions Inventory SCDHEC Regulation 61–62.1, Section III, "Emissions Inventory," requires compilation of an air emissions inventory. To demonstrate compliance, SRS personnel conducted a comprehensive air emissions inventory of all site facilities in 1993. Other purposes of this inventory were

- to ensure that all radiological and nonradiological sources had been accounted for
- to better characterize emission points from site processes
- to provide data for air dispersion modeling that had been required for compliance with Regulation 61–62.5, Standard No. 2 ("Ambient Air Quality Standards") and Standard No. 8.

Guidelines and procedures were written to ensure documentation of all vents and stacks for each building and to calculate emissions based on design capacity, maximum potential emissions, and actual emissions for a selected period of time.

The inventory identified approximately 5,300 radiological and nonradiological air emissions sources. Air emissions data from 1990 established the SRS baseline emissions. Calculations from the 1990 data demonstrated that SRS complied with Standard No. 8. The information from this inventory for all emission sources will be used as input into SRS's Title V permit application, as well as to meet other SCDHEC requirements. One such requirement is that inventory data must be *recorded* annually and *reported* every other year. Data from 1995 were *reported* in 1996. Compilation of 1996 data will be completed in 1997.

Title V Operating Program As previously indicated, the CAAA of 1990 also include, under Title V, a major new permitting section expected to have a significant impact on the site. The primary purpose of the Title V permitting program is to establish federally enforceable operating permits for major sources of air emissions. The implementation plan for this program, submitted to EPA in 1993 by the State of South Carolina and subsequently approved by EPA in June 1995, required that SRS submit an extensive application package for air

emission sources at the site by March 15, 1996; SRS submitted the Title V permit application before the deadline. The full impact on the site is not yet known because the source information and regulation applicability still are being determined. In addition to sources already on existing SCDHEC operating or construction permits, the new permit resulting from Title V may include sources previously "grandfathered" by existing regulations, and it is expected to add a number of new regulatory requirements.

Ozone-Depleting Substances The CAAA of 1990 contained a chapter under Title VI addressing stratospheric ozone protection. This law requires that EPA establish a number of regulations to phase out the production and consumption of ODS. The substances commonly are used as refrigerants in air conditioning and cooling systems; as degreasers and cleaners; as spray can propellants; as fire suppressants (Halon); and as laboratory extractions; and in many other common consumer products.

Several sections of Title VI of the CAAA of 1990, along with recently established EPA regulations, apply to the site. The ODSs are regulated in two general categories: Class I substances—chlorofluorocarbons (CFCs), Halon, carbon tetrachloride, methyl chloroform, methyl bromide, and hydrobromofluorocarbons (HBFCs)—and Class II substances, or hydrochlorofluorocarbons (HCFCs). Class I ODSs are about 10 times more ozone-depleting than HCFCs and thus are more strictly regulated. As required by the CAAA of 1990, most Class I Halon was phased out of production by January 1, 1994, and other Class I ODSs were phased out by January 1, 1996. This means that several very important refrigerants (CFC 11, 12, 114, and 502) used on site essentially may become unavailable for purchase. Many of the large chillers on site that use these refrigerants are being scheduled for total replacement or for retrofits that will use HCFCs or other chemical substitutes. The site also is scheduling fire suppression (Halon) system replacements. Many common degreasers are Class I ODSs and have been targeted for replacement. Most major degreasing applications already have been eliminated or replaced with non-ODS. Smaller ODS degreasing applications, such as those in maintenance and electrical shops, are being targeted for phaseout. ODSs used in laboratory extraction procedures will be replaced when EPA approves newly developed processes that use non-ODSs.

The SRS CAAA of 1990 Title V air permit application includes ODS emission sources. All large (greater than or equal to 50-pound charge) heating, ventilation, and air conditioning (HVAC)/chiller systems for which there are recordkeeping requirements are included as fugitive emission sources.

In 1994, the site formed a CFC steering committee of participants from all the major users of these substances to provide initial direction in the phaseout of Class I ODSs on the site. A number of technical subcommittees also were initiated at that time to address particular applications, such as refrigeration, fire suppression, degreasers, laboratory applications, and environmental compliance. The ODS Subcommittee of the Central Environmental Committee was created in 1995 to communicate to site organizations—through field representatives—any changes in Title VI regulations that could affect established programs. The "Savannah River Site Refrigerant Management Plan," completed and issued in September 1994, provides guidance to assist SRS and DOE in the phaseout of CFC refrigerants and equipment.

The site has

- purchased certified recycling equipment
- trained and certified technicians where required
- implemented required recordkeeping and leak-tracking for large cooling systems
- implemented proper labeling and other record-keeping requirements

In 1996, SRS let a subcontract for the offsite reclamation of used refrigerants. The site also eliminated the use of CFC–114 by completing replacement of the 789–A chiller plant with a new plant that uses a non-CFC refrigerant. The 55,000 pounds of CFC–114 will be sold as part of a decontamination and decommissioning (D&D) contract. Additionally, Executive Order 12856 requires a 50-percent reduction in CFC usage by the end of 1999, based on 1993 data. SRS surpassed the 21,116-pound 1999 goal in 1996 by reducing CFC refrigerant usage to 12,570 pounds.

Three other central refrigerant plant projects—for tritium facilities, F-Canyon, and H-Canyon—were initiated in 1996 to further reduce the site's dependence on Class I ODSs.

Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) gives EPA comprehensive authority to identify and control chemical substances manufactured, imported, processed, used, or distributed in commerce in the United States. Reporting and recordkeeping are mandated for new chemicals and for any chemical

that may present a substantial risk of injury to human health or the environment. EPD and the Industrial Hygiene Section coordinate reporting and recordkeeping requirements under TSCA.

Polychlorinated biphenyls (PCBs), which are chemicals specifically regulated under 40 CFR 761 of TSCA, have been used in the past in various SRS processes. PCBs were used on site in pre-1979 electrical equipment in the form of transformers, small capacitors, and fluorescent light ballasts. The site has a well-structured PCB program that complies with TSCA regulation 40 CFR 761, with DOE orders, and with WSRC policies. The 1995 PCB Annual Document Log was completed prior to the July 1, 1996, deadline in full compliance with the regulations. Disposal of PCBs from SRS is conducted at EPA-approved disposal facilities within the regulatory time frame.

In August 1993, PCBs were confirmed to be present as a component of dense nonaqueous phase liquids in samples from two groundwater monitoring wells around the M-Area hazardous waste management facility. Regulators were notified and a modification to the RCRA Part B Permit Application to address the discovery of PCBs was submitted to SCDHEC in December 1993. Any waste generated was handled according to the appropriate TSCA and RCRA requirements. Savannah River Technology Center (SRTC) continues to study ways to remediate the dense nonaqueous phase liquids.

Certain PCB waste generated by SRS during the late 1970s and early 1980s was radioactively contaminated. Most of the radioactively contaminated waste resulted from a 1978 spill of PCBs from a failed electrical capacitor inside a nuclear materials processing area. TSCA regulations call for annual disposal of PCB waste, but there is insufficient capacity for disposal off site of radioactive PCB waste. A request to conduct a treatability study on this waste was approved by EPA in August 1995, and work continued on the study from late 1995 until May 1996. The study included the evaluation of three chemical dechlorination technologies and one thermal desorption/vacuum extraction technology. The chemical dechlorination technologies were unsuccessful in treating the waste below TSCA thresholds. The test of the thermal desorption/vacuum extraction process was terminated prior to its conclusion because of vendor equipment malfunction and the shutdown of the vendor facility. The residuals from the study subsequently were returned to SRS for storage. SRS now is working to ship the waste to the Oak Ridge TSCA incinerator, but this process is not expected to be completed until 1998 at the earliest.

In 1996, PCBs were detected in certain painted surfaces and electrical cable at the Heavy Water Components Test Reactor. The materials were analyzed as part of the predemolition characterization of the building. Subsequently, varying amounts of PCBs were detected in painted surfaces in two other site facilities. Prior to this discovery, the use of PCBs in paints and other solid items at SRS was unrecognized. The site is investigating the issue of PCBs in solids in older, pre-TSCA structures and is working with EPA on the appropriate path forward.

During 1996, SRS completed the reclassification as non-PCB of 20 electrical transformers that previously contained PCBs. At this time, all the site's electrical transformers are non-PCB. Also during 1996, SRS ended its investigation into the source of PCBs detected in 1994 in the R-Reactor disassembly basin sediment and water. Analyses of several items identified as possible sources did not reveal PCBs.

Endangered Species Act

The Endangered Species Act of 1973, as amended, provides for the designation and protection of wildlife, fish, and plants in danger of becoming extinct. The act also protects and conserves the ecosystems on which such species depend.

Several threatened and endangered species exist at SRS. The site conducts research on the wood stork, the red-cockaded woodpecker, the bald eagle, the shortnose sturgeon, and the smooth purple coneflower. A study of the bald eagle at PAR Pond and L-Lake was completed in 1996 to comply with the Endangered Species Act, as requested by the U.S. Fish and Wildlife Service. Programs designed to enhance the habitat of such species also are in place.

NEPA documentation was prepared and reviewed for several new projects at SRS in 1996. A biological assessment conducted for the Enviro-Comp site found no activities that would significantly impact endangered species. A biological assessment for the River Water System Shutdown EIS concluded that the proposed action could affect the bald eagle, the alligator, and the wood stork. This conclusion resulted in ongoing consultations with U. S. Fish and Wildlife Services personnel, as pursuant to Section 7, "Interagency Cooperation," of the Act.

National Historic Preservation Act

The National Historic Preservation Act of 1966, Section 106, governs the protection and preservation of archaeological and historical resources. SRS ensures that the site is in compliance with this act through the site-use process. All sites being considered for activities such as construction are

evaluated by the University of South Carolina's archaeology group to ensure that archaeological or historic sites are not impacted. NEPA reviews were conducted for numerous new projects at SRS during 1996; only one project—the Three Rivers Landfill Project—was found to have activities of significant impact in terms of the National Historic Preservation Act. This project contained four sites eligible for nomination to the National Registry for Historic Places. The landfill was located so that impacts to three of the four sites can be avoided; the four site was excavated to preserve artifacts.

Floodplains and Wetlands

Under DOE General Provisions, 10 CFR, Part 1022 ("Compliance with Floodplains/Wetlands Environmental Review Requirements"), establishes policies and procedures for implementing DOE's responsibilities in terms of compliance with Executive Orders 11988 ("Floodplain Management") and 11990 ("Protection of Wetlands"). Part 1022 includes DOE policies regarding the consideration of floodplains/wetlands factors in planning and decision making. It also includes DOE procedures for identifying proposed actions involving floodplains/wetlands, providing early public reviews of such proposed actions, preparing floodplains/wetlands assessments, and issuing statements of findings for actions in floodplains.

Executive Order 11988, "Floodplain Management"

Executive Order 11988, "Floodplain Management," was established to avoid long- and short-term impacts associated with the occupancy and modification of floodplains. Evaluation of impacts to SRS floodplains is ensured through the NEPA Evaluation Checklist and the site-use system. Site-use applications are reviewed for potential impacts by WSRC, DOE–SR, SRFS, and the Savannah River Ecology Laboratory (SREL), as well as by professionals from other organizations. NEPA reviews of new projects at SRS in 1996 found no activities of significant impact with respect to Executive Order 11988.

Executive Order 11990, "Protection of Wetlands"

Executive Order 11990, "Protection of Wetlands," was established to mitigate adverse impacts to wetlands caused by destruction and modification of wetlands and to avoid new construction in wetlands wherever possible. Avoidance of impact to SRS wetlands is ensured through the site-use process, various departmental procedures and checklists, and project reviews by the SRS Wetlands Task Group. Many groups and individuals, including scientists at SRTC, SREL, and EPD, review site-use applications to ensure that proposed projects do not impact wetlands. NEPA reviews of new projects at SRS in 1996 found no activities of significant impact with respect to Executive Order 11990. Potential impacts outlined in the River Water System Shutdown EIS will be mitigated as necessary for SRS to fulfill the DOE policy of "no net loss" of wetlands.

Environmental Release Response and Reporting

Response to Unplanned Releases

The SRS environmental monitoring program extends beyond routine effluent monitoring and environmental surveillance activities. Upon request by area operations personnel, the Environmental Monitoring Section (EMS) is prepared to respond to unplanned environmental releases—both radiological and nonradiological.

In 1996, there were a number of unplanned environmental releases, but area operations personnel did not require the sampling and analysis services of EMS. If the services of EMS personnel are requested, the samples collected are given priority in preparation and, if radiological in nature, priority in the count room. Data are validated and a determination is made as to whether there has been an actual release. If there has, then consequences to the public and the environment are determined.

Occurrences Reported to Regulatory Agencies

"Federally permitted" releases comply with legally enforceable licenses, permits, regulations, or orders. Under the Atomic Energy Act, for example, releases of SRS radionuclides are federally permitted as long as public dose standards in DOE orders are not exceeded.

If a nonpermitted release to the environment of a reportable quantity (RQ) or more of a hazardous substance (including radionuclides) occurs, CERCLA requires notification of the National Response Center. Also, the CWA requires that the National Response Center be notified if an oil spill causes a "sheen" on navigable waters of the United States, such as rivers, lakes, or streams. Reporting of oil spills was reinforced with liability provisions in CERCLA's National Contingency Plan.

Other CERCLA provisions allow exemptions from reporting a release of an RQ or more of a hazardous substance if the release is covered by a

Table 2–6
CERCLA Releases Reported to Regulatory Agencies in 1996

Date	Applicable Regulation/ Reason for Notification	Agencies Notified	Description
Jan. 23	Exceeded RQ of 1 pound	EPA/SCDHEC	Released to ground about 8 pounds of condensate liquid (suspected of being hazardous waste but later determined to contain less than the RQ of hazardous constituents)
Feb. 14	Exceeded RQ of 1 pound	EPA/SCDHEC	Released to ground 14–22 pounds of condensate liquid (suspected of being hazardous)

continuous-release notification or if it is federally permitted. A continuous-release notification provides an exemption from reporting each release of a specific hazardous substance greater than an RQ. The site submitted two continuous-release notifications in 1992—for ethylene glycol and for asbestos, each of which had a statutory RQ of 1 pound. SRS withdrew the request for continuous-release notification status for ethylene glycol in 1995, when EPA made an adjustment to that RQ. The asbestos continuous-release notification request is still active.

During 1996, SRS notified regulatory agencies of two CERCLA reportable releases, which are described in table 2–6. This performance compares with four such releases reported during 1995, two during 1994, zero during 1993, three during 1992, and four during 1991.

Also, SRS made six notifications to SCDHEC in 1996 based on agreements with the state. Three were for sewage releases of more than 100 gallons; two were for petroleum spills of more than 25 gallons; and one was a permit exceedance.

EPCRA (40 CFR 355.40) requires that reportable releases of extremely hazardous substances or CERCLA hazardous substances be reported to any local emergency planning committees and state emergency response commissions likely to be affected by the release. There were no EPCRA reportable releases in 1996.

It is SRS policy to notify SCDHEC and the Georgia Department of Natural Resources (GDNR) of any occurrence that may interest state regulatory agencies. Although not required by law, these "courtesy notifications" enhance environmental protection objectives. SRS made eight such notifications to SCDHEC in 1996.

Site Item Reportability and Issues Management (SIRIM) Program

The Site Item Reportability and Issues Management (SIRIM) program, mandated by DOE Order 232.1 (which superceded DOE Order 5000.3B), "Occurrence Reporting and Processing of Operations Information," is designed to "... establish a system for reporting of operations information related to DOE-owned or operated facilities and processing of that information to provide for appropriate corrective action ... ." It is the intent of the order that DOE be "... kept fully and currently informed of all events which could: (1) affect the health and safety of the public; (2) seriously impact the intended purpose of DOE facilities; (3) have a noticeable adverse effect on the environment; or (4) endanger the health and safety of workers."

The SIRIM program at SRS is designed to meet the requirements of DOE Order 232.1 by ensuring that

- all occurrences specified are identified in a timely manner, categorized, and reported
- proper corrective actions are taken in a timely manner
- all reportable occurrences are reviewed to assess significance and root causes
- occurrence reports to DOE operations are disseminated to prevent the recurrence of similar events

All SIRIM events are classified in one of the following categories: (1) facility condition; (2) environmental; (3) personnel safety; (4) personnel radiation protection; (5) safeguards and security; (6) transportation; (7) value-based reporting; 8) facility status; or 9) cross-group items. The impact—or the anticipated impact—of each event is categorized as follows (based on criteria in site procedures):

Table 2–7
Environmentally Related Unusual Occurrences Reported Through SIRIM in 1996

Discovery Date	Occurrence	Report No. (SR–WSRC–)	Cause/Explanation[a]
Feb. 7	About 135 gallons of fuel oil spilled to the ground at Bldg. 292–S, Diesel Fuel Storage Tank #2	WVIT–1996–0003	Attributed to suspected clogged filters; investigation nearing completion at year-end
Feb. 14	Fourteen to 22 pounds (about 2 gallons) of condensate liquid, suspected of being hazardous, leaked to the ground from an off-gas system filter compartment housing at the Consolidated Incineration Facility (Bldg. 261–H)	CIF–1996–0009	Attributed to human error and design deficiency; corrected by installing drain lines to bottom of filter compartment housing
Mar. 22	Waste filter housings received from off site was potentially inaccurately characterized	SLDHZD–1995–0013	Attributed to failure to take into consideration cadmium-plated, cold-rolled steel used as construction material
Nov. 11	About 150 gallons of diesel fuel spilled from a logging truck along about 24 miles of SRS roads	CSWE–1996–0009	Investigation in progress at year-end

a SRS takes followup corrective actions to minimize the impact on the environment.

- **Emergency** – the most serious event; requires increased alert status for onsite and, in specific cases, offsite authorities
- **Unusual occurrence** – a nonemergency event that has significant impact or potential for impact on safety, environment, health, security, or operations
- **Off-normal occurrence** – an abnormal or unplanned event or condition that deviates from established standards or specifications

In 1996, of the approximately 532 SIRIM-reportable events, 25 were categorized as primarily environmental. Of these 25 events, none were classified as emergencies, four were classified as unusual occurrences, and 21 were classified as off-normal occurrences. Table 2–7 lists the four unusual occurrences reported through SIRIM in 1996.

Assessments/Inspections

The SRS environmental program is overseen by a number of organizations, both outside and within the DOE complex. In 1996, the WSRC environmental appraisal program consisted of self and independent assessments. The new program employs total-quality management concepts that support the site's four imperatives of safety, disciplined operations, continuous improvement, and cost effectiveness. It also ensures recognition of noteworthy practices, identification of performance deficiencies, and initiation and tracking of associated corrective actions until they are satisfactorily completed. The primary objectives of the WSRC assessment program are to ensure compliance with regulatory requirements and to foster continuous improvement.

In addition to the assessment program, DOE–SR's Environmental Quality & Management Division (EQMD) ensures—through independent reviews of SRS environmental protection programs and activities—that SRS contractors comply with federal and state environmental regulations, applicable DOE orders, and accepted industry standards.

EQMD operates under the Comprehensive Environmental Protection Assessment Program to identify proficiencies and deficiencies in SRS environmental protection programs and activities according to DOE Order 5482.1B, "Environment, Safety, and Health Appraisal Program," and other environmental requirements. Scheduled assessments have met with positive results; routine 1996 assessments promoted improvement and helped ensure the adequacy of environmental programs and

operations at SRS. The assessments—programmatic and sitewide in scope—are the functional equivalent of appraisals, as defined in DOE Order 5482.1B.

Among the environmental activities assessed by EQMD in 1996 were

- PCB management
- asbestos management
- management of wastes generated during D&D activities
- compliance with STP requirements
- environmental restoration activities monitoring, tracking, and reporting
- EMS program management
- NEPA program
- environmental restoration materials control and accountability
- Spill Prevention and Control Countermeasures/ Best Management Practices program

SCDHEC also inspects the SRS environmental program for regulatory compliance. SCDHEC representatives performed three comprehensive compliance inspections in 1996, as follows:

- During the period April 22–25, annual air compliance inspections were conducted for 66 of the site's 155 operating permitted air emission sources. The air emission sources were in compliance.
- The 1996 Comprehensive Monitoring Evaluation (a RCRA inspection) of SRS was conducted September 16–27. Although no deficiencies were cited during the inspection, the letter from SCDHEC on the 1996 Comprehensive Monitoring Evaluation noted one problem—the failure of DWPF to RCRA-train 29 individuals whose work could involve hazardous waste responsibilities—which SRS reported to SCDHEC in June 1996. This issue was referred to the SCDHEC Enforcement Section; no enforcement action was taken, and the 29 individuals were either trained or reassigned.
- During the period October 14–24, annual CWA/ NPDES operation and maintenance inspections were performed at SRS wastewater treatment facilities, and grab and composite samples were collected at site NPDES discharge points. No deficiencies were noted at the time of the inspection, but SCDHEC is expected to issue a final report—including category ratings—in early 1997.

SCDHEC also performed monthly compliance inspections during the year, with no deficiencies noted.

Two expired NPDES permits were renewed into a single permit, SC0000175, which became effective on October 1, 1996, and expires September 30, 2001. The new permit reduces the number of NPDES outfalls from 81 to 37, which is considered more representative of current SRS activities.

Environmental Permits

SRS has 668 construction and operating permits that specify operating levels for each permitted source. This compares with 643 such permits in 1995, 608 in 1994, 608 in 1993, and 498 in 1992. Table 2–8 summarizes the permits held by the site during the past 5 years. Appendix B ("SRS Environmental Permits") of this report provides a comprehensive list of the permits, including the permit number, type of permit, and permitted source.

Environmental Training

The site's environmental training program identifies training activities to teach job-specific skills that protect the employee and the environment while satisfying regulatory training requirements. Chapter 3 contains more information about the training program.

Transition and Decontamination and Decommissioning

As missions at SRS continue to shift from national defense to cleanup and environmental restoration, selected site facilities are transitioned to responsibility of the Environmental Restoration Division of DOE. As part of this process, existing D&D activities continue, and new D&D activities are initiated.

On October 1, 1996, Babcock & Wilcox joined the Westinghouse management team, establishing B&W Savannah River Company and providing three senior managers for WSRC's new Facilities Decommission Division. Such organizational realignment is indicative of a renewed emphasis on D&D. The new division's charter is to manage SRS excess facilities—from completion of operations shutdown through final disposition—in a manner that minimizes life cycle costs without compromising health, safety, or environmental quality.

Since early 1995 at SRS, B&W Nuclear Environmental Services, Inc., has been actively decontaminating building 232–F (an idle tritium

processing facility) on a fixed-price subcontract to WSRC. As of December 31, 1996, after 23 months of work at the facility, a number of milestones had been accomplished, including the following:

- removal and packaging for disposal of all hazardous materials
- removal, packaging, and transportation (to the E-Area vaults) of tritium-contaminated process equipment
- removal of interior and exterior walls and deconstruction of structural steel and concrete

Another significant D&D project now under Facilities Decommission Division management is the Heavy Water Components Test Reactor. The project's characterization phase, along with a decommissioning alternatives study, were completed in December 1996. This included a 30-day public comment period. The Request for Proposal for the D&D of the Heavy Water Components Test Reactor will be prepared for distribution by late January 1997, and a subcontract for the D&D is scheduled to be let in the spring or early summer of 1997.

Other Major Environmental Issues and Actions

Key SRS compliance issues addressed during 1996 included a shutdown of the site's river water system.

The SRS river water system was constructed in the late 1950s to pump large quantities of cooling water from the Savannah River to five nuclear reactors located on site. Because all the reactors are shut down, no cooling water is required and the system is identified in the SRS Strategic Plan as potential surplus infrastructure.

DOE proposes to shut down the river water system and place all or part of it in a standby condition. The department published the draft EIS in November and accepted comments from the public and government agencies; it plans to issue the final EIS in May 1997. A Record of Decision will be made in July 1997. Under the "standby" alternative, portions of the river water system would be placed in a variety of conditions. For example, surplus portions of the system could be shut down and deactivated; the deactivated portions would not be capable of being

Table 2–8
SRS Construction and Operating Permits

Type of Permit	Number of Permits				
	1992	1993	1994	1995	1996
Air	134	172	189	200	196
U.S. Army Corps of Engineers 404	1	1	1	0	0
Army Corps of Engineers Nationwide Permit	a	a	a	a	8
Domestic Water	127	146	152	165	178
Industrial Wastewater	75	79	83	90	87
NPDES–Discharge	2	2	2	2	2
NPDES–No Discharge	0	1	1	1	1
NPDES–Stormwater	1	2	2	2	2
RCRA	1	1	1	1	1
Sanitary Wastewater	119	120	133	133	135
SCWRC 401	1	1	1	1	1
SCDHEC Navigable Waters	a	a	a	a	4
Solid Waste	6	6	6	6	6
Underground Injection Control	3	6	7	13	18
Underground Storage Tanks	29[a]	31[a]	31[a]	29[a]	29
Totals	498	567	608	643	668

a Formal tracking of these permits was initiated in 1996.
b Additional underground storage tank permits not previously reported were identified in 1996.

restarted. Other portions would be placed in a "layup" condition to ensure that they could be restarted (for future missions or potential environmental mitigation, if necessary).

The EIS evaluates the impacts of two other alternatives. The first—the no-action alternative—would continue current river water system operation, under which the river water system would continue to provide makeup water to L-Lake (and PAR Pond, if necessary). The second alternative would shut down and deactivate the entire river water system. Under this alternative, other water sources (such as from groundwater) would be needed to provide for minor nonreactor cooling requirements (air conditioning, small equipment cooling, etc.). The cessation of river water input to L-Lake would result in the gradual disappearance of the lake and its return to original creek conditions over a period of about 10 years.

The EIS also evaluates a number of environmental impacts, such those as from exposed sediments in the L-Lake bed and from the loss of wildlife habitat as the lake recedes to the original creek condition. It also covers the following:

- impacts to PAR Pond if the lake level drops below 195 feet mean sea level
- the maintenance of minimum flows in Steel Creek and Lower Three Runs Creek
- the classification of L-Lake bed as a potential CERCLA unit, and possible remediation
- the evaluation of various river water system standby alternatives

Table 2–9 Examples of RCRA and RCRA/CERCLA Units at SRS – 1996

Site and Location	Building or Identification Number(s)	Additional Information
A-Area and M-Area		
A-Area Burning Rubble Pits	731–A, –1A	
A-Area Coal Pile Runoff Basin	788–3A	
A-Area Miscellaneous Rubble Pile	731–6A	
A-Area Rubble Pit	731–2A	
A-Area Stormwater Outfalls	A–001, –002, –024, A–013	
716–A Motor Shop Seepage Basin	904–101G	
M-Area Hazardous Waste Management Facility (HWMF) including	904–51G, 904–112G	RCRA-regulated
A/M Groundwater Portion	904–110	RCRA-regulated; Interim Action ROD issued
M-Area HWMF Settling Basin Inactive Process Sewers to Manhole 1	081–M	RCRA-regulated
M-Area HWMF Vadose Zone		RCRA-regulated; Interim Action ROD issued
M-Area West	631–21G	
Met Lab Basin/Carolina Bay	904–110	RCRA-regulated; Interim Action ROD issued
Miscellaneous Chemical Basin/ Metals Burning Pits	731–4A, –5A	
Silverton Road Waste Site	731–3A	
SRL Seepage Basins	904–53G1, –53G2, –54G, –55G	
SRL 904–A Process Trench	904–A	
C-Area		
C-Area Burning/Rubble Pit	131–C	
C-Area Coal Pile Runoff Basin	189–C	
C-Area Reactor Seepage Basins	904–066G, –067G, –068G	
C-Area Stormwater Outfall	C–004	
Tank 105–C		RCRA-regulated; Final ROD issued
General Separations and Waste Management Areas (E-, F-, H-, S-, Y-, and Z-)		
Burial Ground Complex comprised of		
Low Level Radioactive Waste Disposal Facility (nonhazardous portion)	643–7E	RCRA-regulated
Mixed Waste Management Facility	643–28E	RCRA-regulated; Final ROD issued
Old Radioactive Waste Burial Ground	643–E	Interim Action ROD issued
Solvent Tanks S01–S22		RCRA-regulated

Table 2–9 Examples of RCRA and RCRA/CERCLA Units at SRS – 1996

Site and Location	Building or Identification Number(s)	Additional Information
Burial Ground Complex Groundwater		
Burma Road Rubble Pit	231–4F	Final ROD issued
211–FB Pu–239 Release	081–F	
F-Area Acid/Caustic Basin	904–47G	RCRA-regulated
F-Area Burning/Rubble Pits	231–F, –1F, –2F	
F-Area Canyon Groundwater		Unit added during Fiscal Year 1996
F-Area Coal Pile Runoff Basin	289–F	
F-Area Groundwater		
F-Area Hazardous Waste Management Facility	904–41G, –42G, –43G	RCRA-regulated; Final ROD issued
F-Area Inactive Process Sewer Lines from Building to Security Fence	081–1F	
F-Area Retention Basin	281–3F	RCRA permit modification not required
F-Area Seepage Basin Groundwater Operable Unit	904–44F	RCRA-regulated; Interim Action ROD issued
F-Area Tank Farm Groundwater Operable Unit		Unit added during Fiscal Year 1996
H-Area Acid/Caustic Basin	904–75G	RCRA-regulated
H-Area Coal Pile Runoff Basin	289–H	
H-Area Ditch to Outfall H–012	H–012	
H-Area Groundwater		
H-Area Hazardous Waste Management Facility	904–44G, –45G, –46G, –59G	RCRA-regulated; Final ROD issued
H-Area Inactive Process Sewer Lines from Building to the Security Fence	081–H	
H-Area Retention Basin	281–3H	RCRA permit modification not required
H-Area Seepage Basin Groundwater Operable Unit		RCRA-regulated; Interim Action ROD issued
H-Area Stormwater Outfall	H–013	
H-Area Tank Farm Groundwater Operable Unit		
Old F Area Seepage Basin	904–49G	
Tank 16	241–H	
Tank 37 CTS Line Leak	081–1H	
Warner's Pond	685–23G	RCRA permit modification not required

Table 2–9 Examples of RCRA and RCRA/CERCLA Units at SRS – 1996

Site and Location	Building or Identification Number(s)	Additional Information
K-Area		
K-Area Acid/Caustic Basin	904–080G	RCRA-regulated
K-Area Bingham Pump Outage Pit	643–1G	RCRA permit modification not required
K-Area Burning/Rubble Pit	131–K	
K-Area Coal Pile Runoff Basin	189–K	
K-Area Reactor Seepage Basin	904–65G	RCRA permit modification not required
K-Area Rubble Pile	631–20G	
K-Area Sludge Land Application Site	761–4G	
K-Area Stormwater Outfall	K–011	
K-Area Tritium Anomaly		RCRA permit modification not required
L-Area		
Chemicals, Metals, and Pesticides Pits	080–17G, –17.1G, –18G, –19G, –18.1G, –18.2G, –18.3G	
Gas Cylinder Disposal Facility	131–2L	
L-Area Bingham Pump Outage Pits	643–2G, –3G	RCRA permit modification not required
L-Area Burning Rubble Pit	131–L	
L-Area Hot Shop	717–G	
L-Area Oil/Chemical Basin and L-Area Acid/Caustic Basin	904–83G, –77G	
L-Area Rubble Pile	131–3L	
L-Area Rubble Pits	131–1L, –4L	
L-Area Southern Groundwater		
L-Area Stormwater Outfall	L–012	
N-Area (Central Shops)		
Central Shops Burning/Rubble Pits	631–G, –3G, –5G, –6G	
Central Shops Sludge Lagoon	080–24G	
P-Area		
P-Area Acid/Caustic Basin	904–78G	RCRA-regulated
P-Area Bingham Pump Outage Pits	643–G	RCRA permit modification not required
P-Area Burning/Rubble Pit	131–P	
P-Area Coal Pile Runoff Basin	189–P	
P-Area Stormwater Outfall	P–010	

Table 2–9 Examples of RCRA and RCRA/CERCLA Units at SRS – 1996

Site and Location	Building or Identification Number(s)	Additional Information
R-Area		
Overflow Basin	108–4R	RCRA permit modification not required
PAR Pond (including pre–cooler ponds and canals)	685–G	Interim Action ROD issued
PAR Pond Sludge Land Application Site	761–5G	
R-Area Acid/Caustic Basin	904–79G	
R-Area Bingham Pump Outage Pits	643–8G, –9G, –10G	RCRA permit modification not required
R-Area Burning/Rubble Pits	131–R, –1R	
R-Area Reactor Seepage Basins	904–57G, –58G, –59G, –60G –103G, –104G	RCRA permit modification not required
R-Area Rubble Pile	631–25G	
Sanitary Landfill		
Sanitary Landfill	740–G	Portions RCRA-regulated
Sanitary Landfill Groundwater		RCRA-regulated
TNX and D-Areas		
D-Area Oil Seepage Basin	631–G	Interim Action ROD issued
D-Area Ash Basin	488–D	
D-Area Burning/Rubble Pits	431–D, –1D	
D-Area Coal Pile Runoff Basin	489–D	
D-Area Waste Oil Facility	484–D	
New TNX Seepage Basin	904–102G	
Old TNX Seepage Basin	904–076G	
TNX Burying Ground	643–5G	
TNX Groundwater	082–G	Interim Action ROD issued
West of SREL "Georgia Fields" Site	631–19G	
Other		
Fire Department Hose Training Facility	904–113G	
Ford Building Seepage Basin	904–91G	
Ford Building Waste Site	643–11G	RCRA permit modification not required
Fourmile Branch Integrator Operable Unit		
G-Area Oil Seepage Basin	761–13G	
Grace Road Site	631–22G	
Gunsite 113 Access Road	631–24G	
Gunsite 218 Rubble Pile	631–23G	

Table 2–9 Examples of RCRA and RCRA/CERCLA Units at SRS – 1996

Site and Location	Building or Identification Number(s)	Additional Information
Gunsite 720 Rubble Pit	631–16G	
Hydrofluoric Acid Spill	631–4G	RCRA permit modification not required
Lower Three Runs Integrator Operable Unit		
Pen Branch Integrator Operable Unit		
Road A Chemical Basin	904–111G	
Savannah River Integrator Operable Unit		
Savannah River Floodplain Swamp Integrator Operable Unit		
SRL Oil Test Site	080–16G	
Steel Creek Integrator Operable Unit		
Steel Pond		
Upper Three Runs Integrator Operable Unit		
X–001 Outfall Drainage Ditch	X–001	

Chapter 3

Environmental Program Information

Mary Dodgen and Greg Peterson
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To Read About . . . **Turn to Page . . .**

THIS chapter provides a general overview of environmental programs at Savannah River Site (SRS), including environmental monitoring. Two goals of these programs are to measure the concentration or quantity of contaminants released from site operations and to reduce the amount of these contaminants. Specific examples in this chapter will show how achievement of these goals during 1996 helped the site accomplish its missions. (Site missions are presented in chapter 1, "Introduction.")

The goal of environmental monitoring at SRS is to measure site releases that could affect human health and ecological or natural resources. Results of these measurements provide a technical basis for possible corrective actions and generate data that can demonstrate compliance with applicable federal, state, and local regulations, as well as with U.S. Department of Energy (DOE) orders.

Also included in this chapter is an overview of the SRS Dose Reconstruction Study, an evaluation of historical monitoring data and other site records. An objective of this study is to provide an independent assessment of potential human health risk to populations exposed to radioactive materials and chemicals released into the surrounding environment since site operations began in the 1950s.

This chapter also describes the site's pollution prevention program, whose goal is to reduce the impact of site operations on the environment by focusing on source reduction, on recycling, and on increasing employee awareness of—and participation in—waste minimization. Other activities—such as employee training, information exchange, and public outreach—offer ways to provide job-related knowledge and skills; to share information about site operations, programs, and objectives; and to address public concerns.

Various site operating groups—including Westinghouse Savannah River Company's (WSRC) Environmental Protection Department (EPD), Radiological Control Operations (RCO), Savannah River Technology Center (SRTC), Savannah River Ecology Laboratory (SREL), Savannah River Forest Station (SRFS), and Savannah River Archaeological Research Program (SRARP)—have environmental programs. SRTC, SREL, SRFS, and SRARP are discussed in chapter 1.

Environmental Monitoring

SRS environmental monitoring, which includes both onsite and offsite activities, is the responsibility of EPD's Environmental Monitoring Section (EMS). Also, the Division of Environmental Research of the Academy of Natural Sciences of Philadelphia has performed biological and water quality surveys of the Savannah River since 1951.

Though much of the environmental monitoring program focuses on radioactive materials, considerable effort also is dedicated to nonradioactive materials. The primary purpose of the nonradiological monitoring program is to demonstrate that the levels of airborne and liquid releases remain within federal and state standards.

Additional environmental monitoring information in this report is provided in chapters dealing specifically with

- radiological effluent monitoring (chapter 5)
- radiological environmental surveillance (chapter 6)
- nonradiological effluent monitoring (chapter 8)
- nonradiological environmental surveillance (chapter 9)
- groundwater monitoring (chapter 10)
- special surveys and projects (chapter 12)

Effluent Monitoring versus Environmental Surveillance

Per DOE Order 5400.5, "Radiation Protection of the Public and the Environment":

Effluent monitoring is the collection and analysis of samples or measurements of liquid and gaseous effluents for purposes of characterizing and quantifying contaminants, assessing radiation exposure to members of the public, and demonstrating compliance with applicable standards.

Environmental surveillance is the collection and analysis of samples of air, water, soil, foodstuffs, biota, and other media from DOE sites and their environs and the measurement of external radiation for purposes of demonstrating compliance with applicable standards, assessing radiation exposures to members of the public, and assessing the effects, if any, on the local environment.

Monitoring occurs at the point of discharge, such as an air stack or drainage pipe; surveillance involves looking for contaminants in the environment.

Effluent Monitoring

Effluent monitoring is conducted by collecting and analyzing onsite samples of liquid and airborne effluents taken at or very near their points of discharge to the environment. Radiological effluent monitoring meets regulatory requirements and provides source terms for calculating potential offsite radiation doses. More information about these calculations can be found in chapter 7, "Potential Radiation Doses." In 1996, more than 4,400 samples were taken at 86 points of discharge.

RCO and EMS share the responsibility for radiological effluent monitoring. RCO collects and screens air and liquid samples from regulated (radiologically controlled) areas and maintains monitoring equipment on stacks and at some liquid effluent discharge points. EMS collects and analyzes most liquid effluent samples. Following validation, results of these analyses are recorded in a monthly radioactive releases report. Data from the monthly reports are summarized in an annual data publication (in 1996, *SRS Environmental Data for 1996*, WSRC–TR–97–0077).

Because SRS handles plutonium, tritium, and other special nuclear materials, much of the site's environmental monitoring effort is focused on collecting samples of airborne and liquid effluents released during routine operations—and analyzing the samples for radioactive materials. A typical setup for airborne effluent monitoring is illustrated in figure 3–1. As shown, radioactive materials are monitored at their points of discharge, and air monitoring stations are located strategically to track—and to quantify—the dispersion of any released material into the surrounding environment. Monitoring may be performed at any or all of the identified locations as determined by the rationale discussed on page 44.

Monitoring for nonradioactive contaminants in airborne effluents at SRS is designed to show compliance with permits issued by the South Carolina Department of Health and Environmental Control (SCDHEC). These permits are discussed further in chapter 2, "Environmental Compliance," and listed in appendix B, "SRS Environmental Permits." The major nonradiological airborne emissions of concern from SRS stacks include sulfur dioxide, oxides of nitrogen, total particulate matter, and toxic air pollutants, such as tetrachloroethylene (TCE), perchloroethylene (PCE), benzene, and hydrochloric acid. As part of a network associated with the federal Clean Air Act, Georgia and South Carolina environmental agencies verify permit compliance by monitoring ambient air quality near SRS. Clean Air Act Amendments, implemented in 1990, require federal facilities, such as SRS, to comply with provisions of the act.

Nonradioactive liquid effluents generally are sampled at National Pollutant Discharge Elimination System (NPDES) outfalls (points of discharge) and reported to SCDHEC in a monthly discharge monitoring report, as required by the Clean Water Act. Monitoring requirements for liquids may vary at each outfall, depending on the type of facility and the known characteristics of the wastewater. A typical setup for liquid effluent monitoring is shown in figure 3–2.

Environmental Surveillance

Environmental surveillance is conducted by collecting and analyzing onsite and offsite samples taken at various distances from points of discharge. In 1996, approximately 10,000 radiological analyses were performed on approximately 5,000 samples (not including groundwater). Data from radiological environmental surveillance are evaluated to

- determine the effects, if any, of SRS releases

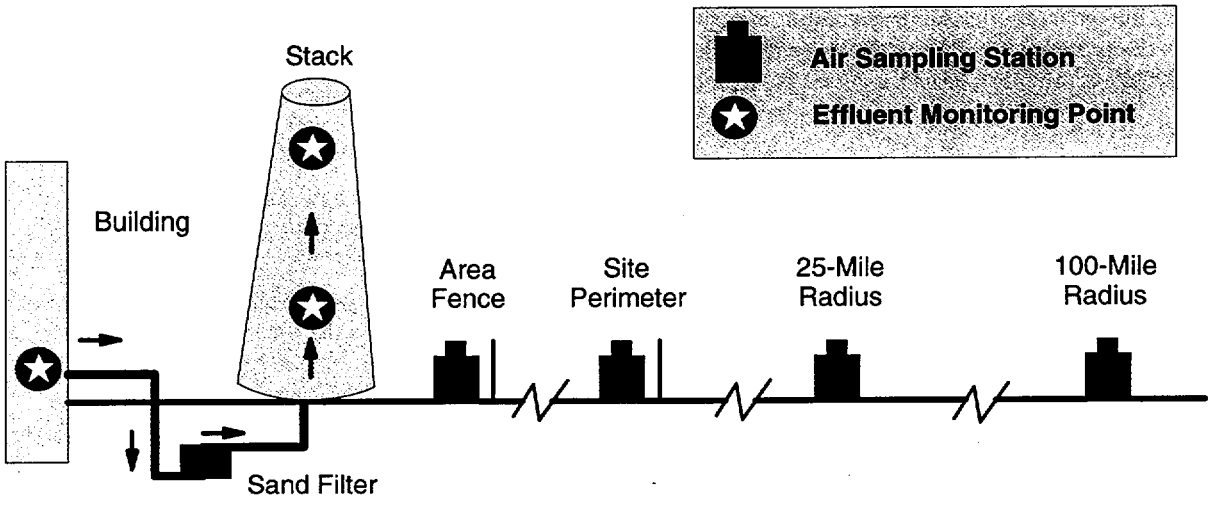

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Figure 3–1 Typical Airborne Effluent Monitoring and Environmental Surveillance
Effluents are monitored at points of discharge. Released materials of concern are tracked in the environment.

- provide a way to verify dose calculations and predictions from mathematical models

Because most contaminants are released in such small amounts that they cannot be readily measured in environmental samples, SRS uses mathematical models to estimate contaminant concentrations in environmental media. The data obtained at the point of discharge (e.g., stack, pipe, or outfall)—where the concentration would be highest if a contaminant were present—is used to calculate the estimated contaminant concentration in sampled media, such as water, soil, or vegetation. More information about modeling can be found in chapter 7.

Nonradiological environmental surveillance is conducted by collecting and analyzing samples from site streams and the Savannah River to verify the outfall sampling data and to ensure the detection and characterization of materials that could adversely

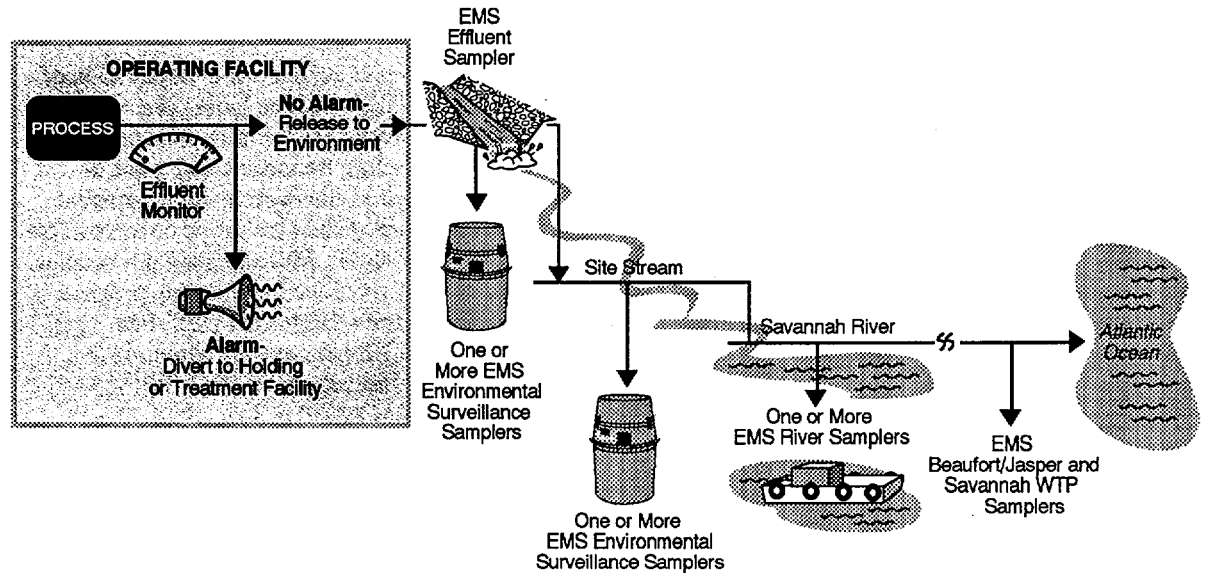

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Figure 3–2 Typical Liquid Effluent Monitoring and Environmental Surveillance
Effluents are monitored at points of discharge. Released materials of concern are tracked in the environment.

affect the environment. Adverse conditions resulting from the presence of such materials are identified and evaluated to provide a basis for corrective action.

Policy

SRS policy requires an environmental monitoring program designed to

- establish effluent and ambient levels of radionuclides and other discharges
- determine trends in these releases
- provide a basis for assessment of dose to humans and the environment
- provide information needed to detect and correct problems

SRS is committed to sharing this information with the public and its representatives.

Objectives

The purpose of many environmental regulations is to protect human health and the environment. In support of this purpose, the SRS environmental monitoring objectives are to

- assess actual or potential exposures of radioactive and nonradioactive materials to critical groups and populations from normal site operations or from accidents
- demonstrate compliance with authorized limits and regulatory requirements
- verify the adequacy of each facility in containing radioactivity and controlling effluents
- notify appropriate officials of unusual or unforeseen conditions and, if necessary, to activate a special environmental monitoring program
- communicate accurate and effective EMS monitoring results to DOE, to other government agencies, and to the general public
- maintain an accurate and continuous record of the effects of SRS operations on the environment
- determine concentrations of radioactive and nonradioactive contaminants in environmental media for the purpose of assessing the immediate and long-term consequences of normal and accidental releases
- distinguish between environmental contamination and effects from SRS operations and those from other sources
- evaluate and revise the environmental monitoring program in response to changing conditions in transport pathways
- provide site-specific data for risk assessment for human populations near SRS
- conduct scientific studies on the transfer pathways of radioactive and nonradioactive contaminants in the environment
- assess the validity and effectiveness of models used to predict the concentration of pollutants in the environment
- determine the long-term buildup of—and predict environmental trends from—site-released contaminants
- establish baselines of environmental quality so that trends in the physical, chemical, and biological condition of environmental media can be characterized
- identify and quantify new or existing environmental quality problems, then assess the need for corrective actions or mitigation measures
- pinpoint exposure pathways in which contaminants are accumulated and transmitted to the public

These objectives incorporate the recommendations of the International Commission on Radiological Protection ("Principles of Monitoring for the Radiation Protection of the Public," ICRP Publication 42), of DOE Order 5400.1 ("General Environmental Protection Program"), and of DOE/EH–0173T ("Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance").

Rationale

Many factors are considered in the determination of monitoring activities at SRS, including responsible environmental stewardship. Sampling locations, sample media, sampling frequency, and types of analysis are selected on the basis of environmental regulations, exposure pathways, public concerns, and measurement capabilities. More detailed information about the site's environmental monitoring program is documented in sections 1101–1111 (SRS EM Program) of the *SRS Environmental Monitoring Section Plans and Procedures*, WSRC–3Q1–2, Volume 1, which was issued in June 1995. This document is reviewed annually and updated every 3 years.

Environmental Regulations

Environmental monitoring at SRS is designed to meet state and federal regulatory requirements for radiological and nonradiological programs. These requirements are stated in DOE orders 5400.1 and 5400.5 ("Radiation Protection of the Public and the

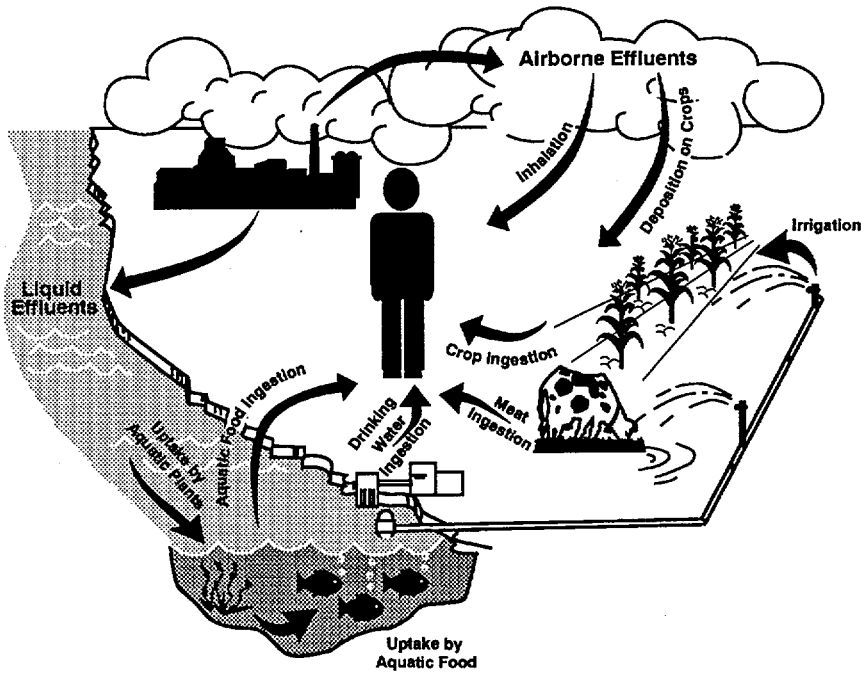

Figure 3–3 Potential Exposure Pathways

Airborne and liquid materials released from SRS operations can reach people in a variety of ways. These ways, or routes, are called exposure pathways.

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Environment"); in the Clean Air Act—for example, National Emission Standards for Hazardous Air Pollutants (NESHAP); in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA—also known as the Superfund); in the Resource Conservation and Recovery Act (RCRA); and in the Clean Water Act—for example, NPDES. SCDHEC, the U.S. Environmental Protection Agency (EPA), and DOE conduct audits to verify that the site complies with environmental regulations. Chapter 2 summarizes the site's compliance status for 1996.

Exposure Pathways

Materials released from SRS reach the environment and people in a variety of ways. The routes that materials follow to get from an SRS facility to the environment and then to people are called exposure pathways. Some potential exposure pathways are illustrated in figure 3–3, which shows that airborne effluents can be ingested directly by inhalation or indirectly as a result of their deposition on crops, followed by ingestion of the crops. Liquid effluents can be ingested directly from drinking water or indirectly by eating aquatic food that previously had taken up the effluents.

The method used to determine exposure pathways is called a critical pathways analysis. In a limited critical pathways analysis completed in 1993, nine radionuclides released each year from SRS facilities were identified as potentially significant contributors to offsite doses; that is, they each represented more than 1 percent of the total dose [Arnett, 1993]. These radionuclides were tritium; strontium-90; iodine-129; iodine-131; cesium-137; uranium-235,238; plutonium-238; and plutonium-239.

A more complete and thorough critical contaminant/critical pathways analysis was initiated in October 1995 by SRTC's Environmental Dosimetry Group in response to a request from DOE's Savannah River Operations Office (DOE–SR). Initially, this analysis was expected to be completed by October 1996; however, because of reduced resources, the projected completion date was extended to February 1997.

Critical pathways analysis results are used in the site's environmental monitoring activities to make decisions about sampling locations, sample media, and sampling frequency. Results from modeling an exposure pathway can help

- verify that a sampling network performs as required
- make the best use of available resources for sampling and analysis

Public Concerns

Public concerns influence the site's environmental monitoring activities. The public wants to know about releases and their potential health effects. One aspect of environmental monitoring that addresses a public concern is the placement of thermoluminescent dosimeters (TLDs) in offsite

locations. These devices, used to measure external gamma radiation, provide a quick, reliable method of determining the dose from gamma-emitting radionuclides in the event of an unplanned release of radioactive material.

Measurement Capabilities

Many materials released from SRS exist in such low concentrations in the environment that they cannot be readily measured Thus, measurement capabilities become significant factors in the rationale for monitoring certain materials. In these cases, modeling with nationally accepted computer programs is used to predict or estimate concentration levels. More information on modeling can be found in chapter 7, more on measurement capabilities, in *SRS Environmental Data for 1996.*

1996 Program Changes

The types, frequencies, and locations of environmental measurements are reviewed annually to determine how best to structure the monitoring program. If a clear rationale for a measurement no longer exists, the measurement is deleted from the program. Likewise, the program is modified as new sampling/analytical methods and needs evolve.

While elements of individual monitoring programs are reviewed annually, it became apparent in 1995 that the overall site monitoring program could benefit from a holistic, comprehensive review of the entire effort that takes into account current and evolving site missions, regulatory trends, and potential program element efficiencies. This review, known as "Rock Hill Initiative #2," was completed in June 1996. Objectives of this review were to define a reasonable environmental monitoring program for the site given current site status and regulatory requirements and to identify cost reductions associated with the program. The review focused on identifying monitoring activities that could be eliminated without compromising the essential information desired and on identifying any risks and consequences associated with the proposed reductions.

Sixty-nine discrete program elements were identified and evaluated by participants from site organizations—DOE–SR, WSRC, SREL, SRFS, and Wackenhut Services Inc. (WSI, contractor for site security)—with assistance from the Environmental Advisory Committee. (The Environmental Advisory Committee is discussed on page 49.) As a result of the review, five elements were eliminated, 43 were reduced in scope, 3 were increased in scope, and 18 were unchanged. Since completion of the review, all nonregulatory changes have been implemented. Rationale to implement acceptable decreases in permit conditions and regulatory monitoring requirements are being prepared for submission to the regulators.

Details of the Rock Hill Initiative #2 review are documented in *Comprehensive Review of Environmental Monitoring Programs at Savannah River Site (U)*, WSRC–RP–96–308. Specific programmatic changes implemented in 1996 are detailed in subsequent chapters of this report.

Dose Reconstruction Study

SRS has conducted environmental monitoring of radioactive materials and chemicals released to the environment since the beginning of site operations in the early 1950s. Historical data from this environmental monitoring and from site operations are being evaluated independently by the federal Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia, as part of the SRS Dose Reconstruction Study, to determine the effects these materials may have had on people living near the site.

Phase I of the SRS Dose Reconstruction Study began in October 1992. Its purpose was to locate and review records—from SRS and other sources—that could be used in the dose reconstruction process. This phase was completed in June 1995. More than 34,000 boxes of documents were searched, with more than 260,000 pages of potentially useful documents identified.

Two reports were published to summarize the evaluation of materials released from SRS and to identify environmental monitoring and research data:

- *Savannah River Site Dose Reconstruction Project, Phase I, Data Retrieval and Assessment, Task 3, Evaluation of Materials Released from the Savannah River Site*
- *Savannah River Site Dose Reconstruction Project, Phase I, Data Retrieval and Assessment, Task 4, Identifying Sources of Environmental Monitoring and Research Data*

The Task 3 report describes methods used to qualitatively characterize the historical use and potential release of chemicals and radionuclides at SRS since the beginning of site operations. The Task 4 report identifies, catalogs, and evaluates historical environmental and research information—in terms of usefulness, limitations, and quality—that could be used to support a dose reconstruction. Copies of these reports are available to the general public in the DOE Reading Room at the University of South Carolina-Aiken.

During Phase II of the study, which began in September 1995, the CDC will estimate the amount

of materials released (the source term) since SRS began operations in 1952 and will reconstruct—through pathways analyses and dose assessments—the doses that the public has received from these materials. This information will be used to assess the possibility of health effects, attributable to site operations, in the population around the site. Phase II is expected to be completed in 1997.

Inquiries can be made about the study by writing to Centers for Disease Control and Prevention, 4770 Buford Highway NE, MS F35, Atlanta, GA 30341–3724; by calling 770–488–7040; or by faxing 770–488–7044.

Pollution Prevention

Pollution prevention at SRS is designed to reduce the impact of site operations on the environment. Pollution prevention at the site includes

- source reduction activities
- recycling of potential wastes and pollutants
- reduction in the use of materials, energy, water, and other resources
- protection of human health and of natural resources through conservation or more efficient use
- disposal of waste in an environmentally safe manner

Pollution prevention programs are a major focus of many activities, organizations, and implementation teams. Improvements in the coordination of and communication between these program areas are ongoing, and employee awareness of—and management emphasis on—pollution prevention is increasing. The *WSRC Waste Minimization and Pollution Prevention Plan* (WSRC–RP–95–36) provides program details. Highlights of some of the 1996 SRS pollution prevention activities are discussed in the following paragraphs.

Waste Minimization

The SRS waste minimization program continued in 1996 to reduce the generation of solid wastes that require costly treatment, storage, and disposal. The annualized solid radioactive waste generation volumes decreased by about 70 percent, or almost 680,000 cubic feet, from 1991 to 1996. (In calendar year 1991, 969,650 cubic feet of radioactive solid waste was generated. In fiscal year 1996, 290,323 cubic feet of radioactive solid waste was generated.) The decrease is attributed largely to waste minimization efforts initiated as a site program in 1991, but also is the result of changing site missions. In 1996, solid waste generators identified more than 125 waste reduction initiatives with potential to reduce forecasted waste generation by more than 145,000 cubic feet on an annualized basis. Key initiatives included incorporation of commercial radioactive waste reduction practices; emphasis on reduction in the size of radioactive contamination areas; and increased use of recyclable—versus disposable— materials for radioactive jobs.

Solid Waste Recycling

Sanitary waste volumes were reduced by recycling initiatives. In fiscal year 1996, more than 3,250 tons of nonradioactive materials were recycled at SRS, including 810 tons of paper and cardboard. A consolidated office waste recycling contract implemented during the year should increase employee participation in recycling by making the recycling option more convenient.

Energy Conservation

Reducing site demand for energy in turn reduces emissions and conserves resources (e.g., coal) associated with energy production. A comprehensive energy conservation program and site mission changes helped drive down facility energy consumption in British thermal units (BTU) per gross square foot by more than 51 percent from 1985 through 1996.

Reduction of Chemical Releases

Under Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA), SRS has filed Toxic Chemical Release Inventory reports annually since 1987. The site calculates chemical releases to the environment and reports aggregate quantities for each regulated chemical that exceeds threshold amounts. Between 1987 and 1995, reportable release quantities have declined by 97 percent. More about Toxic Chemical Release Inventory reports can be found in chapter 2.

Affirmative Procurement of Recycled Products

The SRS Affirmative Procurement Program promotes the purchase of products made from recycled materials to help conserve natural resources. The program follows federal guidance for implementing affirmative procurement requirements at DOE sites. The program expanded the purchasing in several areas during fiscal year 1996, including recycled building insulation and retread tire and re-refined oil use for site fleet vehicle maintenance. The program is

implemented as part of federal Executive Order 12873, "Federal Acquisition, Recycling and Waste Prevention," and RCRA Section 6002.

Excess-Chemical Management

The Chemical Commodity Management Center was created and staffed in 1994 to ensure environmentally sound, safe, and cost-effective acquisition, distribution, and reuse of chemicals/excess chemical products for the site. An "excess chemical product" is defined as any reusable material requiring a material safety data sheet and in the original form and concentration as received as a stock supply item from a supplier. Some accomplishments included implementing reviews of all chemical procurement requests prior to purchase, coordinating the site's annual EPCRA Tier II chemical inventory (chapter 2) and developing a sitewide chemical management program.

Ozone-Depleting Substances

The Clean Air Act Amendments of 1990 require that EPA publish a number of regulations to phase out the production and consumption of ozone-depleting substances. SRS has produced an internal guidance document designed to assist the site in the phaseout of these substances. The main objective of the plan is to reduce the use of chlorofluorocarbon (CFC) refrigerants by replacement and retrofit of CFC equipment and by sound refrigerant containment practices.

During 1996, the A-Area Chiller Replacement project was completed, replacing four CFC chiller units. Future projects will replace or refit 37 major CFC chiller and heating, ventilation, and air conditioning systems throughout the site as funding becomes available.

Examples of Site Cost Savings Estimates

- **Rock Hill Initiative #2 — the review identified a minimum of $8 million in cost reductions associated with the environmental monitoring program for fiscal year 1997.**
- **Energy conservation — In September 1996, a Building Energy Upgrades project for 43 administrative buildings was completed; implementation will generate an estimated annual savings of $241,000. Also, in fiscal year 1996, SRS invested approximately $1.2 million in retrofit projects that are estimated to produce an annual energy savings of $350,000.**
- **Affirmative procurement of recycled products — During fiscal year 1996, SRS contractors purchased more than $400,000 worth of recycled products ranging from paper and paper products, toner cartridges, and other office products to construction and building materials.**
- **Excess-chemical management — During fiscal year 1996, SRS redistributed an estimated $96,000 worth of excess chemical products across the site for use at other work locations, and an estimated $153,000 worth of excess chemical products were sold to vendors or donated to area government institutions.**

Employee Training

SRS environmental training programs help achieve environmental goals at the site. SRS is committed, as a matter of policy, to maintaining its facilities and conducting its operations in full compliance with all applicable laws and regulations for the protection of the environment and of the health and safety of its employees and the general public. The training program identifies training activities to teach job-specific skills that protect the environment and satisfy regulatory requirements.

Environmental training at SRS addresses federal and state regulations. The focus is on required training and recommended education courses for employees (based on responsibility) involved with environmental oversight, hazardous materials, and waste management at the site.

Environmental training activities in 1996 included the following:

- Fourteen site environmental protection coordinators were trained in responsibilities for reporting occurrences having environmental consequences. Training also was provided for DOE and environmental coordinator representatives.
- Seventy-two site workers received Water/Wastewater Continuing Education training.
- More than 200 persons attended environmental training through subcontracted courses.
- Eight hundred twelve site workers attended Hazardous Waste Operations courses (29 CFR 1910.120), which provide health and safety training in hazardous-waste cleanup activities and in working at RCRA treatment, storage, and disposal facilities.
- About 1,880 site workers attended RCRA training.
- More than 15,100 site workers took the Consolidated Annual Training course to meet general training requirements, including some environmental training.

Information Exchange

SRS has opened several avenues of exchange with state and federal regulators, other government-owned, contractor-operated (GOCO) facilities, and scientists to improve and update its environmental monitoring and research programs.

DOE–SR representatives attend DOE Headquarters (DOE–HQ)-sponsored technical information exchange workshops, which provide a way to enhance the exchange of technical information among DOE sites.

Environmental awareness and information exchange tours are conducted for many special-interest groups, including environmental activists and representatives of other GOCOs, of DOE–HQ, of Westinghouse Electric Corporation, of EPA, and of SCDHEC. Tours are designed to meet the needs of a particular group. For example, EPA and SCDHEC tours might focus on regulatory issues, while tours for other GOCOs might cover activities applicable to their programs.

Initiated in 1996, the Interagency Information Exchanges are public forums that enable state and federal regulators and SRS to address environmental compliance issues. At these forums, EPA, SCDHEC, and SRS representatives discuss cleanup plans and draft RCRA permit changes while soliciting public comments. Public input is considered by the agencies and used to develop final remedial approaches.

The Citizens Advisory Board (CAB) for SRS provides recommendations to DOE, EPA, and SCDHEC on environmental remediation, waste management, and related issues. The CAB is composed of 25 South Carolina and Georgia individuals who reflect the cultural diversity of the population affected by SRS. Information about their 1996 recommendations is presented in chapter 4, "Environmental Restoration and Waste Management." Additional information can be obtained by calling 800–249–8155.

The Environmental Advisory Committee, which is comprised of nationally recognized consultants from the fields of biology, ecology, hydrogeology, health physics, environmental restoration, and economics, meets quarterly to review site environmental programs and make recommendations. In 1996, this group formally reviewed the *SRS Environmental Report for 1995* (WSRC–TR–96–0075) and *SRS Environmental Data for 1995* (WSRC–TR–96–0077).

SRS hosted a training exercise in May called Handshake II to help refine the skills of field monitoring teams and data assessment personnel who respond to major radiological emergencies. Taking part in the exercise were about 200 persons—including 20 field monitoring teams—and four mobile laboratories from the DOE Region 3 states—North Carolina, South Carolina, Georgia, Florida, and Alabama. In addition, observers from across the nation and visitors from Brazil, Bulgaria, and Canada were present to view new equipment, its use, and integration of response teams from all levels of government. Also, a separate exercise using specialized equipment and night-operations procedures for designated participants was carried out to support the National Aeronautics and Space Administration's Cassini mission.

The Central Savannah River Area Radiological Environmental Monitoring Program is a data exchange program involving representatives of SCDHEC, the Georgia Department of Natural Resources, Georgia Power Company, Chem-Nuclear Systems, DOE, and WSRC. This group has met semiannually since 1987 to share technical environmental program information and data. These meetings provide an open forum in which to review and possibly improve each organization's monitoring program.

Public Outreach

SRS public outreach activities—such as public meetings, the Visitors Program, the Speakers Bureau, and the Traveling Lecturers Program—provide communication channels between the site and the public. Local newspaper, television, and radio advertisements also inform the public about environmental activities. More information can be obtained by contacting the WSRC Media and Community Relations Department at 800–603–0970.

When topics involve unusually complex issues, DOE may conduct workshops that give special-interest groups or citizens the opportunity to meet with site representatives.

In 1996, DOE–SR initiated the first effort in the DOE complex to integrate feasible environmental justice principles set forth in Executive Order 12898, "Environmental Justice Strategy," into SRS operations. DOE's plan reflects a commitment to participate in efforts to advance the well-being of people in surrounding communities by

- taking an integrated approach to formulating strategies based on clear priorities and tangible benefits and actions that address programmatic, legislative, and regulatory responsibilities

- emphasizing community participation and empowering stakeholders and communities
- refocusing research agendas to reflect a new recognition of various health issues
- encouraging modified approaches for structuring models for occupational and environmental science research for high-risk communities and workers
- embracing interagency coordination to ensure environmental justice
- including plans to heighten the sensitivity of management and staff to environmental justice options within DOE's infrastructure.

As part of the Environmental Justice Strategy effort, a grant was awarded to a group of United Negro College Fund schools for a fish subsistence/consumption survey. Results of the survey are scheduled to be presented to the CAB in January 1997. Another grant was awarded to the Medical University of South Carolina in Charleston with researchers examining concerns about such issues as air and water quality and cancer held by people living near the site (phase 1) and addressing these concerns (phase 2). Presentations on this study also are scheduled to be given in January 1997.

Various regulations require that SRS notify the public of its environmental plans and activities. RCRA, CERCLA, the National Environmental Policy Act (NEPA), and the Clean Water Act mandate regulatory public notice requirements. SRS meets these requirements by using various community involvement tools, including notices to contiguous landowners, to media, to local and state government agencies, and to any other interested stakeholders. Such notices—and the status of documentation—typically are sent in a newsletter called the *Environmental Bulletin*. Appendix B of this report lists the construction and operating permits held by SRS, and chapter 2 lists 1996 SRS project NEPA documentation activities.

Several groups on site are involved in efforts to educate students and teachers. Information about SRS educational outreach programs can be accessed via the SRS Home Page on the Internet at http://www.srs.gov.

WSRC assists in conducting competitions such as the Central Savannah River Area Science and Engineering Fair and the DOE Savannah River Regional Science Bowl to encourage student interest in engineering, science, and mathematics. Education and career fairs that emphasize requirements for advanced skills and education are held in elementary, middle, and high schools. WSRC's EPD offers teacher resource kits and miscellaneous materials to assist teachers in a variety of environmental areas. Tabulations on the 1995-96 school year show that WSRC reached more than 40,000 students in the surrounding communities through a variety of programs and events in science and mathematics.

SRFS has community outreach programs that include Smokey Bear, Woodsy Owl, Earth Day, and the Senior Community Service Program. SRFS environmental awareness programs are shared with visitors. Also, the Natural Resources Environmental Education Program at SRFS aims to increase student awareness of the role of science and mathematics in solving natural resource and environmental problems. The program is a cooperative effort between DOE and the University of South Carolina-Aiken. Another program, a cooperative effort of SRFS, DOE, and South Carolina State University in Orangeburg, was begun at SRS in 1996. This environmental science field education program provides undergraduate students from historically black colleges and universities hands-on field and laboratory experiences in science and engineering. More information about SRFS outreach can be obtained by calling 803–725–2441.

SREL's Environmental Outreach and Education Program was shared with an estimated 60,000 people during 1996. The program emphasizes the importance of environmental awareness in decision making regarding ecological problems. Environmental awareness is promoted through tours of the laboratory; lectures to students and civic and special interest groups; teacher workshops; and various exhibits [Fact Sheet, 1996b]. Presentation topics include animal ecology, outdoor safety, plants and wetlands, the environment, conservation, and careers in ecology and research. More information can be obtained by contacting SREL at 803–725–0156.

SRARP expanded its heritage education activities in 1996 with a full schedule of classroom education, public outreach, and onsite tours. Volunteer excavations at SRS's Tinker Creek site were continued with the Augusta Archaeological Society and other avocational groups, while offsite excavations provided a variety of opportunities for field experience. Some 99 presentations, displays, and tours were provided for schools, historical societies, civic groups, and environmental and historical awareness day celebrations. Also, SRARP personnel taught four anthropology courses at area colleges. More information can be obtained by contacting SRARP at 803–725–3623.