Discussion Draft

Savannah River Site

Long Range Comprehensive Plan

December 2000

Savannah River Site Long Range Comprehensive Plan

Table of Contents

Executive Summary

Chapter 1, Introduction and Background

Chapter 2, Strategic Mission Areas

Chapter 3, Future Land Use Plan

Chapter 4, Facilities Plan

Chapter 5, Infrastructure Plan

Chapter 8, Long Term Stewardship Plan

Appendices

List of Figures

Chapter 1, Introduction and Background

Chapter 2, Strategic Mission Areas

Chapter 3, Future Land Use Plan

Chapter 4, Facilities Plan

Chapter 5, Infrastructure Plan

Chapter 6, Natural Resources Plan

Chapter 7, Cultural Resources Plan

Chapter 8, Long Term Stewardship Plan

List of Tables

Chapter 2, Strategic Mission Areas

Chapter 4, Facilities Plan

Chapter 5, Infrastructure Plan

Chapter 6, Natural Resources Plan

Appendix D, Land Use Models

Acronymns

AACES	Advanced Analytical Center for Environmental Sciences
AASHTO	American Association of State Highway and Transport Officials
A.D.	Anno Domini (in the Year of the Lord in the Christian era)
AIP	Accelerator Improvement Plant Projects
APSF	Actinide Processing and Storage Facility
APT	Accelerator Production of Tritium
ARARs	Applicable or Relevant and Appropriate Requirements
AREA	American Railway Engineering Association
ATM	Asynchronous Transfer Mode
ATTA	Advanced Tactical Training Area
B&R	Budget and Reporting Code
B.C.	Before Christ
BCP	Baseline Change Proposal
BAFIS	Bell Atlantic's Federal Systems Group
B.P.	Before Present
BRI	Building Related Illness
CAB	Citizen Advisory Board
CCF	Central Computing Facility
CE	Capital Equipment
CERCLA	Comprehensive Environmental Restoration Conservation and Liability Act
CFR	Code of Federal Regulations
CFO	Chief Financial Officer
CIF	Consolidated Incineration Facility
CLAB	Central Laboratory Facility
CLWR	Commercial Light Water Reactor
CRC	Customer Response Center
CSRA	Central Savannah River Area
CSWTF	Central Sanitary Waste Treatment Facility
CSWTF	Central Sanitary Wastewater Treatment Facility
D&D	Deactivation and Decommissioning
DNAPL	Dense non-aqueous phase liquids
DI	Deionized Water
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DOE-AL	Department of Energy Albuquerque Field Office
DOE-HQ	Department of Energy Headquarters Office
DOT	Department of Transportation
DP	Defense Programs
DUO	Depleted Uranium Trioxide Powder
DWPF	Defense Waste Processing Facility
EIS	Environmental Impact Statement
EM	Environmental Management
EMI	Environmental Management Integration
EPA	Environmental Protection Agency
ER	Environmental Restoration
ESPC	Energy Savings Performance Contract
ETF	Effluent Treatment Facility
ETRRA	Ecotoxicology, Remediation, and Risk Assessment
FFA	Federal Facilities Agreement
FR	Federal Register
FRA	Federal Railroad Administration
FRR	Foreign Research Reactor
FY	Fiscal Year
GIS	Geographic Information System
GLOBE	Global Learning and Observations to Benefit the Environment
GPG	Good Practices Guide
GPP	General Plant Project
GPRA	Government Performance and Results Act
GWSB	Glass Waste Storage Building
HAW	High Activity Waste
HEU	Highly Enriched Uranium
HLW	High Level Waste
HVAC	Heating, Ventilation, and Air Conditioning
HWCTR	Heavy Water Components Test Reactor
IAEA	International Atomic Energy Agency
INEEL	Idaho National Engineering and Environmental Laboratory
IPL	Integrated Priority List
ISO	International Standards Organization
ITP	In-Tank Precipitation
KAMS	K-Area Material Storage Facility Project
KV	Kilovolt
LMI	Logistics Management Institute
LUTC	Land Use Technical Committee
MCLs	Maximum Concentration Limits

MCS	Management Control System
MD	Fissile Material Disposition
MOX	Mixed Oxide
mph	Miles Per Hour
MTHM	Metric Tons of Heavy Metal
NEPA	National Environmental Policy Act
NERP	National Environmental Research Park
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Administration
PA/SAS	Public Address/Safety Alarm System
PCBs	Polychlorinated Biphenyl
Pu	Plutonium
PUREX	plutonium/uranium extraction
RADMAPS	Radiation Mapping System
RBOF	Receiving Basin for Offsite Fuels
RCRA	Resource Conservation and Recovery Act
RCW	Red-cockaded Woodpecker
RFETS	Rocky Flats Environmental Technology Site
RHLWE	Replacement High-Level Waste Evaporator
ROD	Record of Decision
RW	Civilian Radioactive Waste Management
S&S	Safeguards and Security
SA	Single Axle
SAS	Safety Alarm System
SATA	Small Arms Training Area
SBS	Sick Building Syndrome
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SEIS	Supplemental Environmental Impact Statement
SIPID	Site Integration and Performance Improvement Division
SNF	Spent Nuclear Fuel
SREL	The University of Georgia Savannah River Ecology Laboratory
SRBP	Savannah River Budget Plan
SRP	Savannah River Plant
SRS	Savannah River Site
SRTC	Savannah River Technology Center
TBD	To be determined
TCMC	Trailer Commodity Management Center
TCP/IP	Transmission Control Protocol/Internet Protocol
TEC	Total Estimated Cost
TEF	Tritium Extraction Facility
TRIGA	Training, Research, Isotope, General Atomics
TRU	Transuranic
TSD	Treatment, Storage, and Disposal
TSF	Treatment and Storage Facility
T/T	Tractor trailer
TVA	Tennessee Valley Authority
USFS-SR	U. S. Forest Service-Savannah River
VOCs	Volatile Organic Compounds
WIPP	Waste Isolation Pilot Plant
WSI-SRS	Wackenhut Services, Incorporated-Savannah River Site
WSRC	Westinghouse Savannah River Company

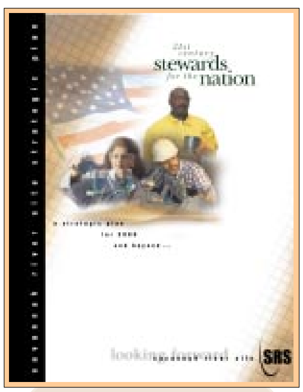
Executive Summary

The purpose of the *Savannah River Site (SRS) Long Range Comprehensive Plan* is to provide the framework for integrating the SRS mission and vision with ecological, economic, cultural, and social factors in a regional context and to aid in effective decision-making for near-term and long-term uses of the site. In addition, this plan reflects a cooperative working relationship between the Department of Energy (DOE) and the state of South Carolina.

The *SRS Long Range Comprehensive Plan* describes the site's current situation, defines a vision for the evolution of the site over the next 50 years, outlines actions to achieve the vision, and guides the allocation of resources toward attainment of that vision. While the site's strategic plan, *21st Century Stewards for the Nation: A Strategic Plan for 2000 and Beyond*, provides the basis for the development of all planning documents at SRS, the *SRS Long Range Comprehensive Plan* provides the next level of detail to support and promote the integration of site mission plans. This plan provides guidance and direction for the future physical development of the site and provides a framework within which detailed analyses will be conducted to determine the courses of action required to reach optimum site configuration. This plan is based on specific assumptions. If these assumptions change, the plan will be updated to reflect the changing conditions. Closely associated with the physcial configuration of the site is consideration of the needs of our most important asset — the site's workforce.

This plan does not specifically discuss current or future program interface or linkage with other DOE sites. However, this plan, along with other similar plans from other DOE sites, provides an initial basis for DOE Headquarters (DOE-HQ) to integrate complex-wide issues and develop overall strategies and objectives to achieve DOE missions.

The approaches in the *SRS Long Range Comprehensive Plan*, coupled with the site's ongoing comprehensive planning process, will help ensure that effective, integrated decisions are made to move SRS successfully into the 21st century. SRS has transitioned from the Cold War to the post-Cold War era. During the Cold War, SRS served the nation by producing nuclear materials critical to its strong nuclear deterrent. While the need remains to continue this deterrence, the nation now faces additional challenges, including the proliferation of nuclear weapons and materials. The site's missions have expanded from primarily a defense mission to one that includes environmental cleanup and the stabilization, storage, and preparation for final disposition of nuclear materials.



SRS Mission:

We serve the nation through safe, secure, cost-effective management of our nuclear weapons stockpile, nuclear materials, and the environment.

SRS Vision:

SRS will be a modernized DOE site, recognized for performance and excellence in support of our national security and as a responsible steward of the environment.

As we enter the new millennium, SRS is poised to fulfill a significant, enduring, and even larger role for the nation into the three stewardship areas described below.

- **Nuclear Weapons Stockpile Stewardship** emphasizes science-based maintenance of the nuclear weapons stockpile. SRS supports the stockpile by ensuring the safe and reliable production, recycle, delivery, and management of tritium resources; by contributing to the stockpile surveillance program; and by its readiness to provide support for large-scale plutonium pit production capability, if required.
- **Nuclear Materials Stewardship** is the management of excess nuclear materials, including transportation, stabilization, storage, and disposition, which supports nuclear nonproliferation initiatives. Primary nuclear materials in this program include components from dismantled weapons, residues from weapons processing activities, spent nuclear fuel, and other legacy materials.
- **Environmental Stewardship** involves management, treatment, and disposal of nuclear and non-nuclear hazardous wastes and restoration of the environment impacted by nuclear weapons production activities. Environmental Stewardship also encompasses stewardship of the site's extensive natural and cultural resources.

Key elements for the success of these programs include adequate funding; continual focus on safety and security; finding solutions to technical challenges; deploying best-in-class project management; and retaining, recruiting, and training a highly-skilled, motivated workforce.

To successfully accomplish the site's assigned stewardship roles, investments in infrastructure, facilities, and the workforce will be required over the next 20 years. These investments include the construction of new facilities, safely dispositioning obsolete facilities, retooling existing site facilities for new missions, and reconfiguration of the site to a form that is more conducive to meeting mission requirements.

In the decades ahead, SRS will consolidate its functions toward the center of the site. Any specific proposals stipulated in the plan will be thoroughly analyzed prior to implementation to assure that they are beneficial in terms of safety, security, and return on investment. This does not mean that the least expensive course of action always will be chosen. Rather, the intangible benefits will be considered in addition to financial factors. As new missions are funded, facilities will be placed near areas of current industrialization to minimize maintenance costs, decrease infrastructure needs, and diminish developmental impact. Rather than upgrade or replace aging facilities and deteriorating infrastructure outside the central industrial zone, SRS will safely take these facilities out of service as their useful life ends. New facilities and infrastructure will be located near existing industrial facilities in locations chosen carefully to minimize environmental impacts.

Other important benefits of this consolidated approach include larger buffer areas for safety and security and less impact to ecosystems. In addition, there is increased opportunity for programs advocated by stakeholders, including continued use of the site as a National Environmental Research Park and controlled public access. Reconfiguration of the site requires significant investment, which includes the construction of new facilities, modification of existing site facilities, and modernization of the site's infrastructure. It is necessary that there be continuity in support and direction over the course of future administrations to maintain progress. The chief challenge will be to provide funding investment for the enduring, long-term missions at SRS while aggressively pursuing cleanup. Given the substantial investment required, the reconfiguration will take place over many years. SRS has proposed a line item project, the Infrastructure Restoration Line Item, to restore critical infrastructure at SRS. Any specific proposals in this line item must support the proposed reconfiguration of the site.

In September 1999, the Secretary of Energy signed the *Statement of Principle*s with several state governors, including the Governor of South Carolina, to lay the foundation for a cooperative working relationship to complete the cleanup and closure of DOE sites. The *Statement of Principles* outlines issues common to all the states, as well as issues specific to each state. Common issues include: completing the cleanup of DOE sites as expeditiously as possible and in compliance with state and federal regulations, obtaining a commitment to predictable and adequate funding for cleanup, continuing investments in science and technology, and protecting groundwater assets. Specific South Carolina issues include working together to define a long-term mission and comprehensive plan for SRS consistent with the needs of the state and surrounding communities and assuring adequate funding to support new missions and offsite waste/materials processing, handling, and storage. SRS representatives have continued to work cooperatively with the Governor's Office to achieve progress on these principles. This plan serves as the primary vehicle through which the Department of Energy and the State of South Carolina are working together on solutions for addressing these issues.

The *SRS Long Range Comprehensive Plan* is divided into eight chapters. The general content and essence of each chapter is as follows:

Chapter 1 explains the *SRS Long Range Comprehensive Plan's* purpose and scope and describes the SRS comprehensive planning process. A major component of this chapter is an outline of a framework for the future - site reconfiguration. It also provides an introduction to the site, including a description of the site and its region of influence; information on site employees and employers; and a brief discussion of the site's mission and focus areas. In addition, this chapter includes information on the *Statement of Principles* between the Secretary of Energy and the Governor of South Carolina.

Chapter 2 describes the current missions through which the Savannah River Site will fill its role in supporting Nuclear Weapons Stockpile Stewardship, Nuclear Materials Stewardship, and Environmental Stewardship. The site's applied research and development laboratory, the Savannah River Technology Center (SRTC), the University of Georgia Savannah River Ecology Laboratory (SREL), and the transportation of nuclear and hazardous materials also are discussed in this chapter.

Chapter 3 contains information on future land use. Topics included in this section include the future land use planning assumptions and development considerations, community-related considerations, the multiple-use concept, and the implementation of land use zones. SRS is divided into three principal land use planning zones: Site Industrial, Site Industrial Support, and General Support. The most intensive uses will be located in the Site Industrial zone which is located at the site's center in order to minimize the effect on surrounding communities, maintain controlled site access, and ensure the integrity of the established safety and security buffer. The Site Industrial Support and General Support zones accommodate uses of decreasing intensity.

Chapter 4 provides an area-by-area description of site facilities and projects; the future facility configuration based on known mission work; probable useful life of facilities; and a proposed reconfiguration scenario designed to promote efficiency. A summary of the major proposed reconfiguration actions includes:

- Closure of A Area phased over time, with administrative functions relocating to B Area; SRTC relocating to the industrial center; maintenance, warehousing and vehicular support relocating to N Area; and SRE) relocating to B Area.
- Administrative consolidation into B Area, forming a site administrative complex that includes DOE and Westinghouse Savannah River Company (WSRC) administration, SREL, U.S. Forest Service-Savannah River, site training functions, medical operations, and a visitors' center with museum display and badging office.
- Elimination of temporary structures and consolidation of personnel into permanent structures, including consolidation of H-Area personnel into an office building.
- Closure of little-used industrial sections such as D, T, P, and R Areas.

Chapter 5 provides a description, the current physical condition, and limitations of various site infrastructure components and projects the reconfiguration of infrastructure systems based on the proposed reconfiguration scenario. Infrastructure components discussed in this chapter include the site's electrical system, steam, domestic and process water, dams, central chillers, primary and secondary roads, railroads, aviation, water transportation, information technology system networks, and public address/safety alarm system. A summary of the major proposed infrastructure changes includes:

- Minimizing the infrastructure footprint by closure of A, D, P, R, and T Areas.
- Expansion of the infrastructure systems in B Area to accommodate expanded administrative functions.

Chapter 6 describes the site's natural resources and mission work related to natural resource management. Natural resource components such as plant communities, renewable forest products, wildlife, surface water, soils, air quality, recreation, and education are discussed. Key features include continued timber production as a revenue source to support natural resource programs, increasing the hardwood acreage for uses other than timber production, restoration of Carolina bays, and an increasing role in the protection and restoration of threatened and endangered species.

Chapter 7 describes the cultural resources and management of cultural resources at the site, including archaeological sensitivity zones and future plans. SRS is currently out of compliance with cultural resource regulations; therefore, a key component of this plan is development of a permanent home for archaeological collections. This facility, proposed for B Area, would allow public access to the collections as required by the regulations.

Chapter 8 outlines plans for long-term stewardship of facilities, land, and groundwater resources, consistent with DOE policies and SRS regulatory agreements. It describes the DOE national perspective and the use of active controls and passive institutional requirements. A key element of the national long-term stewardship program is the use of institutional controls to ensure that land use restrictions are maintained. The site is divided into six units for managing site remediation activities, based on watershed boundaries. This chapter also discusses contaminants found in the soil, water, engineered units, and facilities of each watershed. The site anticipates that environmental remediation activities will be completed by 2038, after which long-term stewardship activities will be fully implemented.

Several appendices provide more detailed background information on issues related to this plan. These include information on the SRS and federal budget processes, nuclear material transportation contacts, sensitive, threatened, and endangered species, land use models, risk ranking of inactive facilities, and archaeological issues. A list of major references used in the development of this plan is also included.

This plan will be used as guidance to develop future budget requests. As a consequence, the plan will be reviewed annually and updated, as needed. As detailed studies are completed, the plan may be modified to reflect the results of the studies to assure that the *SRS Long Range Comprehensive Plan's* vision for the future is consistent with current site priorities. Readers should verify that they are reading the most current version of specific sections by contacting the DOE-SR Chief Financial Office.

People . . . our most important resource.

Chapter 1

Introduction and Background

This plan defines a vision for the physical development of the Savannah River Site (SRS) over the next 50 years in a comprehensive and integrated way, maintaining a corporate view of planning that addresses the needs of the entire site. Closely associated with the physical improvement of the site is consideration for the needs of our most important asset, the site's workforce, as expressed in the site's strategic plan. The *SRS Long Range Comprehensive Plan* is divided into chapters that address specific parts of site operations, including strategic missions, future land use, facilities, infrastructure, natural resources, cultural resources, and long-term stewardship. Each operational chapter integrates the needs of the other operations to form a comprehensive vision for the future of SRS.

Chapter 1 explains the *SRS Long Range Comprehensive Plan's* purpose and describes the site's comprehensive planning process. This chapter also provides an introduction to the site, including its physical description, region of influence, and information on site employees and employers. It includes a discussion on how this plan addresses the *Statement of Principles*, an agreement between the Secretary of Energy and the Governor of South Carolina and introduces and provides the rationale for the concept of site reconfiguration.

The *SRS Long-Range Comprehensive Plan* defines a direction for the site based on specific assumptions that are articulated in each chapter. A few of the key planning assumptions from the various chapters are highlighted on the next page. It should be recognized that recommendations for changes to the site's physical assets contained in this plan do not necessarily reflect final decisions and that further studies and analyses will be conducted prior to implementation. Because changes in assumptions, mission direction, or physical conditions may influence the plan in any number of ways, contingencies are not addressed in this plan. Rather, the planning process recognizes that plans are dynamic and must be adjusted as requirements, priorities, and resources change. As these changes occur, they will be analyzed for their impact on the plan, and the plan will be updated, as appropriate, to accommodate new circumstances.

Background - The Savannah River Site

The Savannah River Site is one of the several government-owned, contractor-operated sites in the U. S. Department of Energy's (DOE) nuclear defense complex. On June 12, 1950, the U.S. Atomic Energy Commission asked E.I. Du Pont de Nemours and Company to design, construct, and operate what was to become the Savannah River Plant (SRP). The

General Planning Assumptions

- SRS will remain federally owned property.
- Site boundaries will remain unchanged.
- Health and safety of the public, the workforce, and the environment will not be compromised.
- Funding requirements will reflect meeting all compliance agreements and other regulatory commitments..
- The Department of Energy will have a continuing stewardship role, which will require ongoing monitoring and maintenance.
- Offsite national repositories will be available for permanent disposal of nuclear waste.
- Sufficient federal funding will be provided to both accomplish assigned missions and support the reconfiguration of the site to optimize its ability to meet future requirements.
- The number of site employees will remain relatively stable and able to support new missions,
- While demands for infrastructure in individual areas may decrease, the overall capacity may remain fairly constant.
- SRS will continue to protect and manage the site's natural resources.
- SRS will maintain and optimize the site as a National Environmental Research Park.

Atomic Energy Commission approved the location of the present site in November 1950, and purchased tracts of land totaling 310 square miles in Aiken, Barnwell, and Allendale Counties in South Carolina, adjacent to the Savannah River (see Figure 1.1). Construction began on February 1, 1951, and the first facility, the heavy water plant, began operating in August 1952. The first production reactor started operating in December 1953.

During the Cold War, SRS served the nation by producing nuclear materials critical to developing and maintaining a strong nuclear deterrent. While the need for a strong nuclear deterrent remains, the nation now faces additional challenges, including the proliferation of nuclear weapons and materials and the cleanup of the Cold War legacy. To meet these challenges, the site's mission has expanded from primarily defense to one that includes the stabilization, storage, and preparation for final disposition of nuclear materials. The site will continue its ongoing emphasis on responsible waste management, environmental cleanup, natural resource management, and the science and technology associated with these missions. The site will invest in new or upgraded facilities and site infrastructure to create a modernized site to accomplish these missions and realize the site's vision. The *SRS Long-Range Comprehensive Plan* is based on the mission and vision established in the site's strategic plan, *21st Century Stewards for the Nation: a Strategic Plan for 2000 and Beyond.*

SRS Long Range Comprehensive Plan Purpose and Scope

The purpose of the *SRS Long Range Comprehensive Plan* is to provide the framework for integrating the SRS mission and vision with ecological, economic, cultural, and social factors in a regional context and to aid in effective decision-making for near-term and long-term uses of the site. The *SRS Long Range Comprehensive Plan* addresses the physical development of the site in a comprehensive and integrated way, maintaining a corporate view of the needs of the entire site. It defines the site's current situation and outlines actions needed to move into the 21st century. This plan does not include detailed information on support functions such as environmental compliance, health physics, safeguards and security, etc. This information can be found in lower level, more detailed plans. Comprehensive planning assures that presently defined and future mission activities are compatible with land use, core competencies, facility conditions, and infrastructure. The *SRS Long Range Comprehensive Plan* also outlines the framework for physical development of the site to cost effectively accomplish the mission, vision and objectives specified in the *21st Century Stewards for the Nation: A Strategic Plan for 2000 and Beyond.* Another important characteristic of the comprehensive plan is that it provides a planning framework to analyze future site options. The plan serves as a vital tool with which to communicate current and future plans to internal and

Figure 1.1
Savannah River Site is located in South Carolina adjacent to the Savannah River

external stakeholders and serves as the guiding document for resource allocation.

Development of the *SRS Long Range Comprehensive Plan* is an integral part of the site's adherence to the Government Performance and Results Act of 1993 (GPRA). GPRA was enacted to improve federal program effectiveness and public accountability by promoting a new focus on results-oriented management. Further, the "Results Act," as it has become known, requires plans that define the missions, long-term goals, and shorter-term performance. Guided by the *SRS Strategic Plan* and supported by lower tiered plans, the *SRS Long Range Comprehensive Plan* plays a vital role in planning by not only addressing the spirit of GPRA but also by assuring that the act's major tenets are fulfilled. While the *SRS Strategic Plan* provides the basis for the development of all planning documents at SRS, the *SRS Long Range Comprehensive Plan* provides the link to integrate site mission plans.

A 50-year time horizon has been adopted for this *SRS Long Range Comprehensive Plan* in accordance with executive and congressional requirements for future land use and long-term stewardship. As cleanup of SRS and other DOE sites progresses, it has become clear that long-term stewardship activities will be required for long-lived contaminants and wastes that will remain in place and preclude unrestricted use of the property. Beyond the 50-year planning horizon, SRS will continue to be in a long-term stewardship mode.

The SRS Long Range Comprehensive Planning Process

Comprehensive planning is a systematic process that includes development, approval, revision, and integration of SRS plans with budget formulation, budget execution, and program evaluation. The process includes customer input and stakeholder involvement.

The organizational framework used to implement the process includes the SRS Executive Board, consisting of senior managers from all major DOE and contractor organizations; the SRS Planning Board, comprised of working level representatives from all site organizations; and a professional planning staff. The Executive Board develops the site's vision for the future. The vision is then shown in the *SRS Strategic Plan* with specific goals and objectives to accomplish this vision. Strategies are developed to implement the goals and objectives of the *SRS Strategic Plan* by the SRS Planning Board through individual site programs. These strategies are integrated with the long-term vision for the site in this *SRS Long Range Comprehensive Plan*. This process is formalized in DOE Savannah River Implementing Procedure 430.2, *SRS Comprehensive Planning*. Direction for and approval of this plan ultimately is

SRS Mission and Vision from the *21st Century Stewards for the Nation: A Strategic Plan for 2000 and Beyond*.

SRS Mission:

We serve the nation through safe, secure, cost-effective management of our nuclear weapons stockpile, nuclear materials, and the environment.

SRS Vision:

SRS will be a modernized DOE site, recognized for performance and excellence in support of our national security and as a responsible steward of the environment.

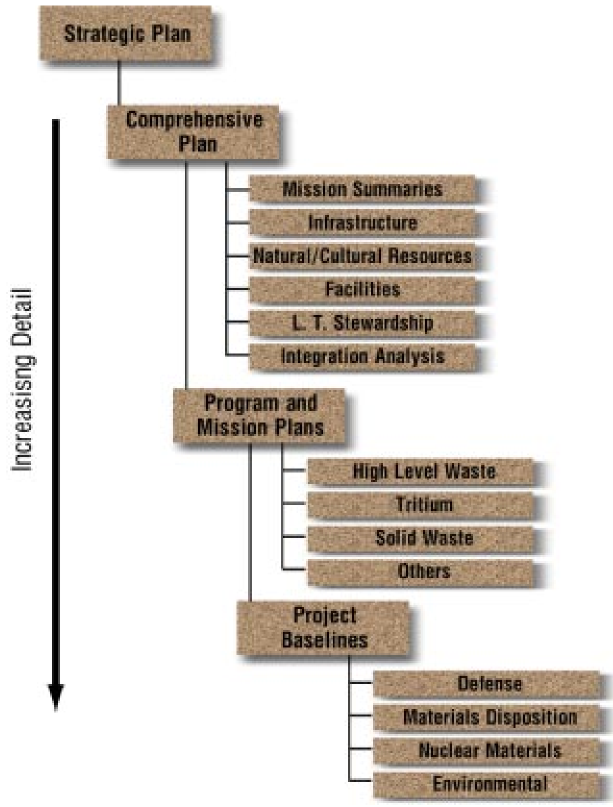


Figure 1.2
Hierarchy of SRS planning documents

the responsibility of the Site Manager. However, the manager receives guidance from high-level management groups such as the Executive Board and the Joint Leadership Group, two teams comprised of site senior managers.

The *SRS Long Range Comprehensive Plan* is based on the premise that planning drives budget development. SRS has instituted a formal and disciplined process with which to link the planning process with budgeting, called the Management Control System (MCS). The MCS defines the specific processes and data flow used to manage all the site's work activities and is structured to align with the DOE HQ Strategic Management System, linking planning, budget formulation, budget execution, and evaluation processes. This linkage is required by the Government Performance and Results Act (GPRA) and other management practices. All related business processes and initiatives are integrated into and subsequently executed within this overall site process.

The various levels of planning documents at SRS are depicted in Figure 1.2. The top-level planning document for the site is the SRS Strategic Plan, *21st Century Stewards for the Nation: a Strategic Plan for 2000 and Beyond*. This plan provides the site vision and mission with accompanying goals, objectives, and strategies for the three mission areas: Nuclear Weapons Stockpile Stewardship, Nuclear Materials Stewardship, and Environmental Stewardship. The *SRS Long Range Comprehensive Plan* provides more detail than *the SRS Strategic Plan*, but not as much detail as program plans and baselines. This plan integrates all of the various aspects of site planning. With the *SRS Long Range Comprehensive Plan* setting the planning boundaries, the next level includes program and mission plans, which are tactical, life-cycle plans written for various DOE programs. These describe, in detail, plans for the various missions and programs at SRS. At the most detailed level of planning, the project baselines describe the necessary projects to accomplish the missions for the DOE programs.

Prior to implementation of project-specific plans, the activities are reviewed with consideration of the National Environmental Policy Act (NEPA), where either environmental impact statements or environmental assessments are written and analyzed. After a record of decision or finding of no significant impact is made, project-specific plans are finalized, including requests for additional funding to implement the decision. If funded, design and construction follow, with operations beginning for the new facility only after careful review and safety analyses are completed. References to specific NEPA activities are made in this *SRS Long Range Comprehensive Plan*, where appropriate.

The SRS Long Range Comprehensive Plan is not organized by DOE programs, but instead views the site as one land unit and plans accordingly. Activities at SRS are managed through both the National Nuclear Security Administration (NNSA), which includes several current and future SRS national security and nuclear nonproliferation functions and the DOE-SR Field Office, which performs DOE environmental program missions and support for a number of other programs. This plan addresses the needs of both programs. This plan does not specifically discuss current or future program interface or linkage with other DOE sites. However, this plan, along with similar plans from other DOE sites, provides an initial basis for DOE-wide overview and integration of strategies and objectives to achieve DOE missions.

Reconfiguration of SRS

Implementing the SRS vision of becoming a "modernized DOE site" will mean developing new facilities, improving existing facilities, and taking the actions necessary to physically configure SRS so that the site cost effectively supports both current and future missions. The term used to describe this process is called "reconfiguration." The *SRS Strategic Plan* pledges that "...SRS will begin a phased approach to reconfiguring the site, focusing on infrastructure, facilities, and human resources to meet the challenges of the 21st century." The land, facilities, infrastructure, and people that make up SRS form a unique national asset that could not be reasonably duplicated today. Through the proposed reconfiguration, SRS is optimizing its ability not only to meet the nation's current missions but also to enhance its ability to meet the challenge of future national and international missions.

When the site was originally built during the Cold War in the early 1950s, there were uncertainties about the operation of nuclear facilities. To minimize the possibility of nuclear accidents in one facility from triggering accidents in adjacent facilities, to minimize damage to site operations from foreign air invasion, and to facilitate site evacuation in the event of an accident, reactors and operating facilities were separated geographically during early construction of the site. Efforts were made to keep employees in one operating area from interacting with employees from other areas to avoid security leaks. Life-cycle cost considerations, environmental impacts, positive effects of personnel interaction, and operational cost efficiency were not as important in the Cold War era as they are today.

Technological advances in the understanding of the chemistry and physics of nuclear science, changes in the types of safeguards and security threats, maintenance and upgrade costs on facilities that are more than 50 years old, and other budgetary considerations have changed the configuration requirements for SRS. Reconfiguration of the site would require significant investment, which would include the construction of new nuclear facilities, modification of existing site facilities for new missions, and modifications in the site's infrastructure. It is necessary that there be continuity in support and direction over the course of future administrations to maintain progress. The chief reconfiguration challenge is to provide funding investment for the enduring long-term missions at SRS while aggressively pursuing site cleanup. Given the substantial investment required, the reconfiguration would take place over many years.

The relocation and/or reconstruction of necessary, "right-sized" facilities and supporting systems within the industrial center of the site would shrink the site's infrastructure requirements with an anticipated reduction in operating costs. In addition to cost efficiencies, other intangible benefits could be realized such as provision for enhanced operational efficiency and capability required to meet 21st century needs and mission demands. The reconfiguration vision will drive more detailed studies and analyses to test the viability of the concept. These more detailed studies will determine whether it is efficient, cost-effective, and safe to move from the present configuration, while concurrently providing a stronger basis for future decisions.

Recognizing the magnitude of the challenge of translating the vision expressed in the *SRS Long Range Comprehensive Plan* into reality, the DOE-SR Manager has established a new division, called the Site Integration and Performance Improvement Division (SIPID). The charter for this division includes the responsibility to provide central leadership and sponsorship for the reconfiguration effort. SIPID will serve as the architect of the reconfiguration effort by developing and implementing, in concert with senior management, the detailed "blueprint" and preliminary cost estimates for the long-term consolidation and streamlining of SRS facilities and infrastructure toward the industrial center of the site. In doing so, SIPID will use the *SRS Long Range Comprehensive Plan* as a baseline planning document in order to assure that the optimum site configuration solutions presented in the *plan* are used to faithfully guide all infrastructure planning and development.

To better inform reconfiguration decision making and provide ongoing assurance that the effort improves cost effectiveness and efficiency, this organization will sponsor and/or review and validate detailed studies of infrastructure alternatives that may then modify the vision of the *SRS Long Range Comprehensive Plan*. If necessary, the Long Range Comprehensive Plan will be modified after the studies and analyses are completed. The results of this dynamic process will then be reflected in the site's infrastructure program and proposed capital projects, as well as in future revisions of this plan.

The criteria that will be used to guide the reconfiguration effort are:

- Increase efficiency of operations.
  - Prior to the construction of new facilities, consider the feasibility and cost/benefit of upgrading or retrofitting existing facilities. Included in this decision should be consideration of the life cycle costs of facilities and associated infrastructure, office space, and laboratory requirements to support new missions.
  - Reduce annual operating expenses and improve operating efficiency by shrinking the infrastructure footprint to minimize surveillance and maintenance of outdated infrastructure.
  - Consider opportunities to share facilities. For example, if two facilities both require furnaces and vaults, then the function of a vault and furnace should be consolidated to the maximum extent practical, providing the opportunity for reduction in construction and operating costs.
- Increase the interaction among operating organizations to foster communication and cross training of the workforce.
- Optimize security, especially increased security associated with new plutonium missions.
- Reduce environmental impact.
  - Preferentially locate facilities within existing brownfields rather than in previously unimpacted areas.
  - Co-locate operations with waste processing facilities to minimize onsite transportation and contamination possibility.
  - Maximize the use of energy efficient design in construction of new buildings.

Reconfiguration would change the physical arrangement of functions and facilities at SRS. In the chapters that follow, the plan provides the framework and outlines the anticipated actions to optimize the site configuration. Lower level, detailed studies and plans will be developed to address the specific actions, schedules, and budgetary requirements to implement the concepts outlined in this plan. This proposed reconfiguration includes closure of some areas of the site and consolidation of functions in new or expanded facilities. At present, most operating nuclear facilities are located in the industrial center of the site. New site industrial facilities would be co-located with similar operations in this industrial center. Administrative facilities and associated infrastructure would be evaluated for cost-effective consolidation into a centralized administrative complex located near the industrial zone to provide support. A summary of the major proposed reconfiguration actions includes:

1. Closure of A Area over time, with administrative functions relocating to B Area; SRTC relocating to the industrial center; maintenance, warehousing and vehicular support relocating to N Area; and the University of Georgia Savannah River Ecology Laboratory (SREL) relocating to B Area.
2. Administrative consolidation into B Area, forming a site administrative complex that includes DOE and Westinghouse Savannah River Company (WSRC) administration, SREL, U.S. Forest Service-Savannah River, site training functions, medical operations, and a visitors' center with museum display and badging office.
3. Elimination of temporary structures and consolidation of personnel into permanent structures, including consolidation of H-Area personnel into an office building.
4. Closure of little-used areas like D, T, P, and R Areas.

A more detailed summary schedule of the proposed reconfiguration actions, by area, can be found in Chapter 4.

A Brief Introduction to SRS

The following sections provide a brief overview of the site, including descriptions and information on the site's region of influence, employees and employers, and focus areas.

Site Physical Description

SRS is located in south central South Carolina and occupies an area of approximately 310 square miles in Aiken, Barnwell, and Allendale counties. The site's center is approximately 23 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina, the two closest major population centers. A marked property line establishes the site's boundary to the north, south and east. The Savannah River forms the site's southwestern boundary for 20 miles on the South Carolina/Georgia border. The southern tail of the site, commonly referred to as the Lower Three Runs Corridor, follows the confluence of Lower Three Runs Creek, and is bounded on both sides by marked property line to its junction with the river (see Figure 1.3).

SRS is situated in the Atlantic Coastal Plain. Land use around SRS is varied and includes residential, industrial, commercial, transportation, recreation, and agricultural activities. Regional industrial land uses include a commercial nuclear power plant near Waynesboro, Georgia; a regional, low-level nuclear waste repository in Barnwell, South Carolina; a variety of conventional chemical industries near Augusta, and a variety of manufacturing industries in Aiken.

The site is drained by several small streams: Upper Three Runs, Fourmile Branch, Pen Branch, Steel Creek, and Lower Three Runs Creek. The streams form the basis for subdividing the site into watershed units used in environmental restoration and long-term stewardship planning. Two large water impoundments, L-Lake and Par Pond, were developed to support past reactor activities, and currently serve as important ecological research areas.

National defense concerns in the early 1950s dictated the need for large tracts of low-cost land. Approximately 300-square miles of land was acquired by the U. S. Atomic Energy Commission for the construction of Savannah River Plant at a cost of about $19 million. Residents worked with the Atomic Energy Commission to relocate from the property to demonstrate their patriotism. Much of the farm and forestland had been used for intensive farming for nearly 200 years, as was typical of land in the South. Nearly 200 years of hunting and exploitation of the woodland habitat had heavily impacted some wildlife populations. Since the ownership transferred to the federal government, land management efforts have played a significant role in site's operation, with increased attention and resources being focused on environmental issues during the last three decades.

The SRS ecology has always been a concern, starting with a census of all wildlife before construction began. Beginning in the early 1950s, the U.S. Forest Service reforested the land to stabilize and rehabilitate the soil to support native plant and animal life, reduce erosion, and minimize dust generation that could impact nuclear facility operations.. In addition, this reforestation also reduced the movement of surface contamination, protecting downstream domestic water supplies. In 1972, the Department of Energy designated SRS as the nation's first National Environmental Research Park (NERP), providing a large tract of land where the effects of human activities upon the environment could be studied. The deer population has increased from less than 50 animals in 1950 to its present population of approximately 3,500 deer.

Currently, more than 90 percent of the site is covered in forest or other natural vegetation. Production, production support, service, research and development, waste management areas, roads, and utility corridors account for the remaining 10 percent of the site property. The original facility layout of SRS was designed to isolate major radioactive operations away from the site boundaries, creating a buffer zone that provided additional security and reduced the risk of accidental exposure to the general public. DOE has designated the entire site as a property protection area with limited public access.

Socio-Economic Impact

The SRS region of influence is the area outside the site boundary affecting and affected by site activities. The site is located in the Central Savannah River Area (CSRA), consisting of eight counties in South Carolina and Georgia. The region contains eight county governments and 38 incorporated areas.

The population of the CSRA is approximately 500,000, primarily located in Aiken County in South Carolina and Columbia and Richmond Counties in Georgia. Over 70 percent of this population is classified as urban. The urban-rural mix of the region mirrors that of the United States in general but is more urban than other areas in South Carolina and Georgia. The population density of the region is almost twice that of the nation as a whole. The CSRA population is 37 percent minority.

SRS significantly impacts its region of influence and contributes to the economies of South Carolina and Georgia through employment and purchasing; and educational, research, technology transfer, business development, and community assistance programs. More than 60 percent of the site's annual budget directly impacts the economies of South Carolina and Georgia (*A Study of the Economic Impact of the Savannah River Site on South Carolina and Georgia*, draft, H. S. Grewal, Ph.D., 2000). It is estimated that the site's total contribution to the incomes of both South Carolina and Georgia ranges between $1.6 and $2.7 billion annually. SRS enjoys strong community support from the local jurisdictions, chambers of commerce, educational institutions, and the public at large.

Figure 1.3
General Savannah River Site Map

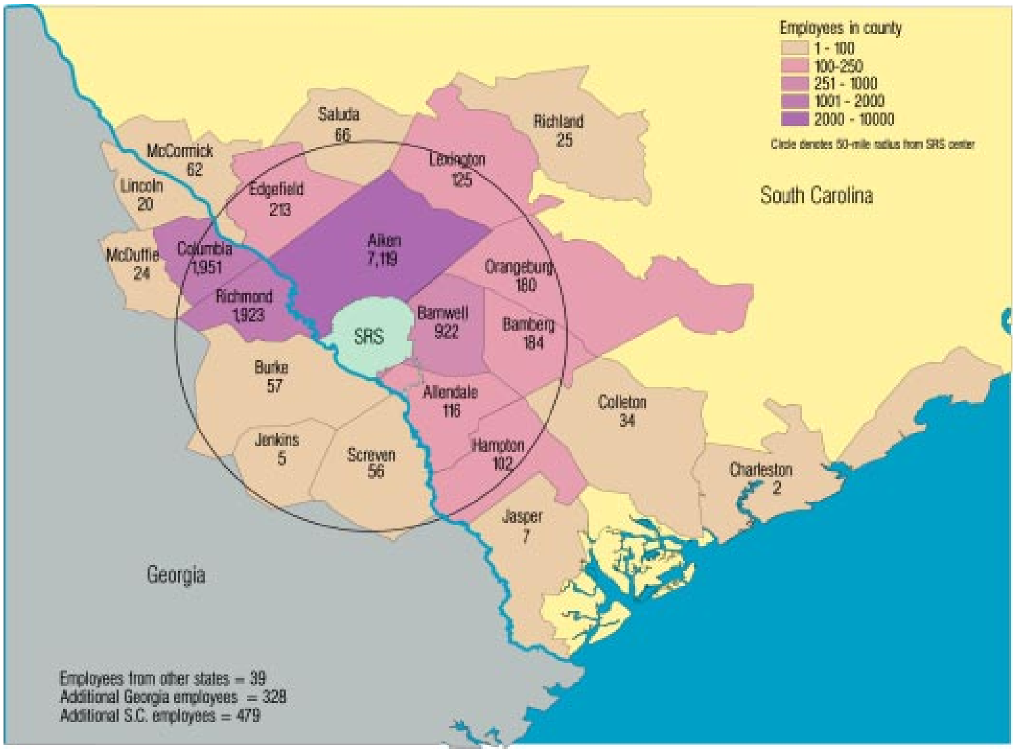


Figure 1.4
Current distribution of SRS employees in each county

Within the 50-year planning horizon, SRS will continue to be an important economic factor for the surrounding regions of South Carolina and Georgia. SRS will continue to be one of South Carolina's largest employers. The site currently provides approximately 14,000 jobs, with two-thirds of site employees residing in South Carolina and one-third of site employees residing in Georgia (see Figure 1.4).

The chart shown on Figure 1.5 shows the percentages of site employees that work for the major SRS organizations. Westinghouse Savannah River Company (WSRC) and its partners, Bechtel Savannah River Company, British Nuclear Fuels, Ltd., and Babcock and Wilcox Savannah River Company, employ more people than the other site organizations combined.

The DOE owns the Savannah River Site. Approximately 500 permanent government employees are responsible for overall management and oversight of SRS operations through the DOE Savannah River Operations Office and the National Nuclear Security Administration Savannah River Area Operations Office. WSRC, employing approximately 12,200, is responsible for management and integration of site activities, including subcontractors and over 700 construction craft employees. The WSRC employment figures include Bechtel Savannah River, Inc., which is responsible for project management of environmental restoration, engineering, and construction projects; Babcock and Wilcox, Inc. Savannah River Company, which is responsible for managing facility decontamination and decommissioning projects; and British Nuclear Fuels, Ltd. Savannah River Corporation, which is responsible for managing the solid waste program. Wackenhut Services, Inc., which employs approximately 800, provides security for

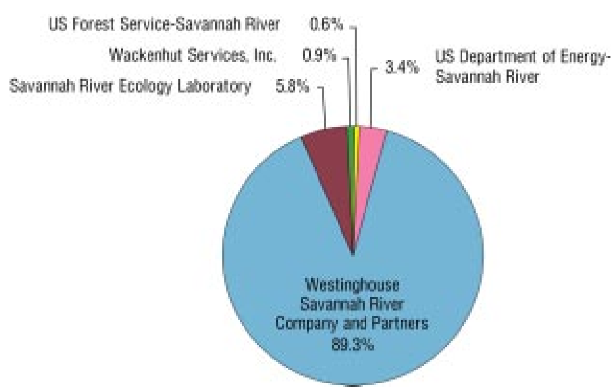


Figure 1.5
Distribution of employees by site organization

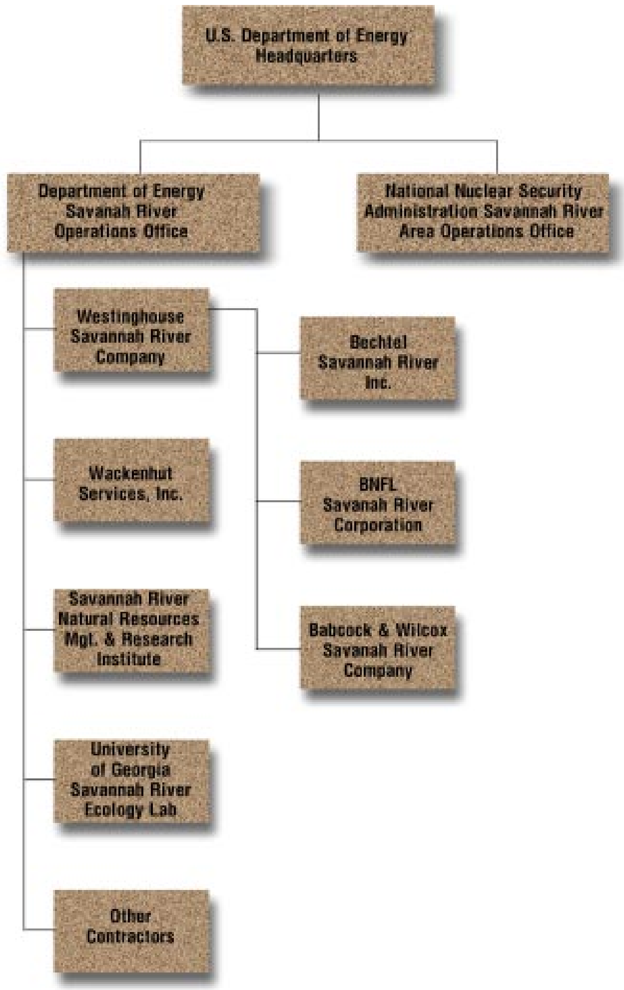


Figure 1.6
Site Organizational Structure

the site. The U.S. Forest Service-Savannah River employs about 75 employees and manages natural resources. The SREL employs approximately 175 and provides ecological evaluations and natural resource research. An additional 120 employees work for support contractors and others, including the University of South Carolina Institute of Archaeology and Anthropology, the U.S. Department of Agriculture Natural Resources Conservation Service, the U. S. Army Corps of Engineers, and the S.C. Department of Natural Resources. The site's organizational structure is shown in Figure 1.6.

The number of SRS workers has declined by over 45 percent since 1992, when employment exceeded 25,000. Figure 1.7 shows the total number of SRS employees over the last 10 years. Estimates of future employment at the site show an increase of approximately 4,000 jobs over the course of the next 6 years due to construction and operation of new facilities, with the numbers decreasing after 2007 as major construction projects are completed.

Significant downsizing was accomplished through a series of voluntary and involuntary separations. While effectively reducing the budget, voluntary separations did not always maintain the skills mix needed to support future missions at SRS, and has also resulted in an older workforce. Approximately 50 percent of the workforce will be eligible for retirement in the next five years. This situation is similar to conditions found at other sites in the DOE Complex. A recent study by the Chiles Commission, established by Congress under the National Defense Authorization Acts of 1997 and 1998, found that the aging workforce, the tight market for talent, the lack of a long-term hiring plan, loss of institutional process knowledge, and other constraints will make it difficult for the Department and its contractors to maintain future nuclear expertise.

In addition to income and employment contributions, SRS also benefits the states of South Carolina and Georgia through a variety of educational, research, technology transfer, business development, and community assistance programs. Funding for these programs is provided to help minimize the impact of SRS downsizing. A recent strategic planning study by the Lower Savannah Council of Governments identified the following as comparative strengths of SRS: the strong technical core competencies of SRS personnel, the site's abundant land resources, and the site's sophisticated infrastructure. These comparative strengths play a role in maintaining strong current missions as well as attracting new missions.

Currently, about 85 percent of the site's budget is funded from the Environmental Management (EM) Program, which also has the "landlord" responsibility for SRS. Other monies for the site are from the National Nuclear Security Administration (NNSA), Defense Programs, Fissile Materials Disposition Program, and other DOE and federal program budgets. New missions coming to SRS (construction and operation of the new Tritium Extraction Facility and new plutonium missions) will require additional funding. Specific funds for these programs have been requested from Congress. Additional information about the national DOE and site's budget processes can be found in Appendix A.

Statement of Principles

While GPRA adherence incorporates the plans of internal stakeholders, various agreements between SRS and external stakeholders guide how the site does business with these -

important groups. In September 1999, the Secretary of Energy signed the *Statement of Principles* with governors of various states that contain DOE sites, including the Governor of South Carolina. This document lays the foundation for a cooperative relationship between DOE and these states. The *Statement of Principles* outlines issues common to all states as well as issues specific to each state and delineates the manner in which DOE and the states can work cooperatively to clean up DOE weapons sites.

Common issues include such items as completing the cleanup of the nuclear weapons legacy as expeditiously as possible in compliance with state and federal regulations; obtaining a commitment to predictable and adequate funding for the cleanup; continuing investments in science and technology; and protecting groundwater. Specific issues common to both DOE and the State of South Carolina include the schedule for shipping transuranic waste out of the state; ensuring SRS cleanup; final disposition for high-level, low-level, and mixed low-level wastes; a plan for use and closure of the SRS canyons; assurance that SRS is treated equitably; and plans to request adequate funding for current and future missions. These principles will also form the foundation for a cooperative, continuing dialogue between the DOE and the states to address long-term funding and stewardship issues (see Figure 1.8).

This *SRS Long Range Comprehensive Plan* serves as the primary implementing vehicle for the Statement of Principles, and each principle has been assigned to a SRS senior manager to address implementation issues. Information in the plan addressing the *Statement of Principles* includes a diagram showing the SRS integrated schedule of major activities; a series of charts depicting generation, receipt, treatment, storage, and disposition pathways for material and wastes; a description of the SRS budget process with an explanation of funding for new missions; and a timeline for SRS activities with subsequent facility disposition activities. A complete explanation of the federal budget process may be found in Appendix A. This plan, along with the plans from other sites, may be used by DOE HQ to integrate Complex-wide issues and develop overall strategies and solutions.

Figure 1.7
History of employment at SRS from fiscal year 1991 to fiscal year 2000

Statement of Principles

Common Interests

- Completing the cleanup of the nuclear weapons legacy as expeditiously as possible and in compliance with state and federal requirements
- Obtaining a commitment to predictable and adequate funding to complete the cleanup
- Optimizing the dollars within each site to ensure a program that addresses risk reduction, compliance and completing the cleanup
- Continuing investments in science and technology
- Finding ways, where feasible and cost effective, to integrate our waste management challenges among sites
- Ensuring safe and efficient transportation of nuclear and hazardous waste
- Recognition that our sites are vast natural resource assets
- Commitment to protect our groundwater resources

How we can work together to achieve our common interests

- Ongoing and active consultation and communication between individual Governors and the Secretary and among the collective group
- Timely and complete sharing of information and response to issues of concern
- Commitment to Executive Involvement and communication to resolve disputes, in particular, in advance of initiation of any legal action
- Development of mechanisms to ensure that individual decisions are not made in a vacuum and that the cumulative impacts of these decisions can easily be understood
- Better education of the public, Congress, and the Administration on the historic and continued importance of our sites and the need for predictable and adequate funding to complete the cleanup
- Commitment to use land and other assets for other purposes
- Greater attention paid to the future role and mission of each site and its place within the overall complex
- Development of better mechanisms for interaction with stakeholders

Issues of specific interest to the State of South Carolina

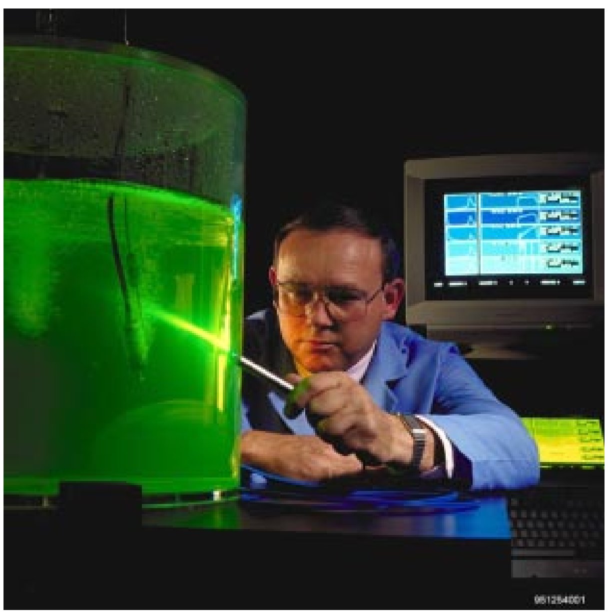
The DOE and the State of South Carolina will continue to work together to achieve the following goals:

- Determine shipping schedule for transuranic waste
- Work together to define a long-term mission and long-term comprehensive plan for the Savannah River Site (SRS) consistent with the needs of DOE, the State, and surrounding communities
- Ensure that cleanup activities stay on schedule, including the pursuit of sufficient funding to maintain the schedule
- Ensure a disposition path for high level waste
- Find mutually acceptable solutions to disposal of low level waste and mixed low level waste
- Develop a plan for use/closure of the canyons that addresses the needs of DOE, the State, and the surrounding communities
- Assure funding adequate to support new missions and offsite waste/materials processing, handling, and storage
- Ensure that SRS is treated equitably in allocation of Congressional “general reductions”
- Provide adequate grant funding to support state regulatory and oversight programs
- Establish a plan for decontamination and decommissioning that is integrated with site cleanup mission

Figure 1.8
The Statement of Principles, signed by the Secretary of Energy and the Governor, defines a cooperative working relationship between the DOE and South Carolina

Chapter 2

Strategic Mission Areas



Purpose And Scope

The missions of SRS fall into three stewardship mission areas defined in SRS's strategic plan, *21st Century Stewards for the Nation: a Strategic Plan for 2000 and Beyond* (March 2000). This chapter describes the mission work in these stewardship areas. An understanding of the site's current and future missions is necessary for planning future activities, facilities, and infrastructure. In addition, this chapter discusses the site's applied research and development, natural resources, and the offsite transportation of nuclear and hazardous materials that also impact the site's facilities and infrastructure.

Introduction

As the country has moved to the post-Cold War era, the Savannah River Site (SRS) has adjusted its activities to remain responsive to the Department of Energy's (DOE) mission directions. Through a series of international nonproliferation treaties, the United States and the former Soviet Union negotiated a commitment to reduce their respective nuclear arsenals. SRS has been chosen to maintain a significant, enduring, and larger role in the stewardship of the nation's nuclear weapons stockpile, nuclear materials, and the environment. During the Cold War, SRS primarily served the nation by producing nuclear materials critical to its strong nuclear deterrent. Although the need remains to continue this deterrence, the site's missions have expanded from a defense mission to include the stabilization, storage, and preparation for final disposition of nuclear materials, environmental cleanup, and natural resource management.

The SRS strategic plan describes the site's three stewardship mission areas, as follows:

Nuclear Weapons Stockpile Stewardship emphasizes science-based maintenance of the nuclear weapons stockpile. SRS supports the stockpile by ensuring the safe and reliable recycle, delivery, and management of tritium resources; by contributing to the stockpile surveillance program; and by assisting in the development of alternatives for large-scale plutonium pit production capability, if required.

Nuclear Materials Stewardship is the management of excess nuclear materials, including transportation, stabilization, storage, and disposition to support nuclear nonproliferation initiatives. Primary nuclear materials in this program include components from dismantled weapons, residues from weapons processing activities, spent nuclear fuel, and other legacy materials.

Environmental Stewardship involves management, treatment, and disposal of radioactive, hazardous, and non-radioactive wastes resulting from past, present and future operations. This stewardship includes pollution prevention and restoration of the environment impacted by site operations. Environmental Stewardship also encompasses stewardship of the site's extensive natural and cultural resources.

In addition to these three stewardship functions, the SRS Strategic Plan identifies another area of strategic focus, called Corporate Management.

Corporate Management guides *how* business will be conducted in the mission-related areas, forming the underlying basis of what is important across the site and cross-cutting all mission areas. This area addresses the fundamental principles, values, and systems critical to the SRS stewardships. The goals of Corporate Management are to excel in environmental, safety, and health performance; to demonstrate excellence in customer satisfaction and stakeholder/regulator involvement; to maintain a skilled workforce; and to manage efficiently and effectively. Priorities of Corporate Management are described in the five management focus areas, as discussed below.

- **Safety and Security.** To protect workers, the public, and the environment and to protect national security interests.
- **Technical Capability and Performance.** To achieve a diverse workforce that is highly trained, qualified, and motivated and to ensure that SRS facilities and infrastructure are available to support assigned missions.
- **Community, State, and Regulator Relationships.** To demonstrate to the community, state, and regulatory agencies that SRS meets its obligations and communicates openly and honestly.
- **Cost Effectiveness.** To ensure that products and services are delivered through the efficient operation of facilities, cost-effective contracting, and effective project management.
- **Corporate Perspective.** To integrate activities across the site, throughout the DOE complex, and with other governmental agencies.

Ongoing Missions

The following sections in this chapter highlight the site's missions and functions.

Nuclear Weapons Stockpile Stewardship

The site's Nuclear Weapons Stockpile Stewardship mission includes maintaining technical expertise in tritium operations, production, and engineering to support the nation's weapons stockpile. This also includes the planning and support of the long-range plutonium pit fabrication contingency.

Tritium Supply. The mission of the Tritium Program is to provide tritium to meet the ongoing requirements of the Nuclear Weapons Stockpile Memorandum, to conduct equipment surveillance operations, and to manage existing tritium inventories and facilities. Tritium, a radioactive isotope of hydrogen, is an essential component of our nation's nuclear stockpile. This gas decays at a relatively rapid rate to a form of helium and must be replenished periodically to maintain weapon viability. At the present time, tritium is available only from recycling tritium from dismantled nuclear weapons and from routine tritium reservoir exchanges from the existing nuclear stockpile. SRS is the only facility in the DOE Complex capable of meeting production requirements for delivery of tritium reservoirs to the weapons stockpile and has also become the single storage location for bulk quantities of tritium by consolidating tritium operations from other DOE sites. Related activities include recovering, purifying, and storing tritium from dismantled weapons and recycling and loading weapon components for the stockpile.

To continue the site's tritium mission, significant emphasis has been placed on the upgrade and maintenance of the site's tritium facilities to ensure reservoir quality and schedule reliability. A new loading facility was commissioned in 1994, and additional loading capabilities for advance reservoir designs were added in 1998. The tritium mission is carried out in a 25-acre compound within the H-Area chemical processing facilities. Under the Tritium Facility Modernization and Consolidation Project, several existing process systems, equipment, and process functions have been relocated to existing buildings within the Tritium Facility to reduce the size of the tritium facilities' "footprint" and reduce operating costs. This modernization project will provide the capability to process tritium from the Tritium Extraction Facility.

To determine the best source for new tritium production, DOE prepared and issued several Environmental Impact Statements (EISs) as follows:

- *Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor*, DOE/EIS-0288, March 1999.

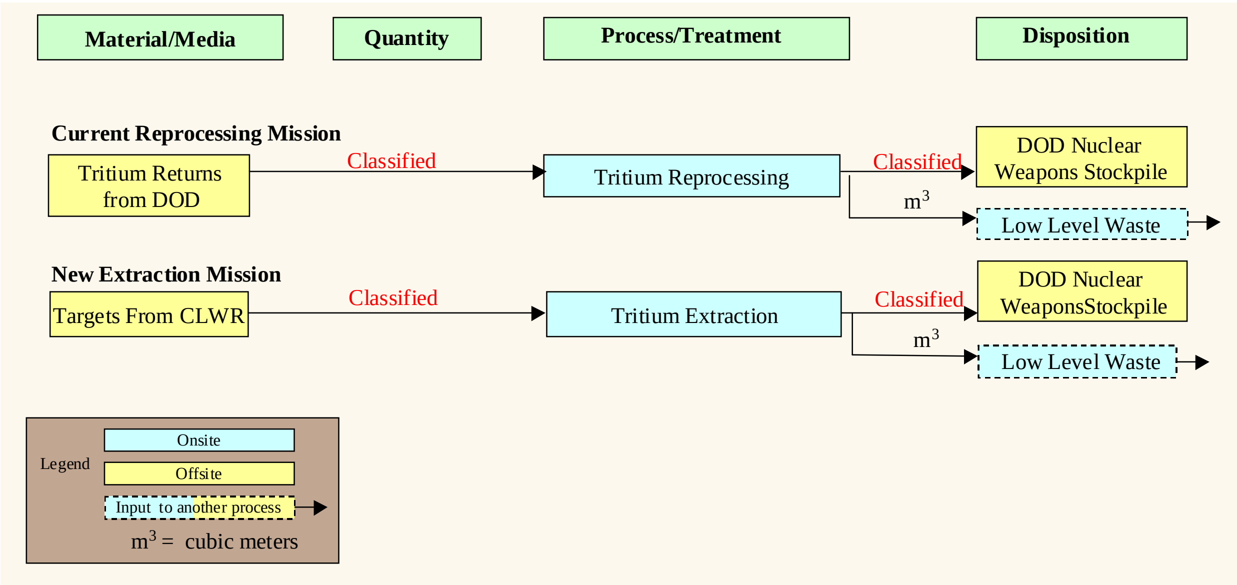


Figure 2.1.
Material movement associated with the current Tritium Reprocessing Mission and the new Tritium Extraction Mission. Tritium quantities and waste volumes are classified for security reasons. Low-level waste is transferred to onsite treatment processes shown on Figure 2.6.

- *Environmental Impact Statement Accelerator Production of Tritium at the Savannah River Site*, DOE/EIS-0270, March 1999.
- *Final Environmental Impact Statement: Construction and Operation of a Tritium Extraction Facility at the Savannah River Site*, DOE/EIS-0271, March 1999.

The *Consolidated Record of Decision* (ROD) *for Tritium Supply and Recycling* (FR Vol. 64, No. 93, May 14, 1999) determined that the use of commercial light water reactors would be the chosen technology for tritium production. The ROD further stated that the construction of an accelerator at SRS will be the backup tritium supply source method; however, an accelerator will not be constructed. The ROD announcement named the Tennessee Valley Authority's Watts Bar Unit 1 and Sequoyah Units 1 and 2 reactors as the specific commercial nuclear reactors that will provide the irradiation services for the tritium supply.

The ROD also announced that the H Area would be the location for the proposed Tritium Extraction Facility. This facility will safely and efficiently extract tritium-containing gases from tritium producing burnable absorber rods that have been irradiated in one of the commercial reactors mentioned above. Construction began in August 2000, with operation of the facility projected to begin in 2006. The facility will require industrial development of about four acres adjacent to the existing tritium facilities in H Area. As discussed in the Final Environmental Impact Statement: Construction and Operation *of a Tritium Extraction Facility at the Savannah River Site*, three major structures are planned: a remote handling area, a tritium processing area, and an administrative support building. Associated with this industrial facility will be a modest expansion of utilities and transportation, mostly within the existing industrial area.

The origin of tritium entering the site for recycling or processing; the process or treatment that will be used to prepare it for use or disposition; and its ultimate use or disposition are shown in Figure 2.1. Because quantities of tritium are classified information, they are not shown on this diagram.

Plutonium Pit Manufacturing Support. For many years, the Rocky Flats Environmental Technology Site (RFETS) in Colorado was the source for the plutonium portion of nuclear weapons, called the "pit." Following the announcement of the shutdown of the RFETS in Colorado, the Los Alamos National Laboratory in New Mexico was selected in the *Record of Decision Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (FR Vol. 61, No. 249, December 26, 1996) to produce these pits. DOE is investigating the need for a new large-scale plutonium pit manufacturing facility to meet future production requirements. Utilizing its existing plutonium infrastructure and experience, SRS supports this contingency through research and engineering studies. If it were determined in the future that a large-scale manufacturing facility is required, SRS would be the most likely site for this mission.

Nuclear Materials Stewardship

Within the DOE Complex, SRS will be a focal point to ensure the safe and secure storage, stabilization, and disposition of surplus, weapons-usable, and other nuclear materials, including materials from dismantled weapons and spent nuclear fuel. In support of the disposition mission, SRS will continue to develop and demonstrate advanced disposition technologies and concepts. The site supports national objectives and international agreements to reduce inventories of fissile material, which can be used for making weapons. SRS will continue to support beneficial reuse of its nuclear material assets to satisfy potential emerging needs in deep space exploration, nuclear science research, and energy.

In September 1993, President Clinton issued the *Non-proliferation and Export Control Policy* in response to the growing threat of nuclear weapons proliferation. In January 1994, the United States' President and Russia's President issued the *Joint Statement Between the United States and Russia on Non-Proliferation of Weapons of Mass Destruction and the Means of Their Delivery.* In accordance with these policies and statements, the focus of U.S. nonproliferation efforts is to ensure the safe, secure, long-term storage and disposition of surplus, weapons-usable plutonium and highly enriched uranium (HEU). In July 1998, the U.S. and Russia signed a five-year agreement to provide the scientific and technical basis for decisions concerning how surplus plutonium will be managed and a statement of principles with the intention of removing approximately 50 metric tons of plutonium from each country's stockpile. DOE has implemented a program to provide for safe and secure storage of surplus weapons-usable fissile material (plutonium and highly enriched uranium) and a strategy for the disposition of surplus weapons-usable plutonium through both the immobilization and mixed oxide (MOX) fuel approaches. SRS maintains a high level of safeguards for these materials while in storage. The immobilization and MOX fuel strategies ensure that excess plutonium is never again available for use in nuclear weapons production.

Nuclear Materials Stabilization and Storage of Legacy Materials. The goals of the site's Nuclear Materials Stabilization and Storage Program are to accomplish the following:

- Safely and securely stabilize, and store the site's legacy nuclear materials in a verifiable, cost-effective, and environmentally sound manner until disposition;
- Receive, stabilize, and store plutonium from other DOE sites;
- Develop partnerships with the Rocky Flats, Hanford, and other sites to accelerate cleanup and reduce life-cycle costs; and
- Maintain storage and operating facilities for potential future missions while transitioning facilities that have no further identified missions to minimum surveillance and maintenance status.

On May 26, 1994, the Defense Nuclear Facilities Safety Board (DNFSB) issued *DNFSB Recommendation 1994-1 to the Secretary of Energy, May 26, 1994.* This document notes the DNFSB's concern that the halt of the production of nuclear materials left some nuclear materials in the nuclear processing stream in a state that, for safety reasons, needed immediate stabilization. DOE shares the concerns regarding nuclear materials stabilization for long-term storage and has implemented a plan to address these urgent problems. The DOE has given high priority to accelerated cleanup and closure of sites and the disposition of nuclear materials and waste. The DOE's vision is to complete cleanup at most of its 113 sites by 2006.

As part of the continuing effort to accomplish this vision, DOE has developed critical closure paths and timetables for closure activities, and progress has been made in identifying waste and nuclear materials inventories, determining final disposition paths, and evaluating opportunities for program improvements and cost avoidance. Several major National Environmental Policy Act (NEPA) analyses and associated Records of Decision have been completed that determine the disposition paths for surplus plutonium and highly enriched uranium. Other decisions have been made under NEPA regarding stabilization efforts for materials such as depleted uranium, at-risk spent nuclear fuel, and target materials to resolve near-term storage vulnerabilities and prepare the materials for disposition.

SRS has made progress in stabilizing nuclear materials for long-term storage in anticipation of final disposition. All imminent hazards have been mitigated, and SRS has released a plan to stabilize the remainder of the legacy nuclear materials identified by the DNFSB. The site's chemical separations facilities support DOE's commitment to complete this stabilization work. SRS is mid-way through an 11-year program to stabilize its legacy materials. SRS personnel are working with DOE-HQ and other sites to develop cost-effective solutions for the technical challenges presented by the legacy materials around the DOE Complex currently awaiting stabilization. DOE may elect to continue operation of the SRS processing facilities following stabilization of currently approved materials to accept materials from other DOE sites until all legacy materials are stabilized. At the conclusion of the stabilization mission, the processing facilities will transition to minimum surveillance and maintenance necessary to maintain the optimum safety envelope, pending decontamination and decommissioning.

For example, DOE has decided on an approach that maintains the existing SRS canyon strategy. This strategy targets the early phase-out of F-Area Plutonium/Uranium Extraction (PUREX) operations, but DOE has made plans for a new plutonium stabilization and packaging system in Building 235-F to convert SRS materials to a form meeting the Department's long-term storage standard.

DNFSB Recommendation 2000-1 to the Secretary of Energy, January 14, 2000 identified numerous problems that still were unresolved in 2000 and recommended a prioritized list of technical actions that need to be resolved to mitigate the hazard of these materials. DOE has prepared the *Implementation Plan for the Remediation of Nuclear Materials in the Defense Nuclear Facilities Complex, Revision 3, May 31, 2000* that includes a schedule for completing the material stabilization. The strategy for addressing these DNFSB recommendations is resulting in expeditious stabilization of SRS materials and early stabilization of certain limited quantities of plutonium from the Rocky Flats Environmental Technology Site. This strategy will also help maintain the process capability for converting plutonium and highly enriched uranium received from off site locations.

In June 2000, DOE issued *A Strategic Approach to Integrating the Long-Term Management of Nuclear Materials: The Department of Energy's Integrated Nuclear Materials Management Plan* (Report to Congress, June 2000). This plan includes unclassified inventory information that charts a path toward integrated and effective life-cycle management of nuclear materials. This plan also includes multi-year strategies to examine opportunities for achieving greater integration, coordination, and efficiency in the management of nuclear materials. Additional details on the management of nuclear materials can be found in *A Strategic Approach to Integrating the Long-Term Management of Nuclear Materials: The Department of Energy's Integrated Nuclear Materials Management Plan (May 2000).*

The K-Area Material Storage Facility Project (KAMS) is modifying K-Area facilities to provide cost-effective, interim storage of non-pit, legacy plutonium metals and oxides in the years before the new plutonium disposition facilities are available. The Rocky Flats Environmental Technology Site plans to accelerate its site closure to 2006, from 2010, in order to realize a significant reduction in life-cycle costs. KAMS is an important part of new plutonium disposition missions announced in the ROD for the *Surplus Plutonium Disposition Final EIS* (FR Vol. 65, No. 7, January 11, 2000), designating SRS as the recipient of three new plutonium disposition facilities.

Additionally, existing facilities will be used to process other materials that are candidates for stabilization, such as americium/curium. No other stabilization capability currently exists within the DOE Complex for this material.

Plutonium Disposition. The Secretary of Energy selected SRS as the location for the construction and operation of facilities to dispose of as much as 50 metric tons of surplus weapons-usable plutonium in a manner that meets the "Spent Fuel Standard. " The Spent Fuel Standard is achieved when weapons-usable plutonium is made as inaccessible and unattractive for weapons use as is the plutonium that exists in spent nuclear fuel from commercial reactors. This strategy is acceptable for disposal in a geologic repository per the *Record of Decision for the Surplus Plutonium Disposition Final EIS* (FR Vol. 65, No. 7, January 11, 2000.) The nation's nuclear weapons are disassembled at the Pantex Plant in Texas. Plutonium pits from inside the nuclear weapons that are no longer needed for defense will be sent to the SRS Pit Disassembly and Conversion Facility.

As announced in the ROD, three new facilities will be required to accomplish the plutonium disposition mission. One facility is the Pit Disassembly and Conversion Facility, which will disassemble the plutonium component of a nuclear weapon, called the pit, and convert the resulting plutonium metal to a declassified oxide form suitable for disposition in either the Plutonium Immobilization Facility or the MOX Fuel

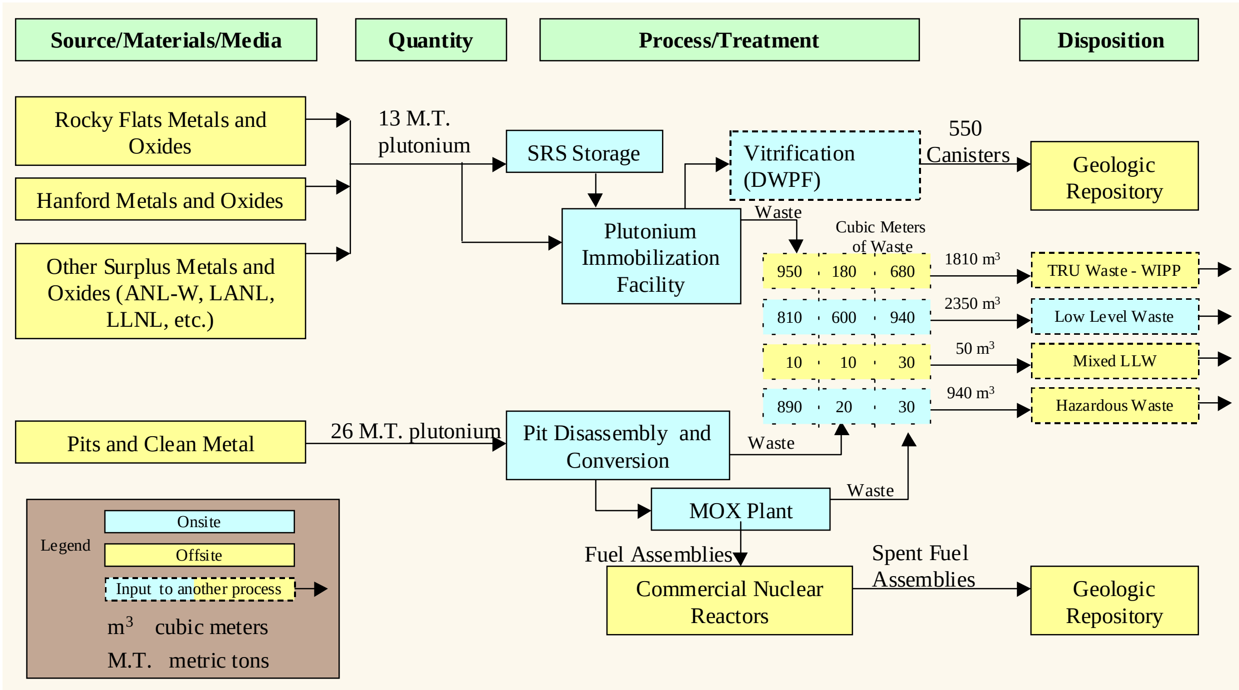


Figure 2.2.
Movement of material associated with the Plutonium Disposition Missions. The volume of waste generated by these missions is a small percentage of the other wastes presently scheduled for treatment and disposal at SRS. Uranium for making ceramic and fuels is not shown on this diagram. TRU, mixed low level, and hazardous wastes are shipped from SRS for disposal as shown in Figure 2.11. Low-level waste is transferred to onsite treatment processes shown on Figure 2.6.

Fabrication Facility. The new Plutonium Immobilization Facility will use ceramic can-in-canister technology. The immobilization process will convert approximately 17 metric tons of surplus plutonium to a ceramic form and seal it in cans. The cans will be placed in canisters in the Plutonium Immobilization Facility, which will then be filled with borosilicate glass containing high-level radioactive waste at the Defense Waste Processing Facility (DWPF). The third facility is the MOX Fuel Fabrication Facility, which will blend uranium dioxide and plutonium dioxide, form the mixture into pellets, and load the pellets into fuel rods for use in commercial nuclear power plants. Approximately 33 metric tons of surplus plutonium will be used to fabricate this MOX fuel. The MOX Fuel Fabrication Facility will be owned and financed by DOE but designed, built, licensed, and operated by a private consortium. The facility will operate solely for the disposition of surplus U.S. weapons' plutonium. The facility will be licensed by the Nuclear Regulatory Commission and operated so that the facility will be available for inspection by the International Atomic Energy Agency. The ultimate disposition for both the immobilized plutonium and the MOX fuel, after its use in power plants, will be a geologic repository.

Pursuing both the immobilization and MOX approaches sends a strong signal to the world of the U.S. determination to reduce stockpiles of surplus weapons-usable plutonium irreversibly. Pursuing both approaches also provides some insurance against uncertainties of implementing either approach individually. The construction of new facilities for disposition of surplus U.S. plutonium will not take place unless there is significant progress on plans for plutonium disposition in Russia.

Current plans are to construct the new plutonium disposition facilities near the center of the site in F Area. The program to disposition up to 50 metric tons of surplus plutonium is estimated to require approximately 10 years of operation. The quantity split of materials slated for the immobilization and MOX disposition paths could vary. The current total material capacity for the Immobilization Facility is 13 metric tons and 33 metric tons for the MOX facility. Additional materials could be declared surplus if the U.S. and Russia agree on further reductions in their respective nuclear weapons stockpiles, therefore, potentially extending this mission. Figure 2.2 shows the movement of plutonium materials into and out of SRS and the processing steps that will take place in the plutonium facilities.

Implementation of the new plutonium missions will result in additional waste generation onsite. Comparing the data found on Figure 2.2 with the other waste disposition maps that depict existing waste streams (see Figures 2.3 and 2.6), it can be seen that the new plutonium missions constitute a small percentage of increase in waste volumes over the existing waste management obligations. Table 2.1 provides a comparison of the additional volumes of various wastes that may be generated relative to the volume of waste currently projected in existing missions.

Table 2.1. Comparison of current mission waste inventories with projected waste volumes from New Plutonium Missions

Waste type/ Unit of measure	Current Mission	New Pu Missions (10 year total)	Percent Change
Transuranic waste m^3	18,000	1,810	10%
Mixed low-level waste m^3	5,025	50	1%
Hazardous waste m^3	29,000	940	3%
High-level waste (canisters)	5,700	84	1.5%

Enriched Uranium Blend Down. The U.S. has declared a total of 174.3 metric tons of highly enriched uranium (HEU) surplus to future weapons needs. One path for making this material unsuitable for nuclear weapons is through a dilution process called "blend down," which makes this material suitable for productive use in commercial reactors. Of the 174.3 metric tons of HEU, approximately 85% will be converted to commercial or research reactor fuel. The remaining HEU will be disposed of as waste. Of the HEU to be converted to commercial or research reactor fuel, over 33 metric tons is considered off-specification, meaning the fuel will not meet typical reactor fuel specifications; however, with adjustments in enrichment, it will perform similarly to fuel made from virgin material. Figure 2.3 depicts the origin and quantities of nuclear materials, the process or treatment that will be used on the material to prepare it for disposition, and the ultimate disposition of the material.

Of the more than 33 metric tons of off-specification HEU, approximately 21 metric tons is located at SRS. The *Environmental Assessment for the Construction and Operation of the Highly Enriched Uranium Blend-Down Facilities at the Savannah River Site* (DOE/EA-1322, April 2000) analyzes the environmental impacts of the construction of a new low-enriched uranium loading facility and modifications to current facilities for blend-down of approximately 16 of the 21 metric tons of HEU. The remaining five metric tons of HEU will be shipped to a Tennessee Valley Authority vendor for blend down at the vendor's facility. DOE is negotiating an agreement with the Tennessee Valley Authority to use this fuel for its reactors. SRS plans to take the 16 metric tons of highly enriched uranium with an isotope content greater than 20% of uranium-235, purify it, and then blend it down using natural uranium (uranyl nitrate) supplied by the Tennessee Valley Authority. The blend down process will yield low enriched uranium (LEU) with an isotope content of less than 5% of uranium-235, suitable for commercial nuclear reactors. After purification and blending at SRS, this LEU will be shipped to Tennessee Valley Authority vendors where it will be solidified and made into reactor fuel. Twelve metric tons of off-specification highly enriched uranium is currently stored at the Y-12 Site in Oak Ridge, Tennessee. The agreement with the Tennessee Valley Authority provides for this HEU material to be shipped to the Tennessee Valley Authority vendor for blend-down at the vendor's facility.

SRS currently has an inventory of over 50 million pounds of depleted uranium trioxide powder (DUO). The material is stored in approximately 36,000 fifty-five gallon drums in buildings across the site. The age of the drums varies from 14 to 28 years. Some of the drums have been placed within larger drums because of deterioration of the original drums. These original drums have deteriorated because of poor storage conditions over the last several decades. DUO is considered a low-hazard material. A large portion of the DUO is being considered as shielding to produce dry storage casks for filled DWPF high-level waste canisters. The government would retain ownership of the DUO and have responsibility for ultimate disposal of the casks. If this application were implemented, depleted uranium trioxide would begin to leave SRS in late fiscal year 2001 and continue through fiscal year 2008.

Spent Fuel Management. The site's Spent Fuel Management Program receives and safely stores non-commercial spent nuclear fuel (SNF), unirradiated material, and legacy residues, as well as maintains the facilities in which these materials are stored while awaiting ultimate disposition.

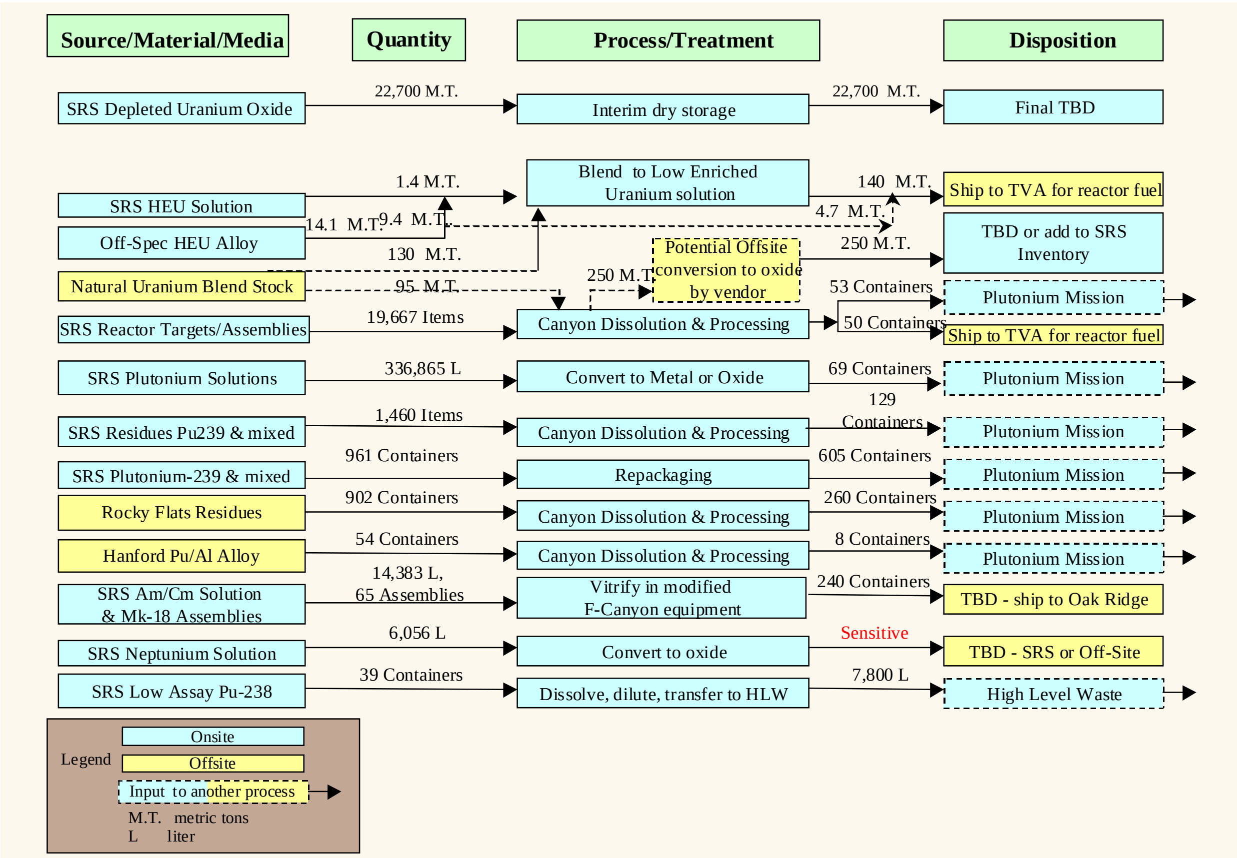


Figure 2.3
Movement of material associated with the current Nuclear Material Stabilization, Storage, and Disposition Missions. "Containers" referenced in this diagram are cylindrical vessels approximately 5 inches in diameter and 10 inches in height. Dashed boxes show material moving into plutonium disposition processes shown in Figure 2.2.

This program is an integral part of DOE's initiative to provide safe and secure storage and disposition of excess weapons-usable materials. SRS safely stores and manages aluminum-clad SNF from previous SRS reactor operations as well as SNF received from foreign and domestic research reactors and is working toward converting this fuel to a form suitable for a permanent repository. SRS also stores non-aluminum-clad SNF to be transferred to Idaho National Environmental and Engineering Laboratory (INEEL).

DOE recently published the *Savannah River Site Spent Nuclear Fuel Management Final EIS* (DOE/0279, March 2000). This EIS evaluates reasonable alternatives for the safe and efficient management of spent nuclear fuel and targets stored and scheduled to be received at SRS, including placing these materials in a form suitable for disposition. The *Record of Decision for the Savannah River Site Spent Nuclear Fuel Management Environmental Impact Statement* (FR Vol. 65, No. 152, August 7, 2000) states the decision to develop and demonstrate the melt-and-dilute technology to manage about 48 metric tons of heavy metal aluminum-clad spent nuclear fuel. Following successful development and demonstration of the technology, including characterization and demonstration of the melt-and-dilute product to meet anticipated repository acceptance criteria, DOE will begin detailed design, construction, testing and startup of a Treatment and Storage Facility. Additional details about the management of SNF can be found in the *Spent Fuel Storage Division Integrated SNF Management Plan* (November 2000).

SRS has proposed a line item for the construction of a treatment and storage facility for the preparation of aluminum-clad SNF for disposition in a geologic repository. This Treatment and Storage Facility (TSF) will be located in and adjacent to the existing 105-L Building and will be used to prepare the SNF inventories not scheduled for stabilization processing in canyon facilities. The proposed TSF would include remote handling and existing heavy lifting (cask handling) capabilities and newly constructed outdoor modular dry storage space for SNF assemblies. The mission of the TSF will be to prepare the SNF for interim dry storage in a "road ready" form for shipping and ultimate disposal in a Nuclear Regulatory Commission (NRC)-licensed geologic repository. The TSF is anticipated to be on-line by fiscal year 2007, based on completion of the development of the melt-and-dilute technology for SNF disposition.

Using the melt-and-dilute technology, SNF would be melted along with other materials to ensure a low-enriched uranium-aluminum product. Most fission products would remain trapped with the product matrix, although some would be volatilized. The melt product would be sealed in corrosion-resistant canisters. These canisters would be packaged along with the site's high-level waste canisters and shipped offsite to a geologic repository for ultimate disposal. A major advantage of the melt-and-dilute process is its ability to reduce the size of nuclear waste generated by fuel-rod disposal. DOE has also decided to use conventional chemical processing for approximately three percent by volume (40% by mass) of the aluminum-clad spent nuclear fuel. If the Treatment and Storage Facility becomes available before these materials have been stabilized, DOE may choose the melt-and-dilute technology rather than conventional processing technology for their stabilization.

DOE has also decided to continue to store small quantities of higher actinide materials until determination of a final disposition. In addition, DOE will ship approximately 20 metric tons of heavy metal non-aluminum spent nuclear fuel from SRS to the Idaho National Engineering and Environmental Laboratory. If DOE identifies any imminent health and safety concerns involving any aluminum-clad spent nuclear fuel before the Treatment and Storage Facility becomes available, DOE will use conventional processing technology to stabilize the material of concern.

Currently, aluminum-clad fuel assemblies from foreign and domestic research reactors are received and wet-stored in the Receiving Basin for Offsite Fuel (RBOF) and L-Area fuel storage basins. RBOF is located in H Area near the center of the site and has been operating and receiving offsite fuels since 1964. SRS plans to use L Basin as the primary receipt and storage facility for offsite SNF, using RBOF only as a backup in the event of equipment failure prohibiting or limiting L-Area fuel handling. More than 1,300 casks are expected over the project lifetime, of which 475 casks will be from foreign sources. Foreign fuel receipts are scheduled to end in 2009, while domestic fuel receipts will continue through 2035. De-inventory of offsite SNF from RBOF to the L-Area Basin began in 1999 and is scheduled to be completed over the next several years. Deinventory of L Basin through the Treatment and Storage Facility is expected to begin in 2008, become current with receipts by approximately 2014, and be completed by 2035.

Site spent nuclear fuels are currently stored in RBOF and the L and K Basins. These fuels will remain safely wet-stored in these areas until shipments to the site canyon facilities for stabilization are complete. The de-inventory of all DNFSB 94-1 fuel, such as Mark 16/22 SNF, is expected to be completed in fiscal year 2006.

Heavy Water. Current inventories of heavy water will either be stored to meet future mission requirements or sold as excess inventory. Plans call for reserving a portion of this inventory for potential use in the proposed Accelerator Production of Tritium facility. K and L Areas will be used to store heavy water in drums as consolidation programs continue. SRS currently has approximately 1,600 metric tons of heavy water stored in C, L, and K Areas.

The unique processing capabilities of SRS provide the potential to be selected to stabilize and store additional nuclear materials, as shown in Figure 2.4.

Environmental Stewardship

The SRS Environmental Stewardship Program strives to demonstrate excellence in the site's management of the environment by protecting human health and the environment; reducing the risks associated with past, current, and future operations; and monitoring, restoring, and sustaining the site's natural resources. The site's pollution prevention program goals are to reduce waste generation, releases of pollutants, and future waste management/pollution to control costs and environmental impacts and to promote increased energy efficiency. SRS is committed to protecting natural resources and the community by monitoring and sampling the environment and remaining compliant with state and federal regulations. SRS is also committed to maintaining its International Standards Organization (ISO) 14001 Environmental Management System certification, demonstrating the site's commitment to environmental excellence. In the Environmental Stewardship Program, five activities are addressed: high-level waste, solid waste, natural and cultural resources, environmental restoration, and surplus facilities disposition.

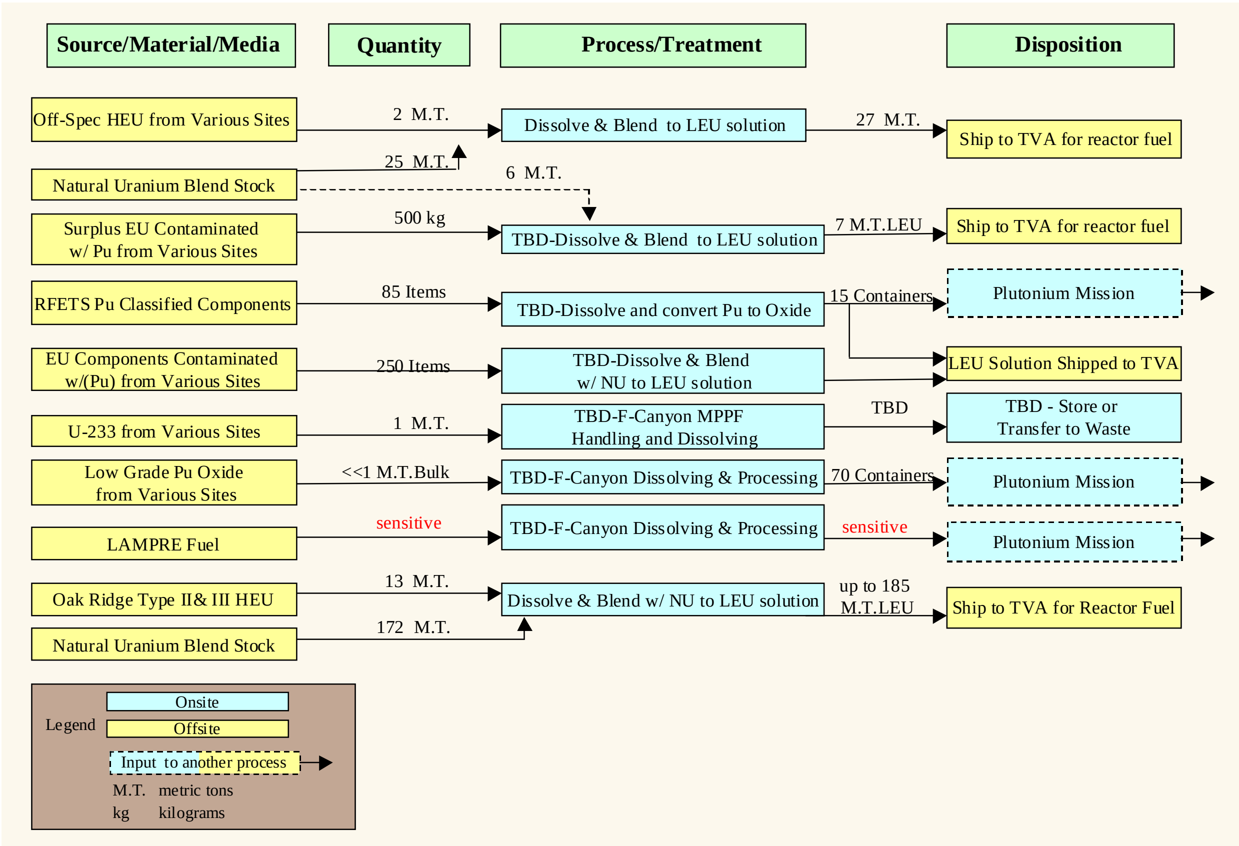


Figure 2.4
Movement of material that may come to SRS for stabilization, storage, or disposition in the future. Dashed boxes show material moving into plutonium disposition processes shown on Figure 2.2.

High Level Waste. The mission of the SRS High Level Waste (HLW) Program is to provide safe and efficient receipt, storage, and processing of highly radioactive liquid waste from SRS canyons via waste tanks to support site operations and DOE plans for permanent disposal of radioactive waste.

The HLW inventory is approximately 35 million gallons (420 million curies), stored in 51 underground waste storage tanks in F and H Areas near the center of the site. The waste stored in SRS tanks is broadly characterized as being either “sludge” or “salt.” Sludge waste, which is insoluble and settles to the bottom of the waste tank, generally contains strontium, plutonium, and uranium in the form of metal hydroxides. Salt waste, which is soluble and is dissolved in the liquid rather than settling to the bottom, generally contains soluble radioactive cesium and trace amounts of other radioactive elements. In total, there are approximately 3 million gallons of sludge and 32 million gallons of salt waste.

The high-level waste components of both sludge and salt waste will be vitrified at the Defense Waste Processing Facility (DWPF) and sent to a federal repository for disposal. The decontaminated low-level salt waste will be being sent to the Saltstone Facility onsite for disposal.

The HLW facilities are comprised of a highly integrated system involving: waste storage, evaporation, removal of waste from tanks, tank isolation and closure, waste pre-treatment, vitrification of the high-level waste component at DWPF, disposal of the low-level waste component at the Saltstone Facility, and interim storage of the vitrified high-level waste canisters pending transfer to a federal repository (see Figure 2.5). These facilities are all located near the center of the site for protection of the public and have the advantage of being located in close proximity to each other. All of the facilities and infrastructure necessary to store, transfer, and pre-treat the

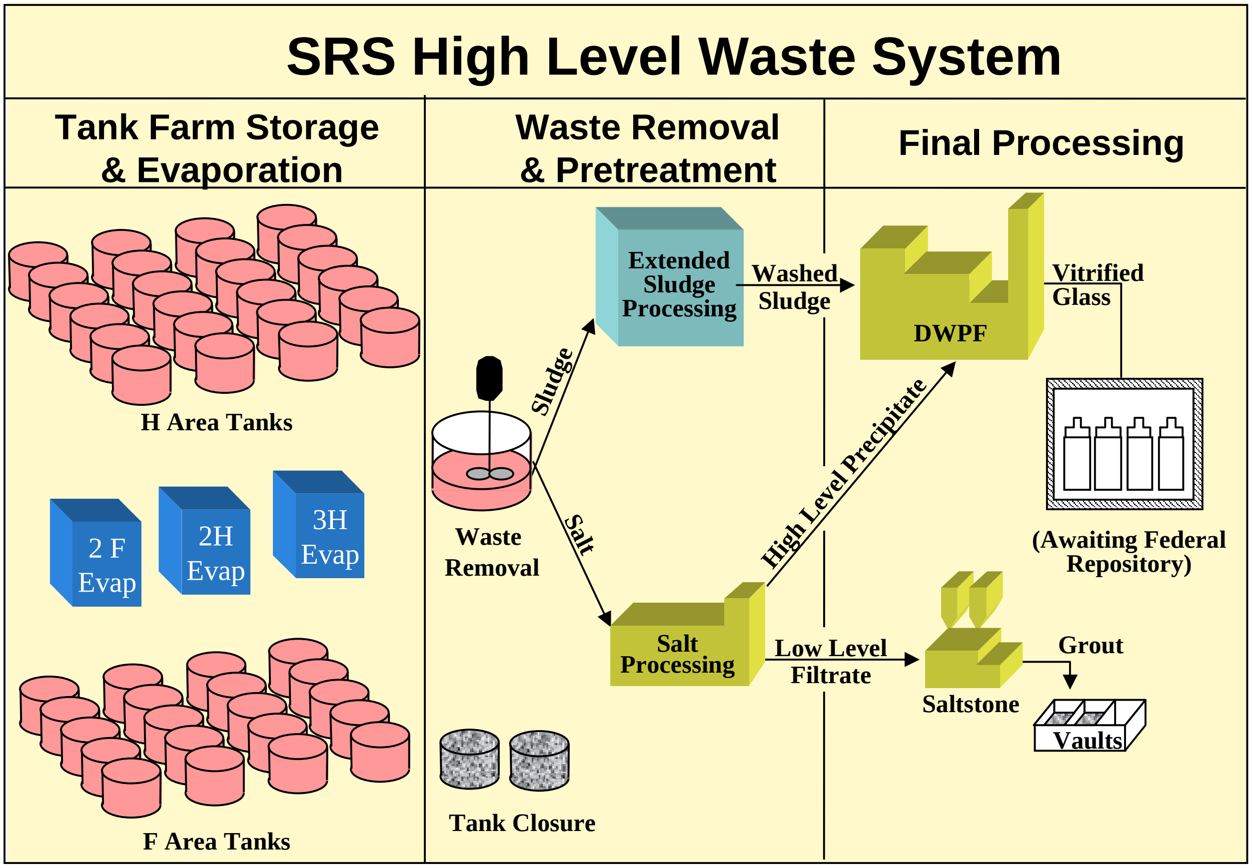


Figure 2.5
Process diagram of the High-Level Waste System

high-level waste are operating, except those required to process the radioactive and salt component.

For potential new missions involving canyon processing, the HLW system would perform its same essential function as it does now as the final step in waste processing.

The 35 million gallons of liquid, high-level radioactive waste in inventory at SRS are stored in 49 underground waste storage and processing tanks. In addition, there are two waste storage tanks that have been emptied and closed, making a total of 51 original tanks. The waste storage tanks are located in two separate "tank farms," one in H Area and the other in F Area. These two tank farms receive liquid waste as it is generated from the Separations Canyons, RBOF, and waste processing activities, particularly recycle water from DWPF and wastewater from waste pretreatment These waste tanks are continuously monitored to ensure safety and protection of the environment.

Waste volume in the high-level waste tanks is reduced by evaporation, thereby freeing tank storage space. This is critical to assure the tank farms maintain receipt capacity. SRS carefully tracks the projected available tank space to ensure that the tank farms do not have to stop receipt of waste, which would shut down the site's nuclear materials stabilization and other environmental program work.

Since 1951, the tank farms have received approximately 100 million gallons of high-level liquid waste, of which 65 million gallons have been evaporated, leaving the 35 million gallons being stored in the 49 storage tanks. A portion of tank space must be reserved for emergency transfers and for working space within the tanks. Waste receipts and transfers are normal tank farm activities as the tank farms receive new waste from the F- and H-Separations Canyons, stabilization and deinventory programs, recycle water from DWPF processing, and wash water from waste pretreatment. The tank farms also make routine transfers to and from tanks and evaporators. Currently, there is a backlog of approximately 5.5 million gallons of waste that has not been evaporated. Once this backlogged waste has been evaporated, the working capacity of the tank farms will be steadily reduced each year until salt processing becomes operational.

The two-evaporator systems currently operating at SRS are the 3H and 2F systems. A third system, the 2H Evaporator is currently in cold standby but is scheduled to resume operation in fiscal year 2001.

During waste removal, water is added to waste tanks and agitated by slurry pumps. The resulting liquid slurry is then pumped out of the tanks and transferred to waste pre-treatment tanks. Waste removal is a multi-year process. First, each waste tank must be retrofitted with 45-foot long slurry and transfer pumps, steel infrastructure to support the pumps, and various service upgrades (power, water, air, or steam). These retrofits can take between two and four years to complete. Then the pumps are operated to slurry the waste. Initially, the pumps operate near the top of the liquid and are lowered sequentially to proper depths, as waste is slurried and transferred out of the tanks. Bulk waste removal normally takes between six to twelve months, with the pumps being left in place for removal of the last few inches of waste.

After bulk waste has been removed from a tank, a series of activities are needed to prepare it for closure. Tank closure involves heel removal and water washing, isolation, and filling with grout. Heel removal and water washing are used to remove the last several inches of residual waste "heel" in the bottom of the tank. Spray nozzles wash down the tank sides and bottom, and specialized equipment removes this residual waste. Then the tank is isolated by cutting and capping power, steam, water, and air service lines and sealing all tank risers and openings. Finally, the tank is filled with layers of grout, which chemically and physically bind any remaining waste, leaving the tank safe for long-term surveillance and maintenance.

The schedule for waste removal and tank closure is part of the Federal Facility Agreement (FFA) between DOE, the Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC).

Sludge waste is "washed" to reduce the amount of non-radioactive aluminum and soluble salts remaining in the sludge. This ensures that the waste meets DWPF Waste Acceptance Criteria and federal repository requirements as well as reducing the overall volume of high-level waste to be vitrified. The processed sludge is called "washed sludge" and is sent to DWPF. During sludge processing, large volumes of wash water are generated and must be returned to the tank farms where it is volume-reduced by evaporation. Over the life of the waste removal program, the sludge currently stored in a number of tanks at SRS will be blended into a total of ten separate sludge "batches" to be processed and fed to DWPF for vitrification.

During salt waste processing, radioactive cesium and trace amounts of strontium and plutonium are separated from the salt solution that has been removed from waste storage tanks. This separated waste is highly radioactive, because it contains almost all the radioactivity of the original salt waste but only a small fraction of the original volume. It is this high-level waste that must be vitrified at DWPF. The remaining waste, now without its highly radioactive components, contains only a small fraction of the original radioactivity but the bulk of the volume. This decontaminated salt solution (low-level waste) can then be safely disposed onsite at the Saltstone Facility. Separating salt waste into its high-level and low-level components greatly reduces the amount of waste that must be vitrified into glass canisters, in turn greatly reducing the capacity and costs of the federal repository being built to dispose of the HLW glass canisters.

Currently, the High Level Waste System is removing and vitrifying only sludge waste. To process salt waste, there are three preferred alternatives being considered. Each alternative includes a proposal for process facilities, service areas, and chemical storage, with generally similar costs and schedules. The *Savannah River Site Salt Disposition Alternatives Supplemental Environmental Impact Statement* (SEIS) (DOE/EIS-0082-S2) is underway to evaluate these technologies for salt processing. Upon selection of a preferred alternative, it is expected that design and construction activities would begin on facilities required to process the salt stream.

Final processing for the highly radioactive washed sludge and salt waste occurs at the DWPF facility. In a complex sequence of carefully controlled chemical reactions, this waste is blended with glass frit and melted at 2100 degrees Fahrenheit to vitrify it into a borosilicate glass form. The resulting molten glass is poured into 10-foot-tall, 2-foot-diameter, stainless steel canisters. As the filled canisters cool, the molten glass solidifies, immobilizing the radioactive waste within the glass structure. The vitrified waste will remain radioactive for thousands of years. After the canisters have cooled, they are permanently sealed and the external surfaces are decontaminated to meet US Department of Transportation requirements. The canisters are then ready to be stored on an interim basis onsite in the Glass Waste Storage Building, pending shipment to a federal repository for permanent disposal.

Since the beginning of it operation in fiscal year 1996, DWPF has filled 950 canisters. Based on current HLW inventory and projections for existing missions, the total number of canisters of vitrified glass expected to be produced is in the range of 5,700-6,000. SRS is expected to complete vitrifying this waste by fiscal year 2023.

After the DWPF vitrification facility has filled, sealed, and decontaminated the canisters, a shielded canister transporter moves the highly radioactive canisters from DWPF to the current Glass Waste Storage Building (GWSB #1) for interim storage. GWSB #1 is a standard, steel-frame building with a below-ground, seismically qualified concrete vault with vertical storage positions for 2,159 canisters. A five-foot thick concrete floor separates the storage vault from the operating area aboveground.

Additional storage capacity will be required when the first Glass Waste Storage Building is filled to capacity. The *Environmental Assessment to Evaluate an Alternate Approach for the Defense Waste Processing Facility Glass Waste Canister Storage Facility at the Savannah River Site* (DOE/EA-1327, May 2000) evaluates alternatives to plan for this eventuality. One alternative under evaluation involves building and operating an onsite aboveground concrete storage pad for casks containing DWPF canisters. A vendor using SRS's inventory of depleted uranium trioxide powder as part of the process would fabricate the storage casks. The casks, similar to those used for commercial spent nuclear fuel, would be procured from the vendor, as they are needed. The ultimate disposal of the casks, including the uranium trioxide used in their manufacture, would be the responsibility of DOE. This alternative is being evaluated to determine if it is technically and economically feasible. In parallel, a more traditional storage facility patterned after the existing Glass Waste Storage Building #1, is in the planning phase and is proposed as a fiscal year 2002 new start line item in the SRS budget request.

When the federal repository is opened, currently scheduled for fiscal year 2010, SRS will begin shipping canisters at a rate of 205 canisters per year. At this rate, all canisters are expected to be shipped by fiscal year 2038.

Final processing for the low-level decontaminated salt solution from salt processing will occur at the Saltstone Facility. In the Saltstone process, low-level waste is mixed with cement, fly ash, and slag to form a grout that can be safely and permanently disposed in onsite vaults in Z Area. The solidified mixture, known as "saltstone," is low-level waste. Additional saltstone vaults or disposal cells will be constructed, as required. Currently this facility is in a lay-up mode until sufficient feed is available for processing. The plans are to operate this facility, as feed becomes available. The Saltstone Facility will process waste through fiscal year 2026 and then will be readied for deactivation and closure.

Two of the 51 HLW tanks have been closed, which are the first in the DOE Complex to be closed. Of the remaining tanks, 22 are old-style tanks that do not meet current requirements for secondary containment and leak detection. These old-style tanks must be removed from service and closed by 2022 to meet Federal Facilities Agreement (FFA) regulatory commitments.

DOE is preparing an environmental impact statement on the current method of tank closure, called the *Savannah River Site High-Level Waste Tank Closure EIS* (DOE/0303). The preferred alternative is to remove residual waste from the tanks to the extent technically and economically feasible, and then to fill them with both a reducing grout to chemically bind up the residual waste and a structural material to prevent collapse of the tanks.

Solid Waste. The mission of the Solid Waste Program is to provide cost-effective solid waste management services in support of DOE missions at SRS and across the DOE Complex. The near-term goal for this program is to install treatment, storage, and disposal capabilities needed to enable SRS to safely store and treat legacy wastes and obtain a steady-state condition with ongoing waste generation.

The following discussion addresses five waste types managed at SRS—sanitary, low-level, hazardous, mixed, and transuranic.

Sanitary waste, or municipal solid waste, is solid waste that is neither radioactive nor hazardous. Sanitary waste consists of materials that would be received by a municipal sanitary landfill and contains salvageable or recyclable materials such as scrap metal.

The DOE Savannah River Operations Office and the Lower Savannah Council of Governments plan to continue the use of the Three Rivers Landfill, which disposes wastes from SRS and nine South Carolina counties. The 1,400-acre site, located onsite off of S. C. Highway 125, is the state's first publicly owned, regulated landfill. It is expected to provide safe and efficient disposal capacity for over 200,000 tons of sanitary waste per year. SRS plans to send about 25 tons per day to this landfill. Some SRS sanitary wastes are being sent to the

City of North Augusta Material Recovery Facility. At this facility, recyclable materials, including white office paper, newspapers and magazines, cardboard, plastic, steel cans, aluminum cans, and glass are recovered. Residual materials that are not recyclable are returned to the Three Rivers Landfill.

Low-level waste is radioactive waste that is not classified as high-level waste, transuranic waste, spent fuel, or byproduct material as defined by *DOE Order 435.1, Radioactive Waste Management*, and does not contain any Resource Conservation and Recovery Act (RCRA)-regulated hazardous waste. Low-level waste consists of radioactively contaminated materials such as miscellaneous job-control waste, small and large equipment, plastic sheeting, gloves, soil and suspect contaminated materials that were used within a radiological material management area and cannot be proven to be free of radioactive contamination.

SRS has over 220 low-level waste streams in a wide variety of physical forms. At present, low-level waste facilities are forecast to receive about 8,000 cubic meters of waste per year for disposition. This amount is expected to decrease. There is some uncertainty regarding future waste stream volume due to limited ability to determine the volume of waste generated during future environmental remedial actions.

At present, compactible low-level waste is segregated from non-compactible low-level waste and processed in a volume reduction facility before final disposal in order to maximize disposal space. The remainder is being stored pending full operation of an onsite sorting and segregation/supercompaction capability. The site's low-level waste operations also include: shallow land disposal for suitable waste forms such as soil, debris, and wood; storage of Naval Reactor components and contaminated large equipment pending disposal; disposal of low-level waste in the low-activity waste vaults; continued disposal of intermediate-level waste in the intermediate-level non-tritiated and tritiated vaults; waste minimization and pollution prevention activities; and surveillance and maintenance of waste facilities. In addition, some low-level waste may be sent to the Nevada Test Site for disposal.

The *Environmental Assessment for the Offsite Transportation of Certain Low Level and Mixed Radioactive Waste from the Savannah River Site for Treatment and Disposal at Commercial Facilities* (DOE/EA-1308, draft, September 2000) is analyzing the possibility of sending some low-level and mixed radioactive waste offsite for commercial treatment and disposal.

Low-level waste facilities include E-Area Vaults, the Long-Lived Waste Storage Building, E-Area Trenches, the Waste Sort Facility, Low-Level Waste Compactor and Naval Reactor Equipment Pads.

Hazardous waste is identified by the U.S. Environmental Protection Agency as specifically listed waste or waste that meets one of the four following hazardous waste characteristics: ignitability, corrosivity, reactivity, and/or toxicity. Hazardous waste generation at SRS is a result of past and current operations, including material stabilization, waste management, environmental restoration, and decontamination and decommissioning activities. Examples of hazardous waste include materials such as lead, solvents, paints, pesticides, and hydrocarbons.

The hazardous waste program primarily consists of three operations: receipt of waste from onsite generators, interim storage, and shipment of waste for offsite treatment and disposal. Hazardous waste is generally shipped offsite to commercial facilities for treatment and disposal. However, some hazardous waste cannot be released from the site because it cannot be confirmed that there is no DOE-added radioactivity. The site is working on improved characterization of these wastes for proper disposition in accordance with the *Site Treatment Plan*. Hazardous waste facilities include the Hazardous Waste Storage Building 710-B, the Hazardous Waste Storage Buildings 645-N and 645-4N, and the Solid Waste Storage Pads in N Area. These facilities also can accommodate mixed waste and polychlorinated biphenyls (PCBs).

Mixed waste contains both hazardous waste and radioactive waste subject to the Atomic Energy Act of 1954. Mixed waste streams are generated at SRS by various activities and operations including tritium, chemical separations, tank farm, solid waste, decontamination and decommissioning, and construction. This waste includes job-control waste such as solvent-contaminated wipes, debris from operations, cleanup, construction, lead and lead forms, waste from laboratory samples, and soils from spill remediation.

The SRS Mixed Waste Program involves four primary operations: receipt of waste, interim storage, treatment, and disposal. The treatment of mixed waste streams is performed by facilities located onsite, at other DOE sites or commercial vendors. Treatment vendors are monitored as to treatment technologies available, the type of environmental permits, and operational status to support planning and scheduling for the treatment of these wastes. The Mixed Waste Upgrades Project will allow legacy mixed waste to be sorted, segregated, and repackaged for treatment by offsite vendors.

Disposal activities include identifying a disposal facility for mixed waste, characterizing for disposal, preparing waste for transport, and shipping. The availability of offsite mixed waste disposal sites is also reviewed annually to support planning and scheduling for the ultimate disposal of the treated mixed waste. Mixed waste facilities include Mixed Waste Storage Buildings 643-29E and 643-43E, Mixed Waste Storage Building 645-2N, M-Area Storage Pad 315-4M, Shed 316-M, and the Consolidated Incineration Facility (CIF), of which operations have been suspended. The facilities in E Area can also accommodate hazardous waste and PCBs.

The CIF was designed to incinerate Plutonium/Uranium Extraction Solvent (PUREX) wastes after the PUREX was diluted with surplus benzene. The surplus benzene source, expected from the In-Tank Precipitation (ITP) process, did not materialize due to safety concerns. Cancellation of the ITP process left the CIF without a readily available dilution source. Purchasing materials to dilute the PUREX drove up the cost of operation of the CIF, and a decision was made to temporarily suspend operation of the CIF to allow time to evaluate other, more cost effective options for treatment of PUREX waste.

Transuranic (TRU) waste is defined as waste contaminated with alpha-emitting transuranic radionuclides, which are radionuclides with atomic numbers greater than 92, with half-lives greater than 20 years, and in concentrations greater than 100 nanocuries per gram of waste matrix. TRU waste at SRS that also contains hazardous constituents is managed in accordance with both DOE Orders and South Carolina Hazardous Waste Management Regulations and is referred to as TRU-mixed waste. The Federal Facility Compliance Act of 1992 requires SRS to develop a plan for treating mixed waste. The South Carolina Department of Health and Environmental Control approved the *SRS Site Treatment Plan* on September 29, 1995, through an issuance of a consent order. The consent order requires that the *Site Treatment Plan* be updated annually.

TRU and TRU-mixed waste are, and have been, generated primarily by plutonium separations facilities and analytical laboratories. In the late 1970s, SRS received a large volume of TRU waste from offsite generators, including Los Alamos National Laboratory (New Mexico), Knolls Atomic Power Laboratory (New York), and the DOE Mound Plant (Ohio). Few offsite generators ship TRU waste to SRS today. TRU waste generated at SRS is primarily job-control waste, including combinations of plastic, paper, rubber, glassware, metal items, lead-lined gloves, filters, used equipment, and other contaminated materials from routine processing. Because of the varied contents of waste containers, TRU waste is generally described by its container, including drums, polyboxes, concrete casks, large steel boxes, and other odd-sized containers.

The TRU Waste Program has historically focused on the acceptance and maintenance of safe storage. However, in preparation for the shipments of TRU waste to the Waste Isolation Pilot Plant (WIPP), TRU waste operations at SRS also include characterizing containers for certification, packaging, and shipment to WIPP for final disposal. New Mexico has issued a RCRA permit for the WIPP facility with more stringent waste certification requirements. SRS is designing and constructing a facility to perform the required visual examination of TRU waste drums required in the new WIPP RCRA permit.

Recent activities in the TRU waste area include the retrieval of containers, which were stored in the 1970s and early 1980s on pads covered with dirt for protection from the environment. Drums stored on these pads were retrieved and vents were installed to allow the release of possible hydrogen build-up. Retrieved containers were evaluated for integrity, and some were over-packed to ensure that the containers could be shipped to WIPP for final disposal. The TRU waste facilities include TRU Waste Storage Pads 1-19 and 23 and the Waste Certification Facility.

According to the *Site Treatment Plan*, the first shipments to WIPP are planned in fiscal year 2001. Plans are to make four shipments in fiscal year 2001, 12 shipments per year for fiscal years 2002 through 2014, 60 shipments per year for fiscal years 2015 through 2022, and 120 shipments per year from fiscal year 2023 through 2032. Each shipment will contain 42 drums.

Figure 2.6 shows the origin and quantities of wastes; the process or treatment that will be used on the waste to prepare it for disposition; and the ultimate disposition of the material.

Environmental Restoration. The Environmental Restoration (ER) Program's mission is to remediate inactive waste sites and groundwater units in order to reduce risk to the environment. Remediation of waste sites is regulated under the RCRA and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In 1993, SRS entered into a Federal Facility Agreement (FFA) with the U.S. Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC). The purpose

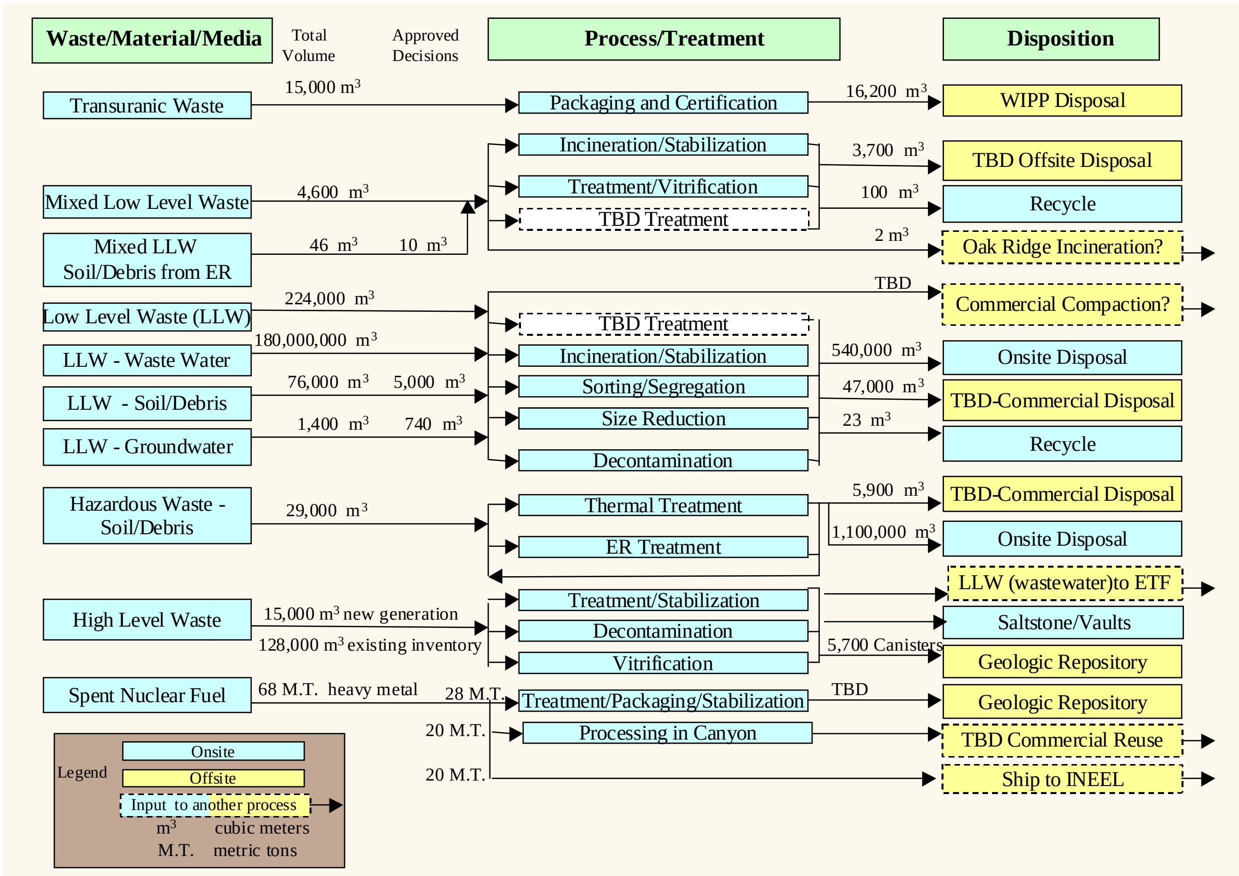


Figure 2.6

Material movement currently in the Waste Management Program. "Canisters" are cylindrical vessels approximately 2 feet in diameter and 10 feet in height that contain vitrified waste.

of this agreement is to assure that the environmental impacts associated with past and present activities at the site are thoroughly investigated, and that consensus is reached on the appropriate corrective/remedial action to protect public health and welfare and the environment. SRS is also assessing and cleaning up parts of the site consistent with the SRS Hazardous Waste Permit and settlement agreements with the SCDHEC. The program actively develops and implements new, more cost-effective technologies.

The ER Program seeks to investigate and, if needed, remediate releases of hazardous substances to minimize or eliminate potential risks to human health or the environment. SRS began inventorying waste units in 1981 and has currently identified 520 waste and groundwater units (see Figure 2.7). Waste sites range in size from a few square feet to tens of acres and include basins, pits, piles, burial grounds, landfills, tanks, and groundwater contamination plumes. Although soils, groundwater, and surface water have been contaminated with radionuclides and hazardous chemicals as a result of over 40 years of site operations, most of the contamination is limited to local areas and does not pose risks offsite.

Currently, 56 waste units have been or are being remediated, 280 of the 500 total acres requiring remediation have been or are being remediated, 6 groundwater treatment systems are in operation, and 150 waste units have been proposed to be, or granted, "No Further Action" status. Also, over 4 billion gallons of an estimated total of 14 billion gallons of groundwater have been treated, with more than 500,000 pounds of organic compounds removed. Of the 520 identified waste units, 180 remain in the Site Evaluation Program. The majority of the 180 units will require no further remediation, although they may require further assessment. Current projections anticipate that by the year 2017, remediation for all units ranked low-, medium-, and high-risk release sites will be complete. As part of the cleanup program, under the CERCLA National Contingency Plan, the SRS Natural Resources Trustee Council, consisting

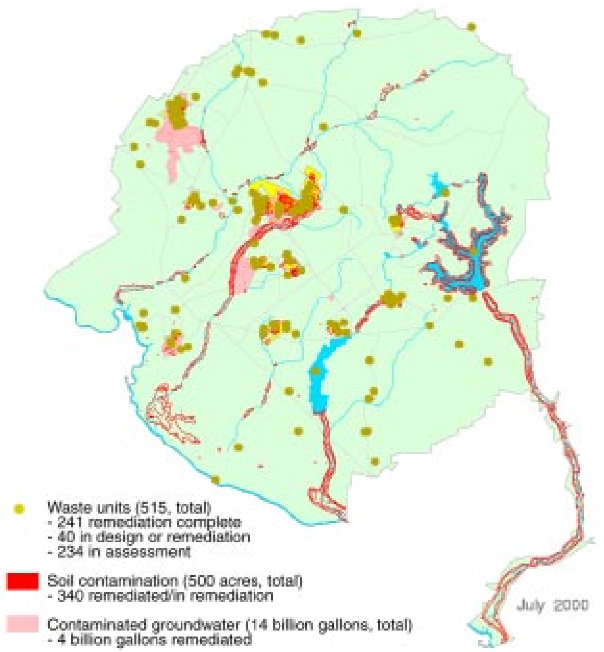


Figure 2.7
Savannah River Site Contaminated Areas Map

of DOE and state and federal entities, assists with certain Environmental Restoration-related activities impacting the site's natural resources.

In some cases, after a site has been remediated, some risks will remain. This may be because total cleanup is cost-prohibitive or the technology does not exist to completely remove or contain contaminants. To protect the public from these risks, DOE places physical barriers to the site and/or applies institutional controls. Institutional controls are measures or actions that may be used to supplement engineering controls to prevent or limit exposure to contaminants at a site to ensure protection of human health. Institutional controls may be applied to ensure that selected land uses are maintained. The advantage of these administrative mechanisms is that they can be used to provide flexibility in the risk decision-making process and mitigate health risks by physically restricting land use at a site. These controls may include fences, security guards, warning signs, deed restrictions, and land use restrictions. Institutional controls do not involve reduction of the toxicity, volume, or mobility of hazardous wastes, but may be used in conjunction with actions that do involve such reductions. The *SRS Long Range Comprehensive Plan* itself constitutes an institu-ional control in that it formalizes policies and direction for fu-ure site land use and development. The CERCLA National Ↄontingency Plan authorizes the use of institutional controls ɔased on recognition of these and other factors.

Figure 2.8 shows the origin, quantities, and type of waste nedia; the process or treatment that will be used on the waste o prepare it for disposition; and the ultimate disposition of the naterial.

Facilities Disposition Program. The near-term objective of ƽRS Facilities Disposition Program activities is to establish a ɔomprehensive, cost-effective approach to reducing residual isks and safely maintaining excess facilities until ɟecommissioning funds can be made available or specific euse is established. A brief discussion is provided here, and ɑdditional details are available in the Facilities Plan Element n Chapter 4.

The site's Facilities Disposition Program assists operating ɔrganizations with transition of facilities to a deactivated state ɑnd assumes responsibility for surplus facilities. The program provides assistance in areas including facility transition planning, end point determination, and deactivation planning. Implementation of a facility deactivation plan generally occurs at mission completion and is intended to include facility surveillance and maintenance costs and environmental, public health, and safety risks to the lowest levels consistent with site policies.

Excess facilities are available for reuse by SRS, other DOE sites, and other federal agencies and for economic development at any of the phases of the disposition process. If there are no plans to reuse the facility, surveillance and maintenance status is the low cost, safe "default" condition. If there is a future use goal for the facility, the end point and surveillance and maintenance plan will reflect the additional work scope and costs to retain the facility in a safe condition for this option.

Immediately following the decommissioning phase, the general facility area including affected soils and water are evaluated to determine if there were any radioactive or hazardous material releases to the environment. If a release is detected, the area is included in the Environmental Restoration Program. If no release is detected, the area is freed for use and returned to the appropriate area manager or appropriate site organization.

The Facilities Disposition Program has established an inactive facilities risk management program to identify and remediate hazards associated with excess legacy facilities,

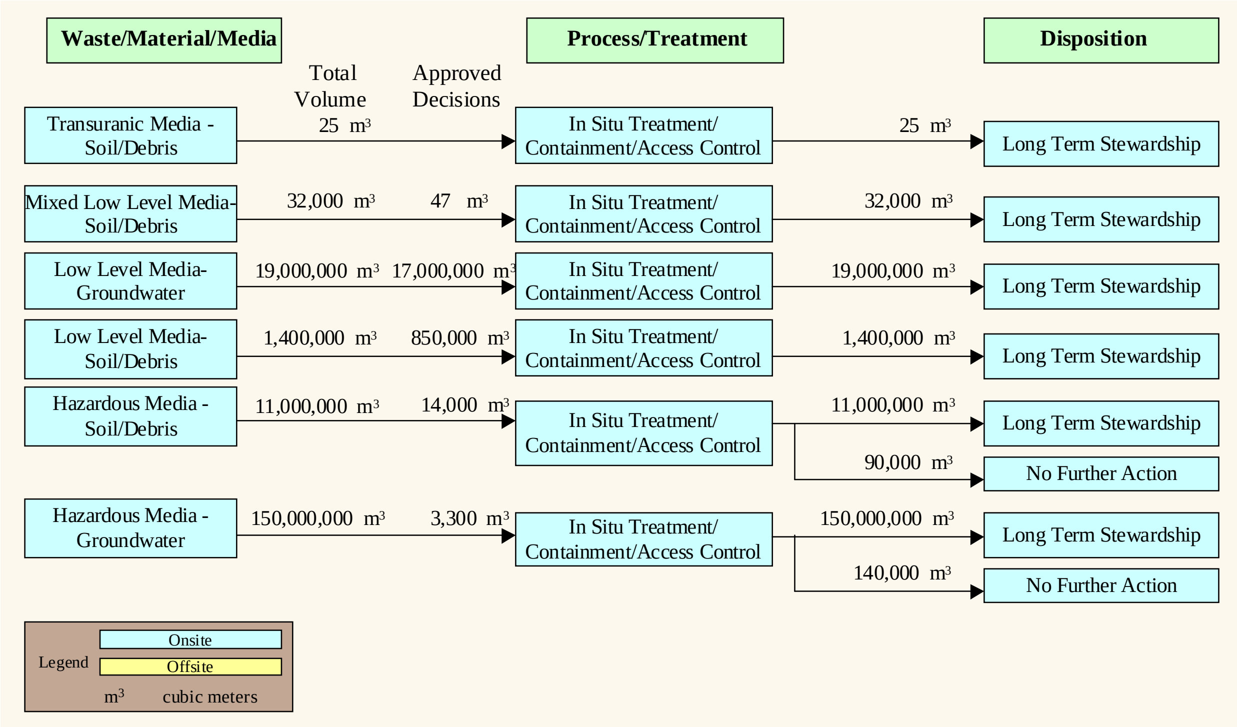


Figure 2.8
A variety of in situ treatment, containment, and access controls are used to manage waste in place. Disposition pathways for the portion of material volume designated "approved decisions" have been approved through regulatory agreements.

especially individual facilities that may be of a lower priority to the missions of other programs. To ensure that risks in these facilities are not overlooked, the program developed an inactive facility risk-ranking system and established a schedule of detailed facility walk-downs to identify latent risks. Beginning in fiscal year 1998, the program ranked 130 inactive facilities by risk and inspected and evaluated the top ten facilities. This list is included in the Facilities Plan element in Chapter 4, and additional details are available in Appendix E. Each year approximately 15 facilities are inspected, evaluated, and risk-ranked. Current plans are to maintain this pace through 2004. The Facilities Disposition Program also continues to ensure that corrective actions are taken by the managing program, funding corrective actions for other programs, or arranging to assume management of the facility.

Summary of Major Mission Activities

An important aspect of comprehensive planning is to integrate activities across the site. Figure 2.9 shows the schedules and established missions of all site programs. As missions are completed, facilities are transferred either to the Facilities Disposition Program or to the Environmental Restoration Program. In some cases, these facilities ultimately will be transferred into the Long Term Stewardship Program. As discussed in previous sections, additional volumes of materials for processing, future new missions, and delays in established schedules will change the projected time frames for activities.

Applied Research and Technology Development

Throughout the past fifty years, SRS has used an applied research and development laboratory, the Savannah River Technology Center (SRTC). SRTC supports the national defense and environmental management missions with the development of technologies in the processing, handling, and storage of tritium and plutonium, and non-proliferation and environmental activities. SRTC works in partnership with SRS's operating divisions; however, in recent years, SRTC's role has expanded to provide related support to other DOE organizations, federal agencies, and private industry.

The laboratory's 750-person staff includes internationally recognized scientists and engineers. SRTC's facilities include biotechnology laboratories, laboratories for the safe study and handling of radioactive materials, a field demonstration site

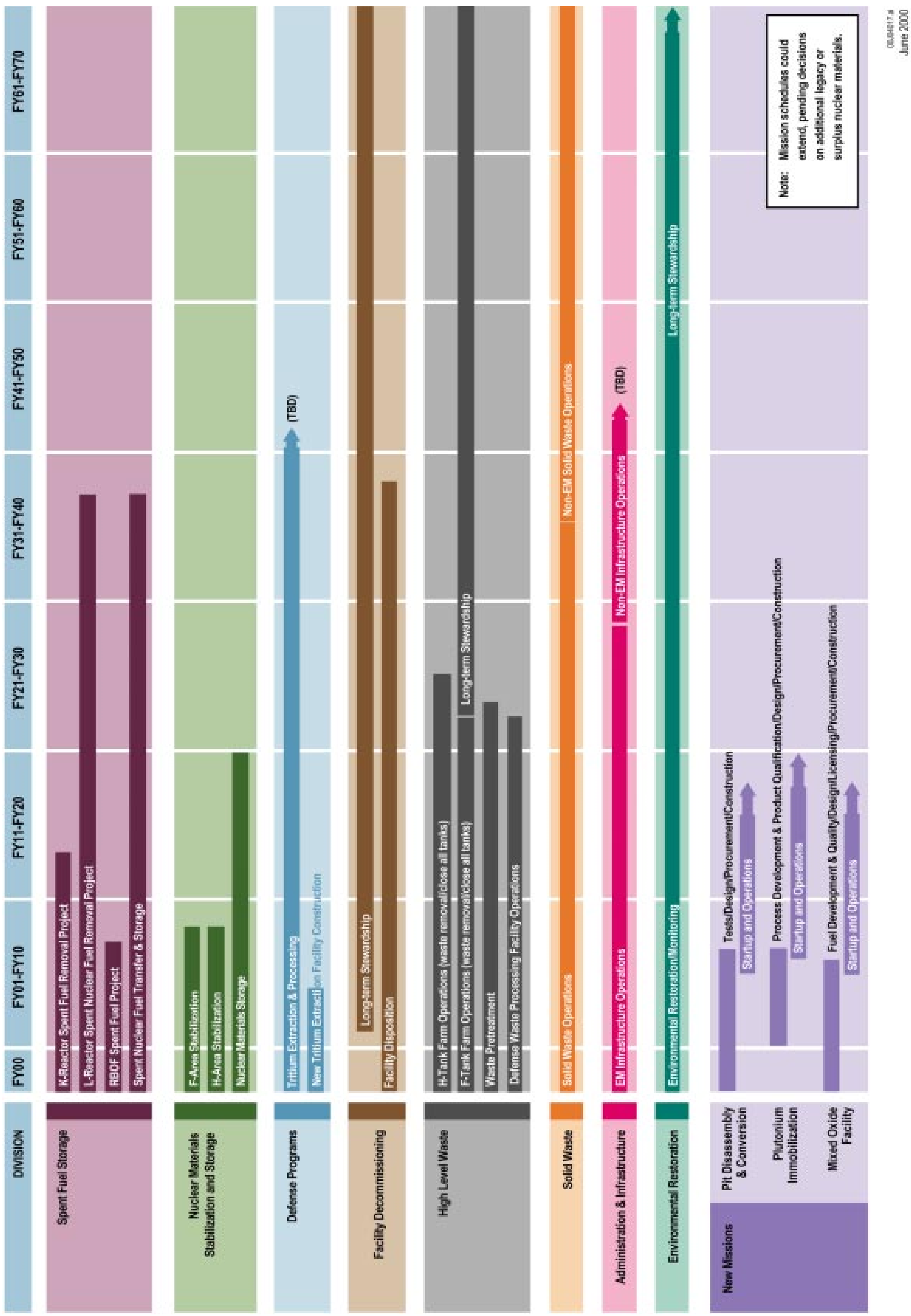


Figure 2.9

Integrated Schedule of Major Activities for testing and evaluating environmental cleanup technologies, and laboratories for ultra-sensitive measurement and analysis of radioactive materials.

The transfer of technology to private industry is an important part of the work done at SRTC. Technology transfer moves existing government-developed technologies to the private sector and helps businesses compete in the national and international marketplace. Through government/industry partnerships for the development of new technologies, SRTC also benefits from industry expertise in finding the best available solutions to mission challenges.

While the laboratory continues to solve the site's technological challenges, half of its work now comes from non-SRS customers, including DOE-Headquarters, other DOE sites, and other federal agencies. The laboratory's largest work-for-others contract to date is a multi-year contract for $31 million to demonstrate and evaluate the processes that will be used at the Hanford Site to treat and dispose of the waste in Hanford's high-level waste tanks.

DOE has selected SRTC as the lead laboratory for its Subsurface Contaminants Focus Area, a national program devoted to developing and implementing technology solutions to meet a broad spectrum of soil and groundwater remediation needs Complex-wide. As lead laboratory, SRTC provides technical consultation to the focus area across the entire program. This includes identifying key technical resources in DOE's laboratories, as well as the nation's universities and industry, with expertise that can be brought to bear on critical subsurface contaminant problems.

SRTC has nine core business segments, which are discussed below.

Environmental Remediation. SRTC is assuming a major role in removing or containing pollutants that have found their way into the ecosystem. The center's scientists and engineers are developing methods of detecting contamination in soils, groundwater, and wetlands and are finding improved ways to eliminate these pollutants without further damaging the environment or exposing personnel to potential harm.

SRTC integrates and applies science and technology to identify and solve environmental restoration and compliance needs. In this role the center identifies, develops, deploys, and optimizes technologies that accelerate cleanup, closure, decommissioning, and long-term stewardship, while reducing risk and cost. SRTC also provides the scientific basis in partnership with other site organizations in the development of strategies and programs to achieve site compliance.

For environmental remediation activities, emphasis will continue to be placed on the deployment of new technologies to reduce cost. There will be an increased emphasis on monitored and accelerated natural attenuation for contaminant cleanup and the development of more cost-effective, reliable technologies for long-term monitoring of waste and waste unit closures. Application of soft-computing technology will expand and allow better integration of multi-dimensional factors for determining improved approaches to management and remediation. Enhanced understanding of exposure pathways and transfer coefficients will aid in the determination of appropriate aquatic and sediment compliance limits.

SRTC is emerging as a national leader in the use of bioremediation technologies. The current focus is the understanding, control, and optimization of microbial processes, which impact a wide variety of activities at SRS. Microbial ecology investigations determine the key factors that govern the occurrence and activity of these microorganisms. In some cases, SRS provides a unique source of new microorganisms, which are highly adapted to harsh chemical environments, intense radioactive exposures, or deep subsurface conditions. These microbes are a promising source of biodiversity, which may have value for industrial, biomedical, or environmental applications. In other cases, natural microorganisms may produce undesirable effects, such as biofouling or biocorrosion, which must be understood and controlled to assure long-term operation of critical systems at SRS.

SRTC scientists are currently researching utilization of in-situ natural bacteria for cost-effective, natural attenuation of chemicals or metals in soils and ground waters. The successful utilization of these beneficial microbial processes may provide significant long-term cost savings for environmental restoration. Sometimes harmful microorganisms grow in locations, such as offices, workplaces, or cooling towers and must be controlled.

New microbial detection technologies utilize specific antibodies linked to markers for the rapid direct detection of pathogens in a wide variety of samples. These biodetection technologies have crossover defense applications for the rapid detection of pathogens, which may be intentionally released as agents of bioterrorism.

Material Stabilization. SRTC has developed the expertise to analyze any liquid or solid waste product, including noble metals, actinides, and those requiring remote handling, such as radioactive materials. SRTC, which has studied the behavior of nearly every element on the periodic table in glass, uses a systems approach to glass development. Process models estimate durability and other properties from the melter-feed ingredients. For more complex problems, the product composition control system allows for random variations in the vitrification process. The result is a reliable production of durable glass product, essential in disposing of radioactive waste.

SRTC, working with the Nuclear Materials and Stabilization Program, has developed and successfully demonstrated an integrated process and equipment for the conversion of americium and curium solutions into a stable glass. This process provides long-term stability and significantly reduces risk to the public.

SRTC, in concert with Lawrence Livermore National Laboratory, is currently developing the ceramic process to immobilize excess plutonium. The ceramic plutonium pucks will be placed in a DWPF canister, and high-level waste glass will be poured around the pucks to prevent long-term proliferation concerns, in a process known as the “can-in-canister” process.

Chemical process flowsheet modifications and material characterizations are being developed to support nuclear material stabilization of intractable and unfamiliar nuclear residues, legacy wastes, and excess nuclear materials to be processed at SRS for disposition and long-term plutonium storage. Melt-and dilute-technology is being developed to prepare spent nuclear fuel for long-term disposal. Various metallurgical and materials investigations are underway aimed at characterizing potential problems of SRS aging facilities, as well as to propose remediation or replacement as needed for safe completion of the site missions. Numerous ad-hoc developments are undertaken as needs arise, providing ongoing backup technical support to SRS operating divisions.

Waste Processing Technology. With the advent of new waste disposal standards, SRTC is developing and applying technologies to manage the site’s waste issues and apply pollution prevention technologies to reduce future waste. SRTC provides the technical basis for safe concentration, storage, transfer, and treatment of high-level radioactive waste in the tank farms. SRTC evaluates other technologies for waste management, including treatment of hard-to-vitrify transuranic waste containing metals, organics, and salts. The most promising are hybrid plasma vitrification, wet chemical oxidation, and hybrid microwave technology. Work is also ongoing to decrease melt times and increase waste loading.

Hydrogen and Tritium Technology. SRTC expertise in hydrogen chemistry ranges from molecular and process modeling to handling and processing hydrogen isotopes and compounds. Recent developments using metal hydrides have revolutionized the handling and processing of hydrogen.

In the Defense Programs area, tritium reservoir surveillance continues in support of assuring the continuing viability of the nation’s remaining nuclear weapons stockpile. Studies continue to define the long-term effects of tritium on metals and other weapons components, aimed at determining more accurately how those changes influence component lifetime.

SRTC has leveraged its hydrogen technology capabilities into research of advanced fuel development. Applications for hydrogen energy technology include fuel cells, metal hydride batteries, hydrogen-powered vehicles, power generation from fusion energy, and metal hydride air conditioning and refrigeration systems.

SRTC participates in a new international effort to develop an experimental fusion reactor. The United States, the European Union, the Russian Federation, and Japan have joined forces to plan the International Thermonuclear Experimental Reactor, an environmentally safe alternative for power generation.

Sensor Technology. In order to minimize risks to workers, the public, and the environment, SRTC developed monitoring and sensor technologies. SRTC-developed monitoring systems provide timely information needed for efficient chemical processing of radioactive material without endangering workers. In addition, sensor technologies monitor the environment and ensure the integrity of equipment containing hazardous and radioactive materials.

SRTC provides rugged, field-tested instrumentation for terrestrial, aquatic, and atmospheric sampling. These instruments are designed for emergency response, radionuclide and chemical contamination measurements, aerial radiation surveys, effluent characterization, and radioactive plume measurements. SRTC engineers also are applying leading edge, commercially available, non-destructive examination technology to ensure the integrity of pipes, vessels, and structures. These techniques include digital radiography, ultrasonics, and a variety of testing methods.

With SRTC's expertise in sensor applications, future opportunities can provide real-time chemical monitoring and analysis. This expertise could be used at chemical weapons destruction sites to verify treaty compliance. In industry, fiber-optic sensor systems promise to simplify chemical accountability, making it much easier and less expensive to comply with environmental regulations on storage of hazardous chemicals.

Remote Systems and Robotics. SRTC robotics and remote systems includes mobile robots and mobile teleoperators, pipe crawlers and wall crawlers, robotic delivery of non-destructive examination devices to remote areas, robotic manipulation of tools and materials, remote viewing systems, and specialty equipment systems. These systems are operated by radio or cable controls from a remote location or by programming a robot to operate autonomously. These systems hold great potential for increased environmental protection and industry safety.

Nonproliferation Technology. SRTC is applying its expertise in tritium and plutonium to support DOE's nonproliferation missions, providing technical support for Non-Nuclear Reconfiguration, Enhanced Surveillance Program, and the Tritium Extraction Facility. SRTC also provides technical services and measurements for the National and International Safeguards Program for treaty verifications, forensics, export control, and other security programs. SRTC supports the Federal Bureau of Investigation in nuclear forensic activities.

In support of its defense mission, SRTC developed RADMAPS, a portable radiation mapping system for detecting, locating, and characterizing nuclear materials when the presence of such material is not otherwise documented. This versatile, portable field unit records gamma or neutron radiation spectra and records its location using the Global Positioning System.

Actinide Processing. Recent work has centered on the stabilization of legacy actinides. The processing of scrap solids containing plutonium and uranium in SRS canyons has become important to stabilize legacy actinide materials. SRTC has developed schematic diagrams for processing these legacy actinides without requiring major equipment changes. SRTC also developed safety documentation for actinide residues in new shipping containers.

SRTC provides research and development support for transuranic waste management alternatives for plutonium-238 waste. This research will help address curie limits for storage at the Waste Isolation Pilot Plant and hydrogen-generation issues with transportation.

Aluminum Reactor Fuel. SRTC is developing and deploying technologies for interim storage (basin and dry), basin surveillance, transportation, and disposal of aluminum-clad spent nuclear fuel. The expertise is being applied to support the repatriation and consolidation of aluminum-clad research reactor fuel as part of DOE's nonproliferation missions. Applications of these technologies are being used at Idaho National Engineering and Environmental Laboratory and are under formal consideration for international use through the International Atomic Energy Agency.

The melt-and-dilute technology has been developed at SRTC to stabilize and reduce the isotopic enrichment of uranium in aluminum-clad fuels to provide a superior disposal form. This treatment technology minimizes proliferation risks and criticality issues with highly enriched research reactor fuels. This process is flexible and can be extended to treat other nuclear materials for safe, permanent repository disposal.

This containment analysis methodology for aluminum-clad fuel with cladding failure greater than a pinhole and minor cracks was developed by SRTC in cooperation with the Nuclear Regulatory Commission (NRC). The NRC requires this methodology to be applied for certification of casks to transport failed aluminum fuel. The result is an estimated cost avoidance to DOE of more than $50 million from the current practice of canning the estimated seven percent of the foreign research reactor fuel with breached cladding prior to shipment. The methodology developed can be extended to other fuels.

Basic and Applied Environmental and Ecological Research

The Savannah River Ecology Laboratory (SREL), established at the SRS in 1951, provides an independent evaluation of the ecological effects of SRS operations through a program of ecological research, education, and outreach. SREL scientists currently are organized into four research groups that interact with one another and cooperate with other research and management personnel on the site, at other DOE facilities across the country and at universities around the world.

The **Advanced Analytical Center for Environmental Sciences (AACES)** is a research and development group that employs an integrated, multidisciplinary, multi-scale "atoms to ecosystems" research approach. This group strives to provide a more complete understanding of chemical species distributions and transformations and to define the primary physicochemical, mineralogical, and biogeochemical controls required to predict contaminant migration accurately, to evaluate environmental risk, and to design cost effective yet environmentally sound remediation strategies.

Ecological Stewardship research focuses on ecosystem health and land stewardship. The goal of this group is to improve understanding of the current ecological status of various habitat types on the SRS, assess the ecological risk to organisms from real or potential land use threats, and provide recommendations on land stewardship to promote ecosystem health. Researchers in this group examine the effects of land-use patterns on abiotic and biotic resources, including individual, population, community, ecosystem, and landscape levels of ecological organization. They also document changes in the physical environment, determine the influence of these changes on the physiology and behavior of individual organisms, and conduct population-to-landscape-level research in natural and disturbed, terrestrial, wetland, and aquatic sites of the SRS and surrounding area.

The **Ecotoxicology, Remediation, and Risk Assessment (ETRRA)** research group conducts research on the toxicology of contaminants in ecological settings and the development and use of cost-effective remediation technologies. The data they collect are useful to the process of conducting risk assessments for contaminated areas on the SRS. Application of site- or region-specific data to the risk assessment process can greatly alter the acceptable remediation activities, making them more effective and efficient, likely reducing the costs and increasing the probability of cleanup.

The **Radioecology** research group studies the transport, fate, and effects of radioactive elements in the natural environment. Current research addresses critical gaps remaining in knowledge regarding the transfer of radionuclides through food chains and their effects in natural ecosystems. This research is conducted at SRS, at other DOE facilities in the U.S., and in territories of the former Soviet Union with the goal of determining the fine-scale spatial distribution of radionuclides on SRS, studying DNA damage in irradiated organisms and the population consequences of living in contaminated environments on the SRS and at Chernobyl, and studying the transport of radionuclides in natural environments, especially former SRS cooling ponds.

Natural Resources Management

The site's natural resources mission is to maintain excellence in natural resource stewardship; continue recognition of SRS as a national leader in resource management, research, and science literacy; and provide cost-effective, flexible, and compatible programs to support SRS missions. Most of the site is currently under some form of natural resource management. SREL, SRTC, and the U. S. Forest Service-Savannah River (USFS-SR) bridge the gap between basic and applied science in support of SRS missions and operations. Research into fundamental aspects of ecological and environmental sciences, fate and effects of contaminants in the environment, and the basic biology of native species provides the foundation necessary to improve both remediation and restoration activities and to enhance management of natural resources.

The site is capitalizing on its National Environmental Research Park (NERP) status to enhance international and domestic research partnerships. Capabilities are available to conduct large-scale landscape manipulations that both enhance natural resource management and provide unique field site opportunities that attract university and industrial partners. In addition to research, SRS science and technology organizations have a strong education mission, striving to improve science education and literacy and educational opportunities for diverse groups.

The USFS-SR conducts research in direct support of endangered species and ecological restoration programs to provide the scientific basis for managing natural resources and other land uses in a mission-compatible manner. The University of South Carolina Savannah River Archaeological Research Program studies the archaeological history of SRS and ensures compliance with federal regulations governing cultural resources and antiquities.

The site is currently restoring native vegetative communities and species, including red-cockaded woodpecker habitat, hardwood habitat, pine-savannahs, and wetlands. In addition, this restoration will protect water quality by stabilizing soil and minimizing industrial area runoff through engineering and vegetative management techniques. Wetland restoration at Pen Branch has recently been completed; Carolina bays are being restored; and restoration of the site's dominant natural vegetation, longleaf pine savannahs, is proceeding where compatible with ambient soil conditions. Prescribed burning operations continue to enhance wildlife habitat, facilitate after-timber-harvest regeneration, and reduce forest fuels. Soil and watershed maintenance and stabilization provide infrastructure support to the SRS industrial areas. Natural resource research projects cover a wide range of topical areas, including short rotation woody crops; biodiversity; prescribed fire and smoke management; wetland, pine savannah, and hardwood restoration; and endangered species recovery. Currently, timber sales average 25 million board feet per year, and in fiscal year 1997, timber receipts returned to the U.S. Treasury totaled almost $4 million; in fiscal year 1998, $7.6 million; in fiscal year 1999, $2.8 million; and in fiscal year 2000, $4.7 million.

In June 1999, DOE designated 10,000 acres of the Savannah River Site as a biological and wildlife refuge, creating the Crackerneck Wildlife Management Area and Ecological Preserve (see Figure 2.10). The South Carolina Department of Natural Resources manages the reserve and associated deer hunts and maintains the site's wild turkey populations.

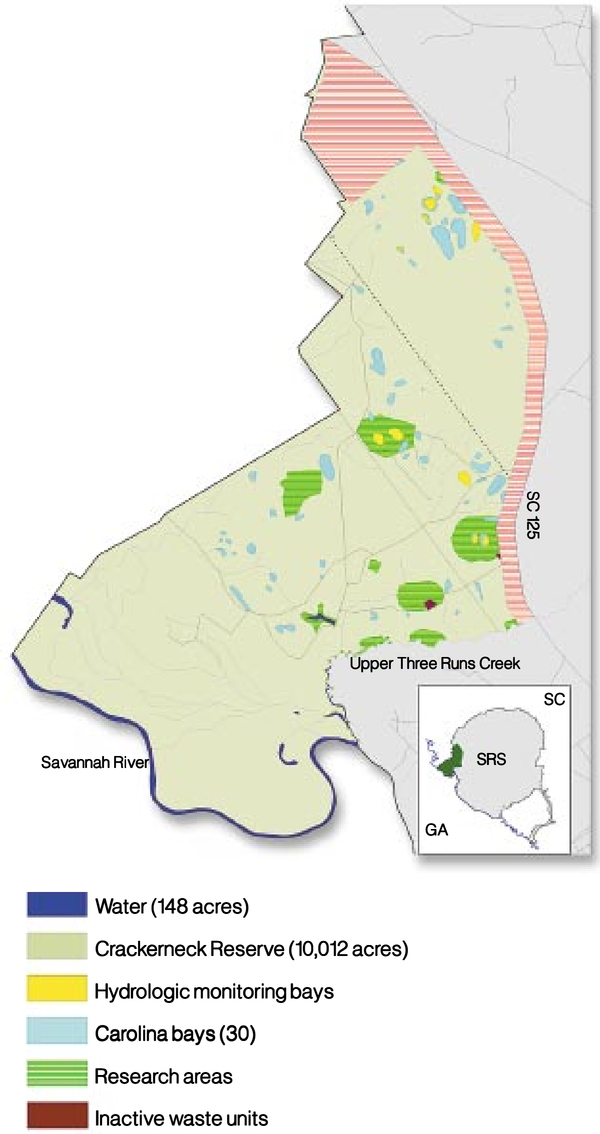


Figure 2.10
Crackerneck Wildlife Management and Ecological Preserve

Off Site Transportation of Nuclear/Hazardous Materials

DOE is committed to the safe, secure, efficient, and cost effective transportation of all materials that support its various programs and activities. For more than 50 years, DOE and its predecessor agencies have maintained a record of safe and efficient transportation of radioactive materials. DOE strives to ensure that its hazardous and radioactive materials, hazardous substances, and hazardous and mixed wastes are handled and transported in compliance with all applicable rules and regulations.

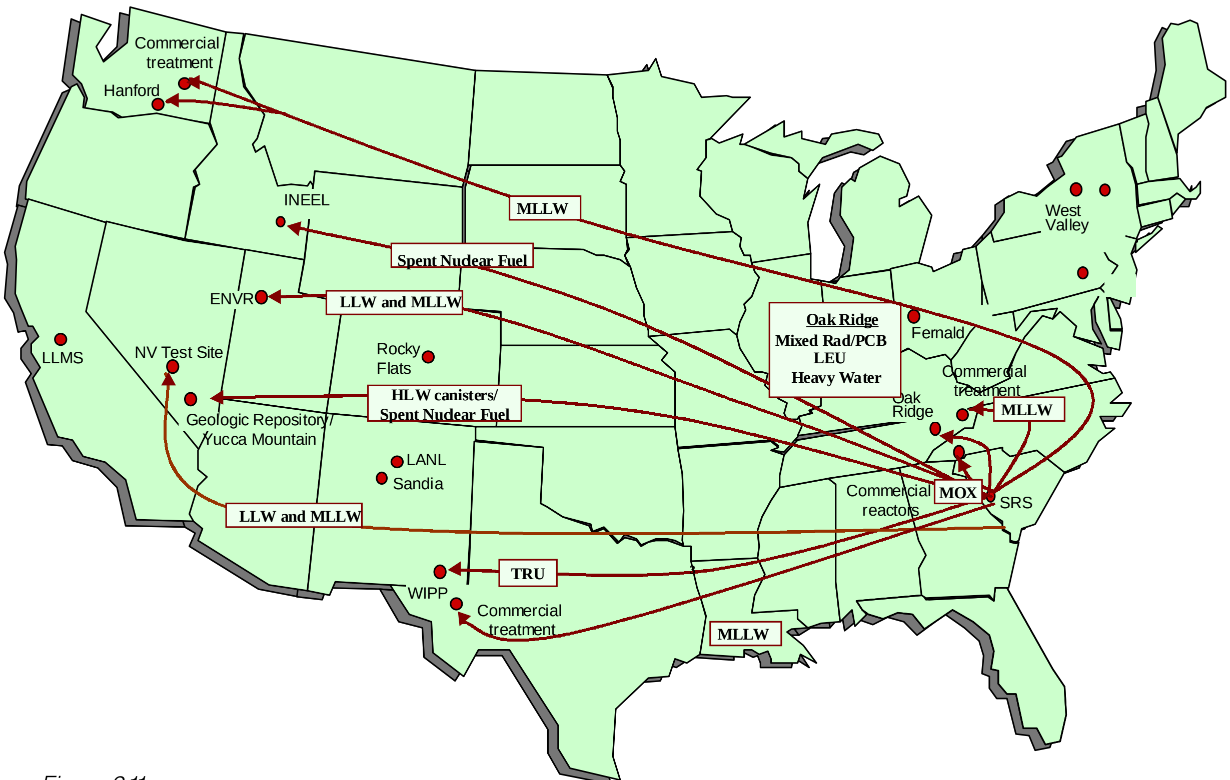


Figure 2.11.
SRS outgoing shipments of waste

The DOE National Transportation Program, located at the Albuquerque Operations Office, provides policy guidance, training, business and safety management programs, packaging management support, and public information materials. Depending on the material to be transported, various program offices within the DOE are responsible for the movement of this material. Each of the program offices works with the appropriate state offices to coordinate the movement of the material through the state, giving advance notification of the shipment, and the preferred ground transportation routes. Contacts for additional information on DOE's radioactive materials transportation programs can be found in Appendix B.

The Department of Transportation (DOT) and the Nuclear Regulatory Commission (NRC) share primary responsibility for regulating the safe transport of radioactive materials in the United States. Shipments utilize special packaging, which meets DOT requirements to provide protection. Figure 2.11 provides a diagram of the waste shipments from SRS and the destinations of the shipments. The DOE continuously monitors shipments using the TRANSCOM system, which combines satellite communications, computerized database management, user networks, and ground communications to follow the progress of en route shipments of hazardous materials. Transponders mounted on transport vehicles send signals to a satellite receiving station that identifies vehicle location. Also, solar powered portable transponders are used on some rail and barge shipments. Data is relayed to the TRANSCOM Control Center through a telecommunications link at five-minute intervals.

The various kinds of materials shipped to and from SRS are described in the following sections.

Foreign and Domestic Research Reactor Spent Fuel Shipments

To reduce the threat of nuclear terrorism, spent nuclear fuel, containing highly enriched uranium originating from the United States, is being shipped from research reactors around the world to the U.S. in order to ensure that the enriched uranium will not be used to make nuclear weapons. DOE, in consultation with the Department of State, established a program under which the U.S. would accept up to 20 metric tons of spent nuclear fuel from research reactors in 41 countries over a 13-year period, from 1996 to 2009.

The spent fuel eligible for shipment to the United States under this policy was initially exported under President Eisenhower's Atoms for Peace Program. Under the Atoms for Peace Program, United States' allies agreed to forego development of nuclear weapons in exchange for our agreement to assist them with peaceful applications of nuclear energy. The United States provided the assistance by aiding its allies in establishing research reactors, and by providing the enriched uranium used to fuel them. Research reactors are used for nuclear medicine, scientific research, and environmental, agricultural, and industrial studies.

The *Record of Decision for the Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel* (FR Vol. 61, No. 97, May 17, 1996) determined that approximately 18 metric tons heavy metal (MTHM) of aluminum-clad foreign research reactor SNF and approximately 0.6 MTHM of target material would be transported to and managed at SRS. Approximately one MTHM of Testing, Research, Isotope, General Atomics (TRIGA) foreign research reactor spent nuclear fuel would be transported and managed at the Idaho National Engineering and Environmental Laboratory (INEEL).

The spent fuel is entering the United States through the Charleston Naval Weapons Station, South Carolina, and the Concord Naval Weapons Station, California. A quantity of the TRIGA spent fuel will be transported from overseas TRIGA reactors via Charleston, South Carolina, to SRS and subsequently transported cross-country to INEEL. Spent nuclear fuel is shipped in containers called "Type B" transportation casks, specially designed and constructed to retain their contents in the event of an extreme accident.

The foreign spent fuel receipt program is expected to continue until approximately 2009. In addition to the foreign spent fuel, universities and government research organizations will ship spent fuel from research reactors to SRS. Domestic shipments will continue until 2035. Over the life of the program, SRS expects to receive about 475 casks from 28 foreign countries. In keeping with national policies intended to ensure the safety and security of the public and the shipments, the DOE cannot provide the date and time of the shipment in advance. General details can be released to the public only after the shipment arrives at its destination. The security regulations that govern such information are the same as those that protect domestic shipments authorized by the NRC and are part of the nation's effort to protect nuclear materials against theft or diversion.

Nuclear Weapons Stockpile Shipments. Material movements associated with DOE's weapons and weapons-related programs are transported under the direction of DOE's Transportation Safeguards Division based in Albuquerque, New Mexico. Because of national security implications, configurations and information about transport vehicles, their operations, and specific shipments are classified information and not available for public release.

Transuranic Waste Shipments. After a combination of sorting, segregation, and repackaging, 16,000 cubic meters of transuranic waste will be shipped from SRS to WIPP. The transuranic waste transportation system is administered by DOE's Carlsbad Area Office. WIPP trucks will carry transuranic waste in NRC-certified containers called "TRUPACTs." A satellite tracking system will monitor each shipment. The trucks will follow specific protocol procedures for inclement weather, safe parking, and notification to the states, tribal nations, and local responders.

Future Waste Shipments

High-level radioactive waste resulting from SRS processing operations will be solidified at DWPF for future shipment to a federal repository. Beginning about 2010, vitrified waste canisters will be shipped to an off-site geologic repository at an expected rate of 205 canisters per year. After a range of treatment activities, SRS plans to ship approximately 4,200 cubic meters of environmental media such as soil, rubble, and debris; 3,600 cubic meters of mixed low-level waste; and 1,000 low-level waste to off-site facilities. , These shipments will be integrated with and/or combined with shipments of spent nuclear fuel that are to be produced in the proposed Treatment and Storage Facility. Shipments of approximately 20 canisters per year beginning as early as 2011 are currently projected.

Chapter 3

Future Land Use Plan

Purpose

The purpose of the Future Land Use Plan is to provide planners, managers, and others with information needed to make decisions concerning SRS land for present and future missions. The site's future use policy, goals, and objectives are the result of significant efforts over the past several years, involving extensive internal and external stakeholder participation. The SRS Future Use Policy ensures consistent future use and development of site land and facilities, which enables SRS to remain a vital national asset. In making land use decisions, SRS will ensure that governmental needs are met for ongoing and new nuclear weapons stockpile stewardship, nuclear materials stewardship, and environmental stewardship missions.

Guidelines

SRS uses a disciplined comprehensive planning process, including designated zoning maps, to guide land and facility use decisions. The objective is to ensure that land and facility planning decisions appropriately involve stakeholders; are integrated with strategic planning, budget formulation and budget execution processes; promote cost-effectiveness and efficiency; and ensure protection of the environment.

The following guidelines, based on site policies, will be considered to the greatest extent possible in determining both future land and facility use at SRS:

- Protection and safety of SRS workers and the public shall be a priority.
- The integrity of site security shall be maintained. Appropriate institutional controls, including environmental monitoring, should be preserved.
- Future use planning shall consider the full range of worker, public, and environmental risks, benefits, and costs.
- Safety buffer zones shall be considered when siting facilities.
- Hazardous and radiological facilities should be located to minimize impact to environmentally sensitive areas or areas outside the SRS boundary.
- A "restricted use" program shall be developed and followed for special areas, such as Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) regulated units, as needed.

- SRS boundaries shall remain unchanged, and the land shall remain under the ownership of the federal government.
- The site's designation as a National Environmental Research Park (NERP) will continue.
- Site missions will receive priority over other uses.
- SRS land should be available for multiple use wherever appropriate and non-conflicting.
- Some land should be designated for continued nuclear and non-nuclear industrial uses.
- Natural resources shall be protected and managed, with biodiversity being a primary goal. Disturbance of undeveloped land and valuable ecological habitats shall be minimized, and. Research Set-Aside areas should be maintained.
- Existing infrastructure and facilities shall be considered for reuse prior to development of new sites. Surplus facilities without reuse potential should be placed in a safe configuration.
- Land use will be compatible with the attributes of the land and adjoining land. The cumulative environmental impacts of existing and newly proposed uses shall be considered.
- Residential uses of all SRS land shall be prohibited.
- Industrial and environmental research and technology development and transfer should be expanded.
- Recreational opportunities should be considered and increased, as appropriate.

Future Land Use Planning Assumptions

A number of assumptions guide future development and use of SRS land and facilities. These have been developed with significant input from internal and external stakeholders over several years. As set forth in the *SRS Strategic Plan*, primary planning assumptions include the following.

- Health and safety of the public, the workforce, and the environment will not be compromised.
- Funding requirements will reflect meeting all compliance agreements and other regulatory commitments.
- Local and national stakeholder comments and concerns will be addressed.
- The canyons will transition to deactivation upon completion of currently scheduled materials stabilization and deinventory activities. This includes offsite materials for which Records of Decision exist.
- After missions are complete, facilities will be deinventoried, deactivated, and maintained in a low-cost surveillance and maintenance state that has a very low safety risk. (NOTE: Further decommissioning plans are in lower level, more detailed documents.)
- The Department of Energy will have a continuing stewardship role, which will require ongoing monitoring and maintenance.
- SRS will accomplish its Environmental Management objectives while continuing to meet critical national security needs through existing and future national security missions.
- Offsite national repositories will be available for permanent disposal of nuclear waste.
- Other DOE sites will be closed or their missions and/or footprint of the land will be reduced, thus increasing reliance on SRS for consolidation and disposition activities.
- National and international commitments will increase emphasis on disposition of surplus nuclear materials.
- Sufficient federal funding will be provided to accomplish assigned missions and support the reconfiguration of the site to optimize its ability to meet future requirements.

Future Land Use Planning Considerations

The SRS land use planning process includes a number of evaluation criteria that are considered when new missions are analyzed, new land uses are proposed, or new facilities are sited. Some criteria are exclusionary for all potential future uses, while others are specific to a particular use. Criteria that generally are exclusionary for facility siting, but not necessarily for other potential uses, include threatened and endangered species habitats, DOE Research Set-Aside areas, Category I wetlands and streams, the 100-year floodplain, seismology, contaminated areas, and other factors. Each of these is discussed below.

Threatened and Endangered Species

SRS provides habitat for four federal endangered species, the red-cockaded woodpecker, wood stork, shortnose sturgeon, and smooth purple coneflower, and two federal threatened species, the bald eagle and American alligator. Planning for habitats for these species is important because available current and future land use in the immediate vicinity of federally threatened or endangered species is limited (see Figure 3.1). Other site species requiring consideration because they

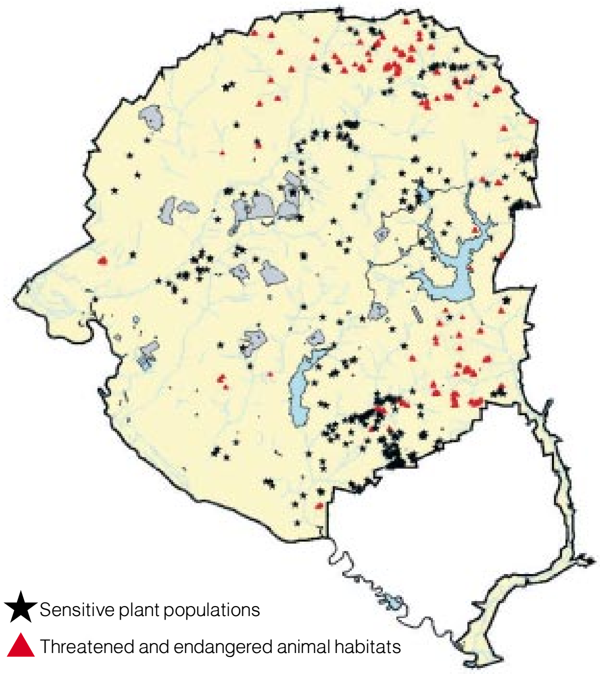


Figure 3.1.
Threatened and endangered plant and animal species habitats

are state listed, or may be federally listed in the future, include the gopher tortoise, Carolina gopher frog, pine snake, and southern hognose snake. Future protection may also be required for neotropical songbirds whose populations have declined significantly in recent years. Although no neotropicals are federally listed at present, the State of South Carolina lists several as priority species for protection. Within the next 25 years, SRS can expect to consider more threatened and endangered species, resulting from new onsite discoveries or additional listings at the federal and state levels (see Appendix C). With projected growth in the surrounding communities and the potential for other species to be endangered, it is envisioned that there will be an increased need for and opportunities to establish cooperative recovery and management ventures in partnership with private entities and other government agencies.

DOE Research Set-Aside Areas

The site has established 30 Research Set-Aside Areas to fulfill a directive related to the site's NERP status. One aspect of NERP status is the setting aside of relatively unimpacted areas for assessment and monitoring purposes. The protection and management philosophy for the DOE Research Set-Aside Areas states that they are for research; should receive as little management as possible; should be protected to remain as natural as possible with little or no human influence; and are primarily for non-manipulative research. These areas also function as "control areas" in evaluating the effects of SRS operations and forest management activities. The largest of these areas is the E. P. Odom Wetland Set-Aside, which includes the northern section of the Upper Three Runs Creek watershed and is specifically protected by the SRS Stream Management Policy. The Research Set-Aside Areas total 14,005 acres, about seven percent of the site. These areas are excluded from most routine maintenance and forest management activities. The Research Set-Aside Areas were selected to represent most of the site's major habitat types and include old fields, sandhills, upland hardwoods, mixed pine/hardwoods, bottomland forests, swamp forests, Carolina bays, and fresh water streams and impoundments.

Category I Wetlands and Streams

Category I resources are defined by the Department of Interior as unique and irreplaceable on a national basis or within an ecoregion. At SRS, this definition includes Carolina bays and cypress-tupelo swamps because of the limited number of undisturbed habitats of that type occurring elsewhere in the region. In addition, any habitat that may support a species of concern would also be considered as unique or irreplaceable. Site areas containing high-quality wetlands or headwater streams, particularly the upper reaches of Upper Three Runs, would also be considered for Category I status. Any planning or site selection process for future use at SRS must consider Category I resources and avoid impact to those areas.

100-Year Floodplain

Although new facilities will not be located within the 100-year floodplain, site land within the floodplain is available for other future land uses. Many of these areas are and will continue to be sites of ecological and archaeological research, and these areas may also accommodate future expansion of site recreational activities.

Seismology

Studies of the site's underlying geology indicate the existence of several faults, including the Pen Branch, Steel Creek, Advanced Tactical Training Area, Ellenton, Crackerneck, and

Upper Three Runs faults. Although none of these faults are thought to be capable of generating significant earthquakes, the presence of faults is considered in proposed future use evaluations.

Contaminated Areas

SRS manages waste units under RCRA, which governs hazardous waste and constituents in regulated and nonregulated units, and the site has been placed on the CERCLA National Priority List. Regulatory requirements dictate the remediation of hazardous substance releases and inactive hazardous waste disposal sites. Over 520 site areas have been identified as potential waste units. Evaluation of these units and remedial actions, if required, are ongoing based upon schedules in the *Federal Facilities Agreement*. Although an area designated as contaminated does not automatically eliminate that area from consideration for future use, future use of contaminated areas will be dependent upon the proposed land use, the nature of the contamination, and the estimated costs of any required remediation.

Other Factors

Other factors that are evaluated in determining the optimal site for new land uses include the following:

- Existing land use at that site, if any;
- Ecological considerations such as distance to streams and other wetlands, distance to threatened, endangered, and sensitive species, and distance to DOE Research Set-Aside Areas;
- Geological considerations such as depth to groundwater, soil stability, faults, and slope;
- Engineering considerations such as distance to roads, rail lines, and existing utilities;
- Likelihood of archaeological deposits;
- Terrain;
- Distance to existing waste sites; and
- Security and human health considerations such as distance to the site boundary, distance to other facilities, and the security requirements of a new land use.

Community-Related Planning Considerations

Although the nature of SRS operations requires restricted or prohibited access to certain areas, many site buildings are outside fenced areas. Safety, security, efficiency, and responsibility are top site priorities. DOE has a significantly better safety record than private industry, and SRS has led the DOE Complex in this regard. Public awareness and community outreach programs offer seminars, meetings, exhibitions, and site tours on a regular basis to educate the public about nuclear technology and environmental issues. Many community groups such as the SRS Citizens Advisory Board, the Central Savannah River Area (CSRA) Planners Group, the Savannah River Regional Diversification Initiative, Citizens for Nuclear Technology Awareness, chambers of commerce, and economic development organizations provide guidance and feedback in designing policies and programs.

Another community-related planning issue involves the concept of environmental justice. The 1994 Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires that federal agencies "identify and address disproportionately high and adverse human health effects of their programs, policies, and activities, on minority populations and low-income populations." Environmental justice programs promote the protection of human health and the environment, empowerment via public participation and the dissemination of relevant information to inform and educate affected communities. Environmental justice is included in all SRS outreach and public involvement planning and activities, including those for site planning, locating new facilities, environmental remediation decisions, and site budgeting priorities.

In addition to the site's primary nuclear weapons stockpile, nuclear materials, and environmental missions, SRS has played an important economic role for the region and the nation during the last five decades. It is estimated that the site's total contribution to the incomes of both South Carolina and Georgia ranges between $1.6 and $2.7 billion annually. In addition, the site provides thousands of jobs, provides environmental and advanced technology, and supports business development initiatives with local communities. Through the multiplier effect, estimated at 2.5 times, the impact of the recent downsizing extends beyond the jobs that are provided directly or indirectly in the region (*A Study of the Economic Impact of the Savannah River Site on South Carolina and Georgi*a, draft, H. S. Grewal, Ph.D., 2000).

The site also contributes significantly toward improving the talent base and citizen involvement of surrounding communities. SRS employees contribute financial resources and time to civic activities and are actively involved in local politics. In the last several years, site employees also annually contributed $1.8 million to the United Way charities, donated more than 20,000 pounds of food, and gave 3,000 units of blood.

SRS also contributes to economic development in South Carolina and Georgia through a number of special programs, supporting educational, research, and business development activities in the two states. In addition, SRS provides direct assistance to various community initiatives in the region. During the last five years, SRS has undertaken several programs to help local communities diversify their economic base. The main purpose of these programs is to help the local communities generate alternative sources of employment to minimize the regional economic impact as a result of SRS downsizing. The site's business development and community assistance organizations have implemented several programs to spur job creation and economic development in the region. Activities include privatizing non-classified SRS operations, transferring technology for commercial use, providing funds for building infrastructure, selling surplus equipment, providing technical assistance to economic development initiatives, and networking with community organizations.

Consideration Of Hazards And Risks

The term "risk" is used frequently in future-use planning. In this context, "risk" means the likelihood of a hazard to cause injury to humans and/or the environment. Questions arise as to the possibility of public contamination and resultant injury or illness and risk of major or irreparable harm to the environment. Identification of hazards does not mean that an area is unusable. However, it does mean that plans should consider the range of risks from hazards when preparing for the future. Assessing risk allows the decision-making process to compare alternative land uses through their compatibility with higher level planning goals and choose those that are most likely to achieve overall success. As cleanup technology improves, or as new risks or new contaminants are discovered, additional considerations could result in changes in future use plans.

Multiple Uses of SRS Land

SRS utilizes the multiple-use planning concept. The multiple-use approach supports compatible, concurrent land uses, normally on large tracts of land. Although the most difficult aspect of multiple use planning is determining compatibility, the site has already demonstrated the ability to accommodate multiple uses on much of its land. Stakeholders are interested in continuing, if not expanding, this multiple use concept. For example, the public has expressed support of the site's status as a NERP and expressed a desire to continue or expand the opportunities inherent in that designation. Opportunities include co-location of industrial, ecological, resource management, and recreational activities within limitations of health, safety, and security. Given the site's size and diversity of missions uses, other than for defense and security-related programs, are not likely to be accelerated in developing future land use options. Therefore, multiple use of the site land for national needs is expected to continue.

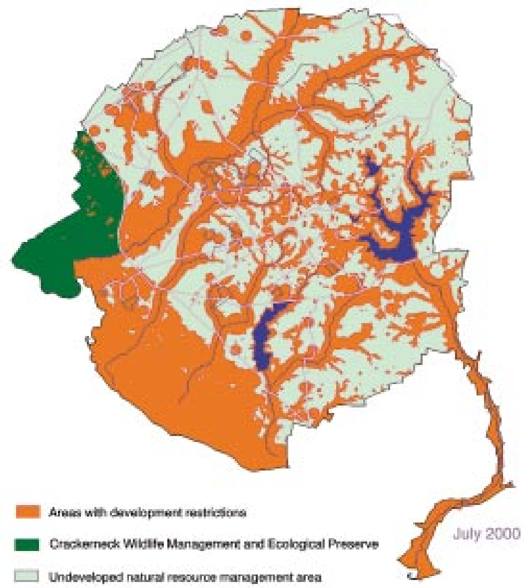


Figure 3.2
Natural and man-made restrictions to development and construction

Mapping Land Use

Sites that are most conducive to unrestricted development are depicted in Figure 3.2. This map takes into consideration the location of geologic faults, areas where threatened and endangered species exist, wetlands, depth to groundwater, availability of utilities, favorable soil types, favorable slopes, availability of transportation, etc. Most sites will have a combination of positive factors and choosing the most favorable with the least impacts is the challenge of the planning process. The map shows areas where development would not negatively impact natural or cultural resources. Because this map depicts general developmental factors, actual site-specific locations for individual projects and their requirements should be analyzed against all the criteria for final optimum site selection.

Integral Site Future Use Model

In 1995, SRS utilized extensive input from external and internal stakeholders, site management, and DOE Headquarters to evaluate various options for future use of the site, based on different visions of the site's future. After public meetings, workshops, consultation with state and federal agencies and development of policy guidance, it was decided that four basic future use models would be evaluated: the Consolidated Core Model, the Residential Model, the Disaggregate Model, and the Integral Site Model. Each of these models is described in Appendix D, Land Use Models. The model that was chosen by management to represent the future configuration for SRS was the Integral Site Future Use Model.

The Integral Site Model most realistically accommodates the site's mission and vision over the next 50 years. In this model, site boundaries would remain intact and land use would not change significantly. However, the industrial footprint would shrink—consolidating to the center of the site in a "reconfigured" land use. This scenario would allow for the accommodation of new missions, as well as the option of expanding the site core if a national need arises, terrorist activities increase, or other external causes of significant re-industrialization occur. The amount of environmental cleanup would be related to the intended future use, but potential new missions that complement existing site uses would be less likely to alter the existing land use. Land uses that require extensive unrestricted public access would not be compatible with this scenario. The key advantages of this model are that it allows flexibility for planned and future missions; provides a maximum safety buffer; and allows for research, natural resource management, biological diversity, and cultural resource management. An important prerequisite is DOE ownership of SRS into the foreseeable future. In selecting this model, SRS management has strengthened its commitment to the application of the future use policy guidelines and planning considerations. It should be noted that residential use would not be allowed, and site security and other institutional controls would be maintained in all zones.

Land Development

From a planning perspective, it is best to locate new facilities in areas of the site that have already been impacted by development. However, if SRS is assigned new missions that cannot be accommodated within previously disturbed areas, greenfield areas may be used for new projects. Unless the new missions require significant forest acreage, such a conversion would not significantly impact forest and wildlife management and research activities or the income presently received from the sale of forest products. The conversion of greenfield areas to industrial use could adversely impact research activities, especially if the necessary greenfield conversion coincides with a unique research location. However, SRS has developed a process to identify land-use conflicts, and this process would strive to avoid such conflicts.

Land Use Zones

SRS planners developed a zoned planning model specifically designed to address SRS's future land use circumstances, including concurrent, compatible land uses. Using this concept, SRS is divided into three principal planning zones: Site Industrial, Site Industrial Support, and General Support. The most intensive uses occur in the Site Industrial Zone located close to the site's center to minimize the effect on surrounding communities, maintain controlled site access, and insure the integrity of the established safety buffer. The Site Industrial Support and General Support Zones accommodate uses of decreasing intensity, particularly as they approach the site's boundaries. Each zone is restricted to the types of uses specified for that zone.

Site Industrial, Site Industrial Support, and General Support land use zones are shown in Figure 3.3. The primary activities within each zone are described in the following sections.

As a remnant of the 1950s site configuration, functional areas are inefficiently distributed across the site. Figure 3.4 shows the current major functions of most areas of the site. M, C, and P Areas are currently inactive, and primary site administrative activities are performed in A, B, H, and G Areas. Nuclear research activities are performed in A Area, which is near the site boundary. Site reconfiguration would address consolidation and co-location of functions to improve efficiency and optimize security.

Zone One: Site Industrial Zone

Principal activities and facilities in this zone include site operations that may pose a potentially significant nuclear or non-nuclear hazard to employees or the general public. Due to these potential hazards, the industrial zone is located at the center of the site and is surrounded by a safety and security buffer area. Included are facilities that (a) process or store radioactive liquid or solid waste, fissionable materials, or tritium,

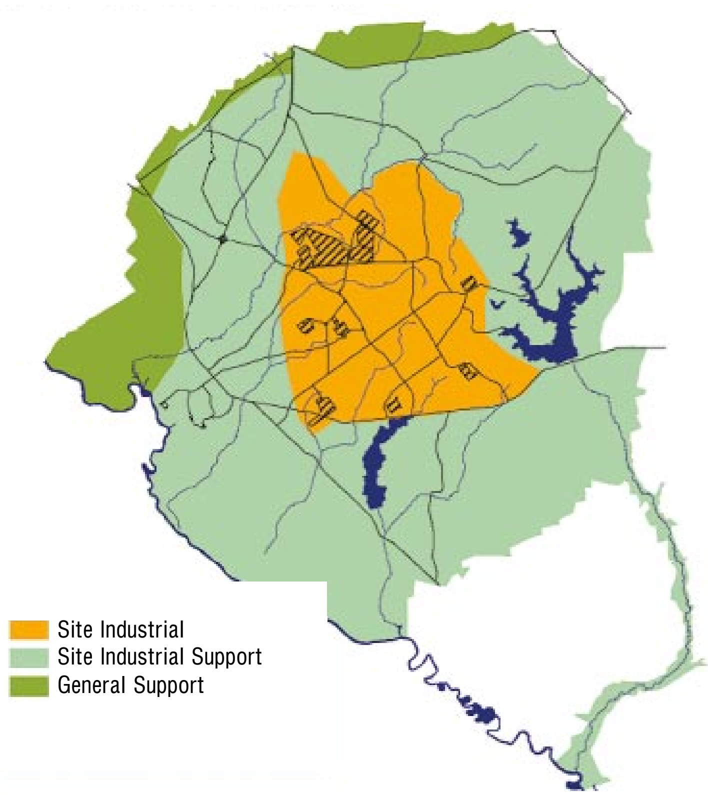


Figure 3.3
SRS Future Land Use Zoning concentrates industrial activities to center of site

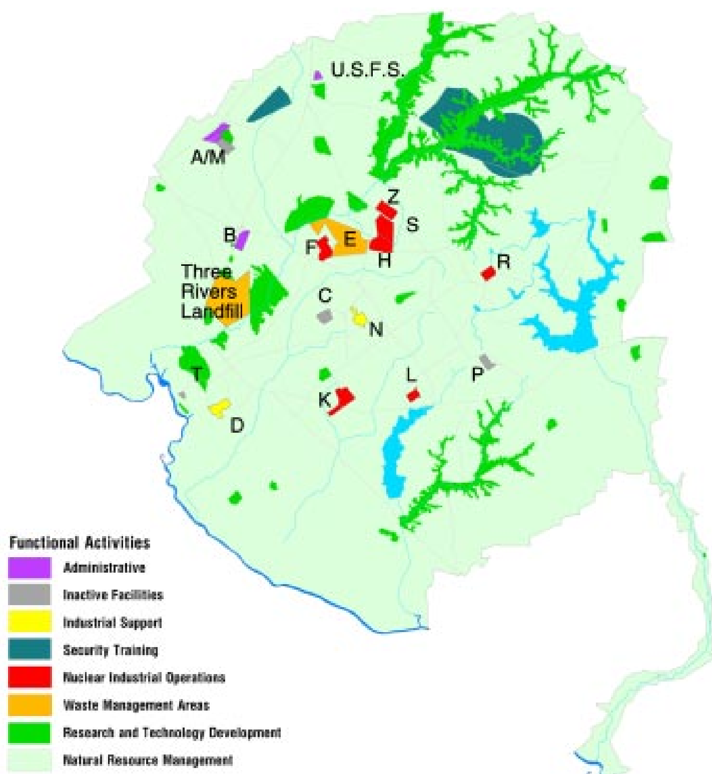


Figure 3.4
Map showing current distribution of functional activities

(b) conduct separations operations, or (c) conduct irradiated materials inspection, fuel fabrication, decontamination, or recovery operations. Primary activities in this zone include the following:

- **Heavy Industrial Non-Nuclear** activities are defined as a use involving basic processing and manufacturing of materials or products from extracted or raw materials. These activities, because of their magnitude, and their individual or cumulative effect on the surrounding area have a significant impact. These activities include those that could be potentially noxious, dangerous, or offensive to surrounding areas.
- **Heavy Industrial Nuclear** use has the same criteria as Heavy Industrial Non-Nuclear activities, but include operations in which radioactive materials are used in such forms and quantity that a potential significant nuclear hazard exists to employees or the general public. Included are facilities that (a) produce, process, store and/or dispose of radioactive liquid or solid waste, fissionable materials, or tritium; (b) conduct nuclear separations operations; (c) perform irradiated materials inspection, fuel fabrication, decontamination, or recovery operations; or (d) conduct fuel enrichment operations. While security requirements exist in Heavy Industrial areas, they play an integral part in the Heavy Industrial Nuclear Zone.

  Specifically for SRS, the site's five reactors (K, L, P, C, and R Reactors), which are permanently shut down, are included in this classification. Although the reactors are shut down, the K-and L-Area facilities are currently used for the safe storage and processing of legacy materials such as spent nuclear fuel (SNF), unirradiated highly enriched uranium (HEU), plutonium and heavy water. R-Area is one of the facilities at SRS used to store depleted uranium oxide. All tritium recycling work supporting the nation's nuclear weapons stockpile is conducted within the site's H-Area tritium facilities, which is also in this category. The F- and H-Areas separations facilities are being used to stabilize legacy nuclear materials. H Area will blend down highly enriched uranium for use as low-enriched uranium in commercial power reactors as part of a nonproliferation and material disposition effort. F-Area also has several facilities used to store depleted uranium oxide. Inactive facilities in this category include the T Area, P Reactor, C Reactor, and M Area. While all M-Area industrial facilities have been shut down, there is a waste treatment facility still operating in one small section.
- **Light Industrial** uses include predominately indoor industrial activities involving processes generating no significant emission that could create harmful or unpleasant effects outside the immediate area. These uses generally involve the manufacture of finished products or parts, including processing, fabrication, assembly, treatment, packaging, storage, and distribution.
- **Waste Operations** consist of any building, structure, installation, equipment, including any pipe into a sewer treatment works, well, pit, pond, lagoon, impoundment, landfill, or any site or area where a hazardous or radioactive substance is deposited, stored, disposed of, placed or otherwise located. The E-, F-, H-, N-, S-, and Z-Areas waste management facilities include the E-Area Solid Waste Disposal Facility, H-Area Effluent Treatment Facility, N-Area Hazardous Waste Storage facilities, H-Area Consolidated Incinerator Facility, S-Area Defense Waste Processing Facility, and the Z-Area Saltstone Facility. Also located on the site but operated by the Three Rivers Authority, is a sanitary landfill in G Area.

Zone Two: Site Industrial Support Zone

Major activities in this zone would have much less impact than those in the Site Industrial Zone. Primary allowable activities in this zone include the following:

- **Administrative** areas are used for office space, medical facilities, laboratories, print shops, photography development, and related facilities. Activities at SRS that fall into this category include the majority of site administrative offices, including the site's emergency response center and central computer operations. Other administrative facilities located onsite include the U.S. Forest Service-Savannah River; H-Area training facilities; and B-Area office complex, security facilities, and bioassay and instrument calibration shops.
- **Research and Technology Development** areas are important for the acquisition and communication of knowledge of ecological and environmental processes and principles useful in defining site program options and future decisions as well as gauging the impact of human activities on the environment. These areas are composed of laboratories, classrooms, conference centers, and study areas used for field evaluation of innovative

technologies in support of specific site missions and the general needs of the DOE Complex. These include the Savannah River Ecology Laboratory (SREL), the Savannah River Technology Center (SRTC), and research and development activities such as Research Set-Aside Areas.

- **Resource Extraction** includes the exploration, utilization, development, disposal, conservation, extraction, and processing of minerals and materials such as clay, sand, gravel, and rock from barrow pits.
- **Storage and Warehousing** includes assorted depot, repository, and storehouse activities, including motor pools and vehicle maintenance activities. This includes the N-Area Central Shops, as well as the shop facilities located in A Area for SRS.
- **Natural Resources Management** activities involve fish and wildlife resources and forest resources. These involve management of wildlife populations through the establishment, research, use, enhancement and maintenance of habitats or species. Forest resources management activities involve the utilization, development, and conservation of forest resources, including reforestation, harvest, processing, and selling of timber, as well as activities providing for the protection of forested land from fire and other destructive agents.
- **Non-hazardous, Non-nuclear Waste Operations** activities include the sanitary waste landfill operated by the Three Rivers Landfill Authority in G Area.

Zone Three: General Support Zone

The General Support Zone includes some ecological research and natural resource management activities. It also includes those uses that are determined to be safe for other limited activities that may include temporary and restricted access by the public. Although this zone is more open and accessible than other SRS zones, it is still required as part of the safety and security buffer system. Other primary allowable uses for this zone include controlled recreation and public education. At SRS, collectively, G Area is the site's natural resource area. There are specific areas for site security training, called, Advanced Tactical Training Area (ATTA) and Small Arms Training Area (SATA).

Most onsite recreation activities involve hunting and walking trails for use by site employees. Specific recommendations for hunting programs include expansion of those already in place and initiation of wildlife management programs for turkey, waterfowl, quail, and other small game. Additionally, several large tracts in the General Support Zone may be suitable for other low-impact, controlled, outdoor public activities such as hiking, bird watching, camping, horseback riding, and bicycling.

Current educational activities include Boy and Girl Scout camporees, science and environmental education programs for school groups, and numerous tours for offsite groups of all types. The site is now part of South Carolina's "Heritage Corridor," and various onsite and offsite groups are exploring different options for SRS participation in this program.

Chapter 4

Facilities Plan

Purpose

The Facilities Plan provides planners and managers the information needed to ensure appropriate use of existing and planned site facilities for present and future missions. This plan describes the functions of the site's major facilities, current and anticipated future use, planning limitations and barriers, and strategies for effective decision-making. An important aspect of this chapter is outlining the scope of the reconfiguration concept and its effect on the facilities in each area. Although this chapter describes significant physical movement of numerous site structures over the next 30 years, it should be recognized that the guidance in this chapter is not reflective of final decisions. The *SRS Long Range Comprehensive Plan* provides a vision to optimize and modernize the site functions and facilities and proposes scenarios to accomplish this gradual reconfiguration. Detailed evaluations of options, cost benefit analyses, and area-specific plans will be completed prior to final decisions and implementation of the reconfiguration scenarios discussed in this chapter.

Scope

DOE defines a facility as buildings and other structures, including the functional systems and equipment installed in the structures and the land underlying the facility. This plan element focuses on the site's major facilities. Lower level planning documents will address lesser facilities and supporting structures.

Facility Planning Goal and Objectives

The primary goal of the facilities plan is to provide an integrated process for the cost-effective life-cycle management of facilities to meet DOE mission needs.

The following objectives support accomplishment of this goal:

- Align site financial resources with facilities priorities.
- Integrate planning and identify opportunities to optimize the efficient use of facilities.
- Determine condition, capacity, and demand for all site facilities.
- Identify major facility upgrades or repairs needed.
- Include physical protection system design in the upgrading and/or design of site facilities.
- Reduce use of modular office units.
- Integrate facility databases.
- Ensure adequate warehouse storage for all classes of site storage.

- Ensure that all site facilities meet Fire Protection Program requirements.
- Reduce excess facility footprint and associated infrastructure requirements.
- Ensure that disposition phases of deactivation, surveillance and maintenance, and decommissioning are included in new facility design.

The SRS Future Use Policy states that buffer zones shall be considered when siting facilities; hazardous and radiological facilities should be located to minimize impact to environmentally sensitive areas or areas outside the SRS boundary; and existing infrastructure and facilities shall be considered for reuse to meet DOE's programmatic needs prior to development of new sites, with surplus facilities without reuse potential placed in a safe configuration.

Facility Use Assumptions

This planning chapter was developed based on the following assumptions.

- Critical safety and health facility needs will be funded.
- Risk reduction will be a key driver for work prioritization decisions within constrained budgets and staffing.
- The number of site employees will remain relatively stable and able to support new missions.
- Permanent structures are preferred over temporary structures to meet long-term needs. Utilization of new modular office units will continue to be restricted, and the removal of existing units will be accelerated.
- The need for repairs/maintenance will continue to increase as facilities age. New physical and environmental hazards may be identified as a result of the site's Inactive Facilities Risk Assessment Program. Remediation of these hazards may require additional funding.
- Future facility utilization is based upon authorization and completion of planned line item projects. If projects are not funded as planned, impacts and replanning will occur to facility utilization.
- The number of trailers onsite will be significantly reduced over the next five years.
- The lowest possible shutdown category will be attained for each excess facility to reduce the surveillance and maintenance costs associated with the facilities. The Environmental Management (*EM) Paths to Closure* strategy for SRS is that upon deactivation, facilities will be entered into long-term stewardship until site closure. Ultimately, DOE-SR will make the final determination on end state for each facility.
- Infrastructure upgrades will be limited to those necessary to support facilities expected to remain in operation through the site reconfiguration, unless there is an immediate health or safety issue.

Facilities Disposition

Disposition is the process that begins when DOE determines a facility is no longer needed to support defense, research or other program missions. Currently, the Facility Disposition Program manages P, C, R, and M Areas, select facilities in F Area, the former heavy water cleanup facilities in D Area, and the Heavy Water Components Test Reactor. P, C, and R Areas contain three of the site's five production reactors, all of which have ceased operation as reactors. Residual contamination, including fission by-products, is found in a number of areas of each reactor building, as a legacy of former operations.

A facility is *inactive* when it is no longer in operation but has not been formally declared excess. A facility is considered *excess* when DOE has determined that it is no longer required to fulfill SRS missions and formal documentation has been initiated to change its status. *Surplus* facilities are facilities that have been declared excess and have been evaluated by a formal screening process, which results in no other identified use or historical preservation significance. Facilities planning includes the disposition process as part of the life-cycle planning approach. Life-cycle planning starts with the projection of future facility requirements and continues through completion of a facility's useful life and eventual decommissioning. An important objective throughout the facility disposition process is to maintain an integrated and seamless process linking deactivation, decommissioning, and surveillance and maintenance with the previous life cycle phases. Activities of facility transition and disposition incorporate integrated safety management at all planning levels to provide cost-effective protection of workers, the public, and the environment.

Disposition planning for inactive facilities follows this general sequence:

1. Identify Hazards – Every year the custodians of facilities at SRS are requested to provide information about inactive facilities so that the Master Inactive Facilities List can be kept up-to-date. Custodians fill out a simple hazard checklist for the facility that is used to establish a priority list of facilities based on the potential hazards present. All inactive legacy facilities are identified in this manner, added to the inactive facility list, and ranked for further detailed investigation. Each fiscal year, a series of detailed walkdown inspections is performed on the highest ranked facilities. For operating facilities that are nearing the end of their useful life, a facility condition documentation package is prepared by the custodial organization, using existing information available to the operating staff.

The tables in the following sections show inactive facilities in each of the site areas as depicted on the Inactive Facility Screening List dated August 2000. This list changes regularly as hazardous conditions are identified and resolved and as newly identified inactive facilities are added to the list. It is revised annually prior to the budget process as part of the Annual Operating Plan.

2. Prioritize Corrective Actions – The potential hazards identified on the inactive facility checklists provide the basis for the risk-ranking priority list. The highest ranked inactive facilities on that priority list are selected for detailed walkdown evaluations. Detailed reports of the actual hazard conditions are written, and each individual hazard is entered into a database for corrective action.

The hazards identified in the walkdowns are assigned an objective numerical score that is based on the nature of the hazard, the degree of severity of the consequences, and the likelihood of those consequences. The scoring system used is the one referred to as the Environmental, Safety, and Health Risk-Based Prioritization *Model* chapter in the DOE Good Practices Guide, *Prioritization* (GPG-FM-030). This scoring is done hazard-by-hazard, rather than building-by-building. All of the hazards are ranked by score. The highest risk hazards are given the highest priority for corrective action, with the highest priority being given the number one, and the rest ordered sequentially by decreasing risk. Based on relative scores, the hazards are sorted into three action groups: 1) unacceptable hazards that require expedited correction, 2) significant hazards that are to be corrected as resources permit, and 3) minor hazards that do not require immediate attention.

3. Perform Corrective Actions – As risk-reducing corrective actions are implemented at the facilities, the overall hazard level will be reduced. Custodial organizations budget and plan the corrective actions on an annual cycle. The highest risk hazards are addressed first. This risk reduction work is performed using the site integrated safety-based work management system.

4. Factor Results of Corrective Actions Back into Planning Cycle – After corrective actions have been completed, the prioritization checklists are filled out again, to reflect the newer reduced hazard level, subsequently changing a facility's position in the risk-ranking priority list. In this way, each year, the remaining inactive facilities with the highest residual hazard levels will migrate to the top of the priority list for the detailed walkdown evaluations.

Lower-level planning documents provide the details of the disposition process for individual facilities and identify specific actions needed during each of the following phases of the disposition process:

Transition activities occur between operation and disposition in a facility's life cycle. Transition begins as soon as a facility has been declared or forecast to be excess to current and future DOE needs. It includes placing the facility in a stable and known condition, identifying hazards, eliminating or mitigating hazards, establishing an initial surveillance and maintenance plan, transferring the facility from operational status to excess status, and transferring programmatic and financial responsibilities from the operating program to the disposition program, if appropriate. Timely completion of transition activities can take advantage of facility operational capabilities before they are lost, eliminating or mitigating hazards in a more efficient, cost-effective manner. In preparation for the disposition phase, it is important that material, systems, and infrastructure stabilization activities be initiated prior to the end of facility operations.

Deactivation is the first disposition activity to take place. The purpose of the deactivation is to place a facility in a safe shutdown condition that is economical to monitor and maintain for an extended period, until the decommissioning of the facility. Deactivation protects the health and safety of workers, the public, and the environment and minimizes the long-term cost of surveillance and maintenance. Deactivation of contaminated, excess facilities should occur as soon as reasonable and for as many facilities as possible. In this way, SRS can apply its resources in a manner that will accomplish the greatest net gains to safety and stability in the shortest time. Deactivation places the facility in a low-risk state with minimum surveillance and maintenance requirements.

Surveillance and Maintenance (S&M)/Safe Storage activities are performed throughout the facility transition and disposition phase to monitor and document the presence, status, and condition of structures, systems, components, and hazards associated with the facility. S&M is adjusted as transition, deactivation, or decommissioning activities are completed. Continuing S&M ensures, at a minimum, that any contamination is adequately contained and that potential hazards to workers, the public, and the environment are minimized and controlled. S&M is conducted during transition, deactivation, decommissioning and during an extended period between deactivation and decommissioning.

Decommissioning is the final disposition process, during which the facility is taken to its ultimate end state through decontamination and/or dismantlement, demolition, or entombment. While the goal of the decommissioning phase is the reutilization of the land for either unrestricted non-residential use or for limited applications, the surrounding area may require SRS control for protection of the public and the environment.

There are many uncertainties and considerable cost differences associated with various approaches to decommissioning facilities at SRS. SRS will continue to safely manage its inactive facilities. The immediate goal is to remove the most dangerous materials from inactive facilities and maintain the facilities under safe and stable conditions.

In general, funding required to decommission processing facilities that have been declared surplus has been deferred beyond fiscal year 2006 in favor of higher priority missions. Following deactivation, facilities will be placed in a long-term, low-cost surveillance and maintenance program pending final decommissioning, which will continue through 2070. Life-cycle costs for facility deactivation are estimated at approximately $10 billion, with an additional $458 million currently included for the High Level Waste Program. Because of budget constraints, the site's Annual Operational Plan includes only modest funding for the Facilities Disposition Program. These actions will mitigate risks associated with the prioritized inactive facilities but do not constitute complete facility deactivation programs. Current budgets will only support the systematic evaluations and development of mitigating action plans for approximately 15 prioritized inactive facilities per year. It may be necessary to secure separate, line item funding to support deactivation and decommissioning activities.

Proposed General Improvements

There are several general improvements proposed as part of a major administrative project called the Infrastructure Restoration and Reconfiguration Line Item, which include administrative facilities refurbishment, heating, ventilation, and air conditioning (HVAC) system replacements, and roof replacements. Decisions regarding refurbishing or upgrading facilities will be weighed with long-range reconfiguration plans prior to authorization and implementation. Specific projects of this proposal are discussed briefly below.

Administrative Facilities Refurbishment and Improvement Project. This project will repair and refurbish aging administrative buildings and related facilities, including the correction of non-routine maintenance deficiencies; and install needed safety and utility upgrades to warehouses and chemical management facilities. It will address electrical, ventilation, plumbing, and other building systems as necessary. New construction may be necessary if life-cycle cost analysis determines it to be the most cost-effective option. Also, elimination of trailers will be considered as an option in lieu of refurbishment of trailers.

One-third of administrative facilities are greater than 35 years old. Certain buildings have inadequate foundation drainage and seals with the result that buildings flood after heavy rains and expose equipment to damage as well as causing occupant safety risks. Areas that flood develop heavy concentrations of mold with recurring damage to carpets, walls, etc. In addition, related facilities such as warehouses and chemical management facilities are in need of upgrades for safety and utility equipment in order to bring them into compliance with regulations.

Heating, Ventilation, and Air Conditioning (HVAC) System Replacement Project. This project will replace units on a highest need basis. There are more than 1000 HVAC units on administrative facilities across the site. The average age of roof top HVAC units is 15 to 20 years, which is well beyond their useful life. The result is that 60% of the HVAC units are no longer economically feasible to repair. Moisture leakage from drip pans aggravates roof deterioration, and internal moisture levels result in mold growth in ventilators and occupant health concerns.

Roof Replacement Project. This project will focus on approximately 130 of the most deteriorated roofs of administrative buildings and related facilities. The site has over 2500 roofs with an estimated 25% of these requiring structural repairs. Some degree of structural sheathing on these roofs is expected to require replacement due to long-term leakage.

Roofs have been repeatedly patched in lieu of replacement, further escalating yearly maintenance costs as overlapping patches become ineffective and leakage becomes more common. Normal deterioration of these roofs due to age and weathering is accelerated due to deferral of maintenance and the cumulative effects of leakage over the years. Leakage also contributes to the development of mold in the structure walls and contributes to the "sick building syndrome."

Facility Assessment and Needs Area by Area Descriptions

The site's existing and planned facilities are the cornerstone to achieving long-range objectives for the Nuclear Weapons Stockpile, Nuclear Materials Management, and Environmental Stewardships. The site's facilities represent a national asset that can be used to safely deal with the nuclear legacy of the Cold War, as well as the post-Cold War management of surplus nuclear materials. This section summarizes the status and plans relating to non-process facilities. Condition assessments and life cycle analyses are used to assess the site's facility needs.

Existing Facilities

There are approximately 2000 buildings onsite, each with an estimated value greater than $25,000. The distribution of the gross square footage in non-process facilities valued in excess of $25,000 is found in Table 4.1.

As buildings age, poor structural conditions leading to indoor air quality problems can increase, resulting in building conditions known as Sick Building Syndrome (SBS) and Building Related Illness (BRI). Neglected maintenance leads to an accumulation and build-up of contaminants in the air system. This, coupled with a moisture build-up, inevitably leads to an increased risk of microbiological contamination, affecting the health of the occupants.

There are two major categories of contaminants found in indoor air that can cause a wide variety of health concerns. These include anything in the air that will irritate individuals with sensitive respiratory systems: allergens (e.g., dust and pollen) and fungals (e.g., microbiological organisms of the fungi kingdom such as mold and mildew).

There are approximately 320 trailers that provide approximately 425,000 square feet of usable space on site. Most of these trailers provide administrative space. Although permanent facilities are the preferred choice to meet the site's administrative space needs, about 10% of trailers satisfy a space need in remote areas that is not satisfied with permanent facilities.

Visual assessments have been performed on all site trailers. According to the assessments, the majority of the trailers are in fair condition. Due to the age of the structures, it is becoming increasingly more difficult to maintain trailers at a level that is adequate to house personnel on a long-term basis, and it also has been determined that it is more cost-effective to house personnel in permanent facilities. There is an aggressive effort in progress to consolidate personnel from trailers into permanent facilities, which will result in improved building and area utilization and increased cost effectiveness.

As organizations identify unneeded trailers across the site, the trailers are evaluated by the Trailer Commodity Management Center (TCMC) for potential reuse. Trailers selected for reuse are typically used for project start-up or to replace existing trailers that are in poor condition that continue to meet a housing need that is not satisfied with a permanent facility. This eliminates the need to lease or purchase additional trailers. Major trailer repair efforts are being suspended on all trailers that have been identified as excess. The TCMC goal is to excess approximately 40 to 50 trailers a year, for the next six years. Meeting the six-year excess goal would reduce the site's trailer inventory to approximately 90 trailers that primarily will be used to meet space needs in remote areas.

Table 4.1. Gross Square Footage of Non-Process Facilities by Category

Use of Space	Percent of Total Gross Square Footage
Administrative	64%
Production/Laboratory	19%
Service Support	7%
Storage	10%
Total	100%

Facility Needs Analyses

Because of recent downsizing and new mission requirements, the site is undertaking various studies to determine the future configuration and facility needs of SRS. All facility types are included in these analyses: Administrative, Industrial, Storage, Research and Technology Demonstration, Safety and Health Protection, Emergency Response, and Safeguards and Security.

Administrative. One-third of administrative facilities are greater than 35 years old. Maintenance funding for these facilities has not been consistent with the maintenance that facilities of this age routinely require. Failure to perform this routine maintenance due to lack of funding has produced an unacceptable rate of deterioration in some facilities.

There are currently 153 administration facilities primarily located in A, B, and C Areas. Administration facilities are also located in each process area to provide office space for personnel who support the areas' specific functions.

Unfortunately, currently available administrative space on the site is inadequate to support closure of a large facility such as 703-A or 704-F. A large portion of currently available administrative space is in trailers or temporary facilities. The degradation of these facilities, and the fact that the poor conditions within these trailers are currently resulting in higher amounts of documented cases of SBS than permanent facilities, has lead to a shortage of space. The DOE-SR Facility Services Division is completing the A-Area Option Study to explore several options to resolve the critical state of conditions in the A-Area facilities.

Storage. Warehouse space is adequate across the site although space allocations and resource utilization issues remain. The lay-down and excess yards are adequate for site needs. Currently no new warehouses or commodity management centers are planned. Upgrades or new facilities may be required for proper storage of site hazardous and chemical material.

Research and Technology Demonstration

The Savannah River Technology Center (SRTC) conducts research, development, and technical support activities. Laboratory operations are conducted in the Technical Area (700 Area) and the TNX Prototype Testing Area (600 Area). There are nuclear facilities within the Technical Area; however, the current nuclear laboratories are insufficient to support the new plutonium missions.

The reconfiguration of the site, described in Chapter 1, proposes the relocation of SRTC to the center of the site near the nuclear processing facilities that it supports.

Other Facilities

Many of the site's perimeter barricades and entry control facilities are in need of repair, renovation, and/or replacement. The buildings are experiencing a number of electrical, structural, roofing, and HVAC problems; and some facilities contain asbestos piping that needs to be removed. Additionally, some facilities do not have adequate space for rest rooms, lockers, meeting rooms, offices, and storage. Several barricades, entry control, and special purpose facilities need to be replaced with new, modern structures that are more conducive to current requirements.

Facility Description By Area

SRS facilities are geographically dispersed across the site in alphabetically designated cluster areas as shown on Figure 1.3. The following sections provide detailed descriptions of each area's current configuration and defined use, current condition, defined future actions, a list of inactive buildings, and a proposed scenario of the area's future configuration consistent with the reconfiguration concept. The complete list of SRS inactive facilities from the risk-ranked matrix of inactive facilities is shown in Appendix E, Inactive Facilities, with an explanation of how the site ranks the risk. The Configuration and Current Use section of each area describes the current activities in the area, as described in other documents such as *Paths to Closure* and the *Defense Program's Ten-Year Plan*. The Future Action sections describe scenarios and proposals being analyzed for future planning. Specific actions for each facility listed in the tables will be evaluated and addressed in lower level, more detailed plans.

A Area

A-Area Configuration and Current Use. A Area is primarily comprised of administrative, laboratory, industrial support, and some warehouse facilities. This part of the site is the most accessible to the general public, and functions as the primary entry point for visitors to the site. Most facilities were constructed in the early 1950s and continue to provide adequate accommodations for their intended missions, and many presently require significant investment in maintenance and repair. The condition of the warehouse space varies from poor to good, but no new warehouse facilities are currently planned. Over 20 percent of the site's employees work in A Area. The primary administration building is Building 703-A.

SRTC is a major tenant in A Area. The facility occupies the primary laboratory building (773-A) and a number of support facilities. Originally established to support the production of nuclear materials for national defense, SRTC plays a key role in advancing the science and development of hydrogen technologies for defense applications. As a national center for technological innovations, SRTC facilities continue to support the national interest by providing the laboratory setting for technology advancements in waste vitrification, environmental remediation, robotics, and advanced sensor systems. SRTC laboratory buildings, constructed in 1953, are showing signs of deterioration in critical mechanical support equipment and instruments, such as HVAC systems and fume hoods. SRTC provides critical nuclear research and support to the tritium, plutonium, and legacy wastes missions. For this reason, heightened security is provided for this facility.

Another major A-Area tenant is the Savannah River Ecology Laboratory (SREL), operated by the University of Georgia. Since 1951, SREL has conducted ecological research at SRS. A permanent ecology laboratory was established in 1961, and new laboratories and a new computer center were added in the 1990s. Some of the SREL facilities currently need upgrade or repair.

A Area is also the location of several critical 24-hour operations, including the Emergency Operations Center, SRTC Laboratory Operations, Records Storage, SRS Fire Department, and the Central Unclassified and Classified Computer Facilities.

Figure 4.1 depicts the projected useful life of the major facilities in A Area. Many of the buildings in A Area are more than 40 years old and are requiring significant investments to maintain. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources should be expended to keep the facilities in operation through their life cycle. As buildings and structures near the end of their useful life, replacement facilities will need to be funded and constructed, and maintenance should be limited to only those items required for the health and safety of the employees until the building is declared inactive.

A-Area Proposed Reconfiguration. In reconfiguration, the focus in A Area over the next 20 years would be to shrink the industrial footprint of A Area. Figure 4.2 depicts the proposed reconfiguration scenario of A Area in the year 2020, which would include a shutdown of A Area to shrink the infrastructure maintenance and operation requirements and consolidate and strengthen secure areas. Additional studies are needed to determine the feasibility of this proposal and to develop alternate strategies before final decisions were made.

It is envisioned that the administrative functions, including the administrative functions of SREL, would be relocated to B Area and become part of an administrative complex. Over the next 10 years, DOE and WSRC administrative employees would be relocated to B Area as space is made available in new facilities. Because of the planned closure of facilities in A Area, maintenance and upgrades on infrastructure systems and buildings in A Area should be limited to the minimum required for maintaining safety and health until the buildings are vacated. The cultural resources group could occupy vacated facilities and set up operations. Archives, research, and public display areas could be made available to provide adequate facilities. If so, they could remain in A Area until approximately 2015, at which time they could relocate to permanent facilities in B Area. Options to lease vacated facilities in A Area might also be considered until the area is completely shut down.

SRTC laboratory facilities are reaching a stage where maintenance or renovation of the deteriorating facility components may be more expensive than construction of new laboratory facilities. Security issues associated with plutonium and tritium research and contamination in the existing buildings indicate that new facilities may be required. Radiological, chemical, and industrial laboratories and the administrative functions of SRTC could be relocated to F or H Areas in the Heavy Industrial Zone near the nuclear operations that they support. If new facilities were constructed, from both security and operational efficiency standpoints, relocating SRTC to the Heavy Industrial Zone near the missions it supports would be logical.

Site warehouse operations in A Area would not be necessary if the administrative and laboratory functions were relocated. Warehouse and maintenance operations in A Area could be consolidated in N Area. After the majority of employees have relocated to B Area, the steam requirements would be lessened, and use of the A Area Powerhouse could be phased out. In the proposed reconfiguration scenario, the buildings shown in red in Figure 4.2 would be vacant and transferred to the Facilities Disposition Program (FDP).

SREL facilities are newer than most of the buildings in A Area and still have some useful life. As long as it is cost effective to maintain infrastructure in A Area for SREL functions, SREL could remain in A Area. As the facilities in SREL near the end of their useful life, new facilities could be constructed near B Area outside the secure zone to allow public access. By 2020, according to the proposed reconfiguration scenario, no building in A Area would be in use, and all facilities would be transferred to the Facility Dispositioning Program. Much of A Area would be under long-term stewardship (LTS) for environmental monitoring purposes.

There are several improvement projects that currently are being proposed in the Infrastructure Restoration and Reconfiguration Line Item, including the Restoration of Waste

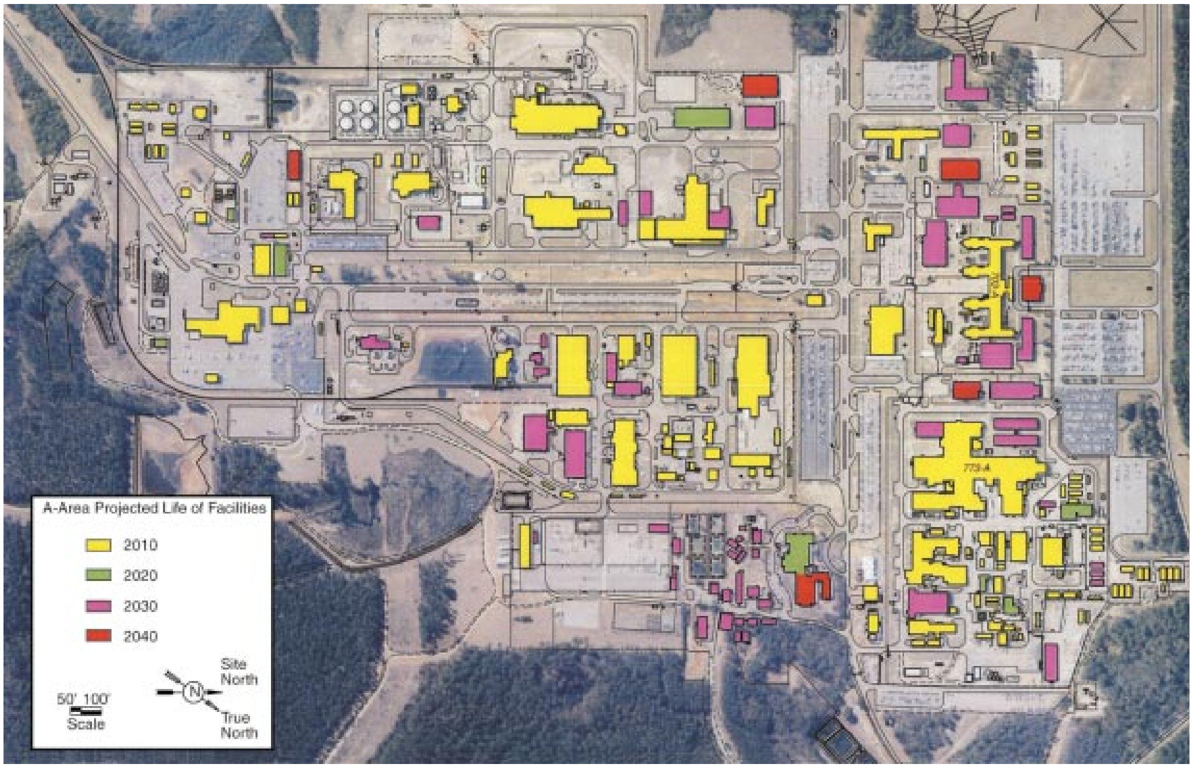


Figure 4.1
Current Configuration and Projected Useful Life of A- and M-Area Major Facilities

Figure 4.2
A- and M-Area Proposed Reconfiguration Scenario in Year 2020

Collection and Transportation System Project and the Reduction of Radiological Hazards in Technical Area Project. Final decisions on these projects will be made after additional studies and analyses. Specifics on these projects are discussed below.

SRTC Restoration of Waste Collection and Transportation Systems. The SRTC Technical Area Waste Treatment, Storage, and Disposal (TS&D) facility has been in operation for approximately fifty years, including the primary and secondary containment vessels and piping. The existing TS&D facility has aged to the point of requiring significant repair to the degraded secondary containment required for the ten 3,700- to 5,500-gallon below-grade waste tanks and over 2,000 feet of 4-inch and 6-inch diameter below-grade waste transfer piping. This project would upgrade waste treatment and storage capabilities or provide replacement facilities for the SRTC Laboratory missions in compliance with existing environmental regulations. This project would be necessary in order to ensure current safe operations and future stabilization, regardless of final SRTC disposition. In addition, the facility operation requires the use of a more than 25-year old, 85-ton transport tank/trailer combination required to transport High Activity Waste (HAW) to another facility located in the center of the site for treatment in a waste evaporator. The HAW Transport trailer is nearing the end of its useful life. It was originally built to commercial standards of the early 1970s and is not compliant with current DOT and DOE Order requirements. The replacement transporter requirements are being evaluated to meet the new DOT requirements. The transporter loading and unloading facilities will be modified or replaced as required to safely mate with the replacement transporter.

Alternatives for upgrading and or replacing the waste collection system will be evaluated based on cost benefits and plant efficiencies.

SRTC Reduction of Radiological Hazards in Technical Area Project. This project will provide for the reduction of operating risks to facility personnel due to highly contaminated laboratory spaces, replacement of critical infrastructure systems, and improvements to the safe handling of nuclear materials.

Actions will include removal of highly contaminated abandoned equipment. Demolition and removal of abandoned highly contaminated hoods and related laboratory equipment, particularly in F-Wing, is required to maintain safety and minimize exposure of facility operating personnel - again, regardless of current operations or ultimate SRTC disposition. It would also include the safe, secure storage of nuclear material in gloveboxes, hoods, and cells and the removal of abandoned sources resulting in the reduction of radiological hazards.

Presently, 11 A-Area facilities have been declared inactive, including five complete A-Area facilities and many rooms within A-Area facilities. Table 4.2 is an excerpt from the site's inactive facilities list which identifies inactive facilities or parts of facilities that are candidates for disposition and inclusion on lower level, more detailed, facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

Table 4.2 A-Area Inactive Facilities, May 2000

Building Number	Building Name
607-001A	Sewage Treatment Plant
701-013A	Guardhouse at Employment Road
773-A	Section F, Alpha D&D Cell
773-A	Section F, Californium Processing Facility, Cells 1, 2, 3
773-A	Section F, Medical Source Facility
773-A	Section F, F003 Gloveboxes
773-A, Section F	Separations Equipment Development
777-10A	PDP (3 levels)/SPRX Room
779-10A	Lunch Room/Change Room Trailer
779-A	Manipulator Repair Shop (Formerly Naval Fuels Building)

B Area

B-Area Configuration and Current Use. B Area is located approximately four miles from A Area, near the intersection of Roads C and 2. It is comprised primarily of administrative, protective force operations, laboratory, and warehouse facilities. Some B-Area facilities were constructed in the early 1950s. Modern administrative, laboratory, and engineering facilities were recently constructed for Information technology, environmental sciences, safety and health, project engineering and construction, and procurement personnel. Over 12 percent of the site's employees work in B-Area facilities.

A major tenant in B Area is Wackenhut Services, Incorporated–Savannah River Site (WSI-SRS), which provides protective-force personnel to guard DOE security interests. SRS protective force capabilities include site access control at perimeter barricades, law enforcement, investigations, special response teams, helicopter operations, boat patrols, sophisticated alarm centers, live fire ranges, and canine operations. Overall management of the WSI-SRS contract is provided from B-Area administration buildings. Other WSI-SRS facilities located in B Area include the Aviation Operations Facility, the Special Response Team Facility, the Canine Facility, Multi-Media Lab, General Repair, Training Exercise Facility, and the Ammunition Storage Facility. SREL currently operates laboratories in B Area, adjacent to WSI-SRS.

Bordering B Area, in an area formerly called U Area, is the location of the former Heavy Water Components Test Reactor (HWCTR). The facility was a research and development reactor built in the 1960s and operated for only a few years. It was shut down permanently in 1967. The support buildings and structures have been demolished, and the only structure remaining is the reactor building. This building is a high-integrity steel containment structure that has been deactivated and welded shut, placing the facility into long-term safe storage. Figure 4.3 depicts the projected useful life of the major facilities in B Area. Based on these projections, individual building maintenance plans should be developed to determine the extent to which resources would be expended to keep the facilities in operation through their life cycle. As buildings near the end of their useful life, replacement facilities will need to be funded and constructed, and maintenance would be limited to only those items required for the health and safety of the employees.

B-Area Proposed Reconfiguration. It is envisioned that B Area would be transformed through reconfiguration to an administrative complex, consolidating most of the site administrative functions. Figure 4.4 depicts the projected reconfiguration scenario of B Area in the year 2020.

In the site reconfiguration scenario, B Area would become a centralized site administrative complex. The DOE-SR and WSRC administrative functions currently located in A Area would be relocated to B Area over the next 10 years, as new office space is made available to consolidate site administrative employees. The Emergency Operations Center, SRTC Laboratory Operations, Records Storage, SRS Fire Department, and the Central Unclassified and Classified Computer Facilities could also be relocated to B Area. A facility or facilities to accommodate site visitors, house museum collections, house medical operations, and provide badging would be constructed in B Area. This facility would be located outside of the secure area, and a security gatehouse would be located near to the B-Area functions to control public access to the site operations.

A new training facility may be constructed in B Area to move this administrative function out of the Heavy Industrial Zone. Locating the training function outside of the nuclear industrial area and closer to site boundaries would facilitate evacuation in the event of an emergency incident.

Support operations, such as cafeteria services, fire protection, and record storage, also would need to be constructed. In this proposed scenario, new facilities would be planned, funded, and built in order to create the required space to support these functions by 2010. Road 2 would be modified to accommodate increased traffic flow in B Area.

To provide space for the construction of new buildings, to minimize risk in the populated areas, and to provide additional security for WSI aviation activities, the WSI Aviation Operations Facility would be relocated away from B Area. By 2020, as the U. S. Forest Service (USFS-SR) and SREL facilities near the end of their useful life, USFS-SR administrative and educational program functions and SREL administrative offices would be located in B Area. The Forest Service would also maintain strategically placed fire protection equipment and maintenance materials and equipment elsewhere around the site. SREL administration would be located outside the secure area near the visitor's center and would maintain laboratory and environmental monitoring facilities around the site, as needed.

The Heavy Water Component Test Reactor Facility and a sanitary wastewater facility in B Area have been declared inactive. Table 4.3 lists the inactive facilities that are candidates for disposition and inclusion on lower level, more detailed facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

Table 4.3. B-Area Inactive Facilities, May 2000

Building Number	Building Name
607-4B	Sanitary Wastewater Facility
770-000U	Test Reactor Building (HWCTR)

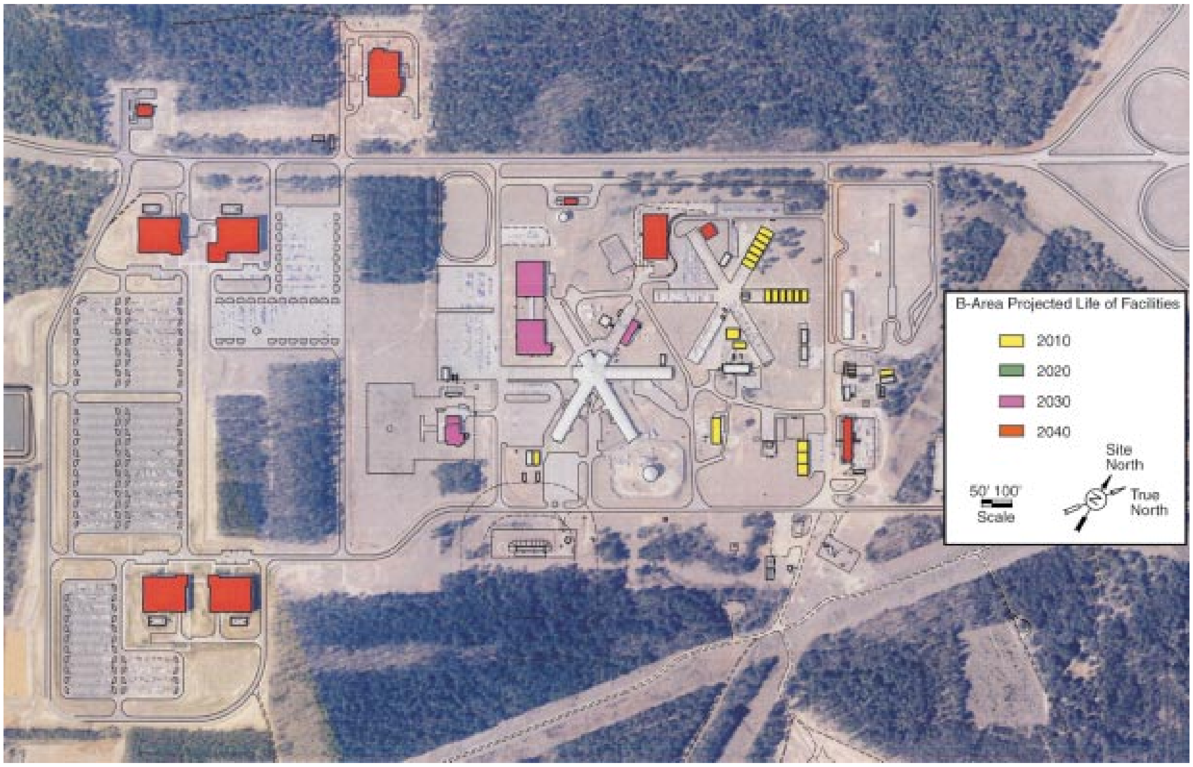


Figure 4.3
Current Configuration and Projected Useful Life of B-Area Major Facilities

Figure 4.4
B-Area Proposed Reconfiguration Scenario in Year 2020

C Area

C-Area Configuration and Current Use. C Area is one of five SRS reactor areas with the original mission of producing material for the Department of Defense nuclear weapons program (see Figure 4.5). The C-Area Reactor at SRS is inactive, and the reactor buildings are being used for alternative purposes until disposition. Currently, C Area is primarily comprised of heavy nuclear industrial, administrative, safeguards and security, and some warehouse facilities. Most facilities were originally constructed in the early 1950s and continue to provide adequate accommodations for their current missions. Approximately three percent of site employees work in C-Area facilities.

C Reactor is a multiple-story facility that contained a reactor tank to house heavy water for reactor control and hundreds of fuel and target elements. The C-Reactor Assembly Area, formerly used for the receipt, handling, and storage of new, unirradiated fuel and targets from the M-Area manufacturing area, currently houses the site Decontamination Center. The disassembly area consists primarily of water-filled basins with metal racks designed for vertical storage of fuel tubes and metal buckets for storing targets during operations. The basin contained several million gallons of water and allowed the target and fuel assemblies to undergo natural radioactive decay after reactor irradiation, usually over a period of 12 to 18 months. Currently, no irradiated or unirradiated fuel or targets are stored in the 105-C Disassembly or Assembly Area. However, heavy water continues to be stored in the reactor building, in the designated process tanks. Plans are being made to remove this heavy water as contained in the *Moderator Management Plan*.

Figure 4.6 depicts the projected useful life of the major facilities in C Area. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources would be expended to keep the facilities in operation through their life cycle. As buildings near the end of their useful life, replacement facilities would need to be funded and constructed, and maintenance should be limited to only those items required for the health and safety of the employees.

Figure 4.5
C Reactor Facilities

C-Area Proposed Reconfiguration. Figure 4.7 depicts the projected reconfiguration scenario of C Area in the year 2020. A narrative of the actions that could take place over the planning period to achieve that reconfiguration follows.

There are no new facilities planned for this area. Presently, 12 C-Area facilities have been declared inactive; however, all buildings in C Area would be placed on the inactive list by 2010, except the newer buildings located on the northeast part of C Area. These newer buildings, including the Reactor Training Facility (705-C), the Reactor Support Services Building (705-3C), the Reactor Simulator Training Facility (707-C), and the Reactor Engineering Office Building (705-1C) could remain active until 2030, at which time they would be vacated and transition into FDP. The C Reactor and associated facilities are designated for inclusion in the LTS program. Table 4.4 is an excerpt from the site's inactive facilities list which identifies inactive facilities or parts of facilities that are candidates for disposition and inclusion on lower level, more detailed, facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

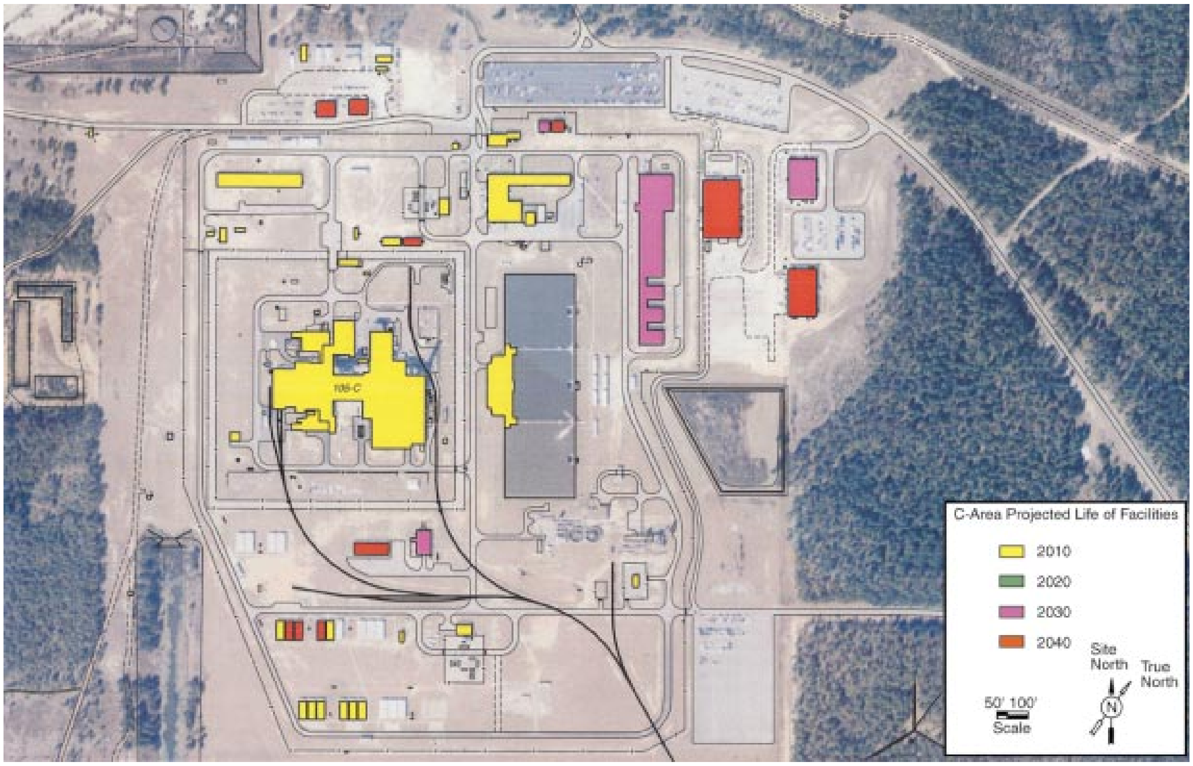


Figure 4.6
Current Configuration and Projected Useful Life of C-Area Major Facilities

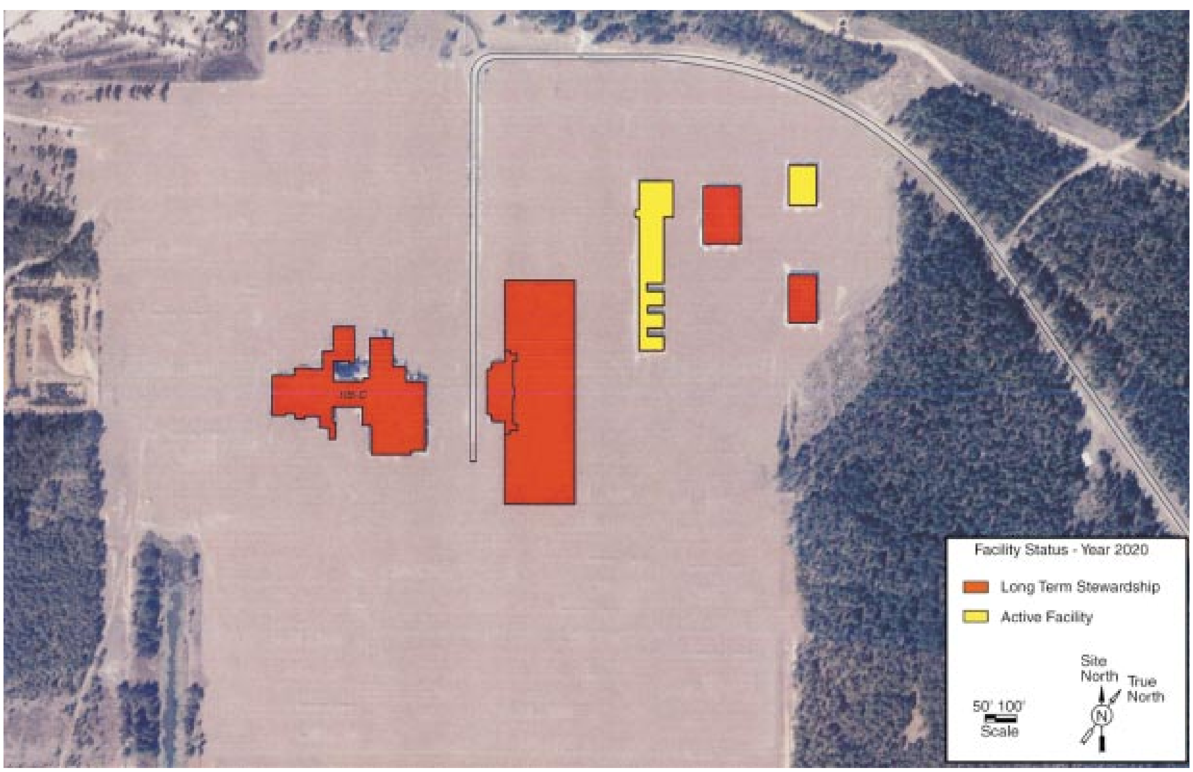


Figure 4.7
C-Area Proposed Reconfiguration Scenario in Year 2020

Table 4.4. C-Area Inactive Facilities, May 2000

Building Number	Building Name
105-000C	Reactor Building
105-006C	Change Building
105-007C	Change Building
108-001C	Emergency Diesel Room
108-002C	Emergency Diesel Room
108-004C	Exhaust 903 Fan Emergency Diesels
190-000C	Cooling Water Pump House
191-000C	Booster Pump Building
608-000C	Change Facility
701-001C	Area Gatehouse and Patrol HQ
701-006C	Guard House
717-000C	Contaminated Maintenance Facility

D Area

D-Area Configuration and Current Use. D-Area Heavy Water Facilities provided the water necessary to moderate SRS's five nuclear reactors. D Area originally contained three sets of heavy water extraction towers with the support facilities needed to concentrate sufficient heavy water to keep each of the five reactor tanks filled, using the Savannah River as the water source. D Area was operational until 1982. By September 1995, two sets of extraction towers and most supporting facilities had been removed. Several detailed plans describe the scope and schedule for discontinuing heavy water production.

The *Heavy Water Shutdown Plan* discusses the cessation of the heavy water waste campaign and transition to a campaign that was completed at the end of the first quarter of 1999. The *Shutdown Transition Plan* details the heavy water facility activities, which include line and system draining, relocation and storage of all heavy water in D Area, and transition of the heavy water facilities to the Facilities Disposition Program. The *Moderator Management Plan*, revised in fiscal year 1999 to reflect the *Shutdown Transition Plan* activities, reflects the heavy water consolidation in preparation for final disposition of the heavy water.

The Rework Unit was shutdown in 1998. The DuPont Water Facility operated through the end of 1998 in support of the National Institute of Standards and Technology product campaign. The Technical Purification Facility was maintained in a standby condition and operated as required in accordance with the *Heavy Water Shutdown Plan* through March 1999. The Moderator Purification Facility continued operations until the inventory on hand was processed. The final removal of heavy water has been completed and the area turned over to the Facility Disposition Program for minimum surveillance and maintenance at the end of fiscal year 1999

Figure 4.8 depicts the projected useful life of the major facilities in D Area. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources would be expended to keep the facilities in operation through their life cycle. As buildings near the end of their useful life, replacement facilities would need to be funded and constructed, and maintenance should be limited to only those items required for the health and safety of the employees.

D-Area Proposed Reconfiguration. Figure 4.9 depicts the projected reconfiguration scenario of D-Area in the year 2020. A narrative of the actions that could take place over the planning period to achieve that reconfiguration follows.

There are no new facilities planned for this area. South Carolina Electric and Gas will operate the co-generation plant in D Area until 2005. After 2005, the renovated H-Area Powerhouse or a suitable substitute, located in the Heavy Industrial Zone would provide steam. All facilities in D Area would transition to FDP. The only activities in D Area would be environmental cleanup and eventual long-term stewardship activities.

Decommissioning of two facilities is planned, dependent on completion of heavy water sale and deinventory (see Table 4.5). These facilities include the Rework Unit, DuPont Water plant, Technical Purification Unit, and the Moderator Processing Facility. Presently, 19 D-Area facilities have been declared inactive. The following excerpt from the site's risk-ranked inactive facilities list identifies inactive facilities or parts of facilities that are candidates for disposition and inclusion on lower level, more detailed, facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

Figure 4.8
Current Configuration and Projected Useful Life of D-Area Major Facilities

Figure 4.9
D-Area Proposed Reconfiguration Scenario in Year 2020

Table 4.5. D-Area Inactive Facilities, May 2000

Building Number	Building Name
403-D	Soil Bioremediation Facility
412-004D	Mask Maintenance Building
412-D	Control Room
420-2D	Moderator Handling and Storage
420-3D	Tritium Effluent Water Monitoring Building
420-D	Concentrator Building
421-2D	Moderator Handling and Storage
421-4D	Drum Storage
421-5D	Loading Dock
421-6D	Heavy Water Equipment Storage
421-D	Finishing Building
480-2D	Maintenance Material Storage
501-D	Emergency Diesel
711-1D	Storage Building
711-D	T&T Office and Storage Building
717-1D	Storage Building
717-D	Shops, Stores and Change House
772-D	Control Laboratory and Supervisor's Office
800-000D	Soils Bioremediation Facility

E Area

E-Area Configuration and Current Use. E Area, which includes the Old Burial Ground, Mixed Waste Management Facility, and E-Area Vaults, receives low-level solid, transuranic (TRU), and mixed waste from all site areas. E-Area facilities are maintained to manage previously received waste and to prepare for the receipt of waste from new site operations. Low-level waste is sorted and segregated, held ready for treatment and disposed in the E-Area Vaults or trenches. Transuranic waste is characterized and made ready for shipment to the Waste Isolation Pilot Plant (WIPP) for ultimate disposal. Mixed waste is stored and will be sorted and segregated to allow waste to be readied for shipment to treatment facilities. E Area occupies approximately 195 acres in the central section of the site between F and H Areas and is primarily comprised of radioactive waste storage and disposal facilities and administrative facilities. About one percent of site employees work in E-Area facilities.

Figure 4.10 depicts the projected useful life of the major facilities in E Area. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources would be expended to keep the facilities in operation through their life cycle. As buildings near the end of their useful life, replacement facilities would need to be funded and constructed, and maintenance should be limited to only those items required for the health and safety of the employees.

E-Area Proposed Reconfiguration. Figure 4.11 depicts the projected reconfiguration scenario of E-Area in the year 2020. In the future, there will be an expansion of the E-Area Vaults, and additional TRU waste storage pads may be required. The Mixed Waste Project upgrades and TRU View Project will be included in existing facilities. The Transuranic Category II (TRU Cat II) facility will process primarily plutonium-238 waste containers by opening, sorting, size-reducing, characterizing, and repackaging the waste to meet WIPP requirements and then sending the waste to WIPP for disposal.

As buildings reach the end of their useful life, employees working in E-Area facilities would use the facilities in B Area or H Area. An analysis of functional requirements would be performed to optimize location of employees currently housed in facilities in that area. Access to the E-Area operations area would be developed from Road 4. When a building becomes vacant, it would transition to FDP. By 2030, all buildings in E Area would be in FDP. By 2070 the entire area would be included in the LTS program.

The only facility on the current list of inactive facilities is shown below in Table 4.6. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

Table 4.6. E-Area Inactive Facilities, May 2000

Building Number	Building Name
643-021E	Emergency Diesel Generator

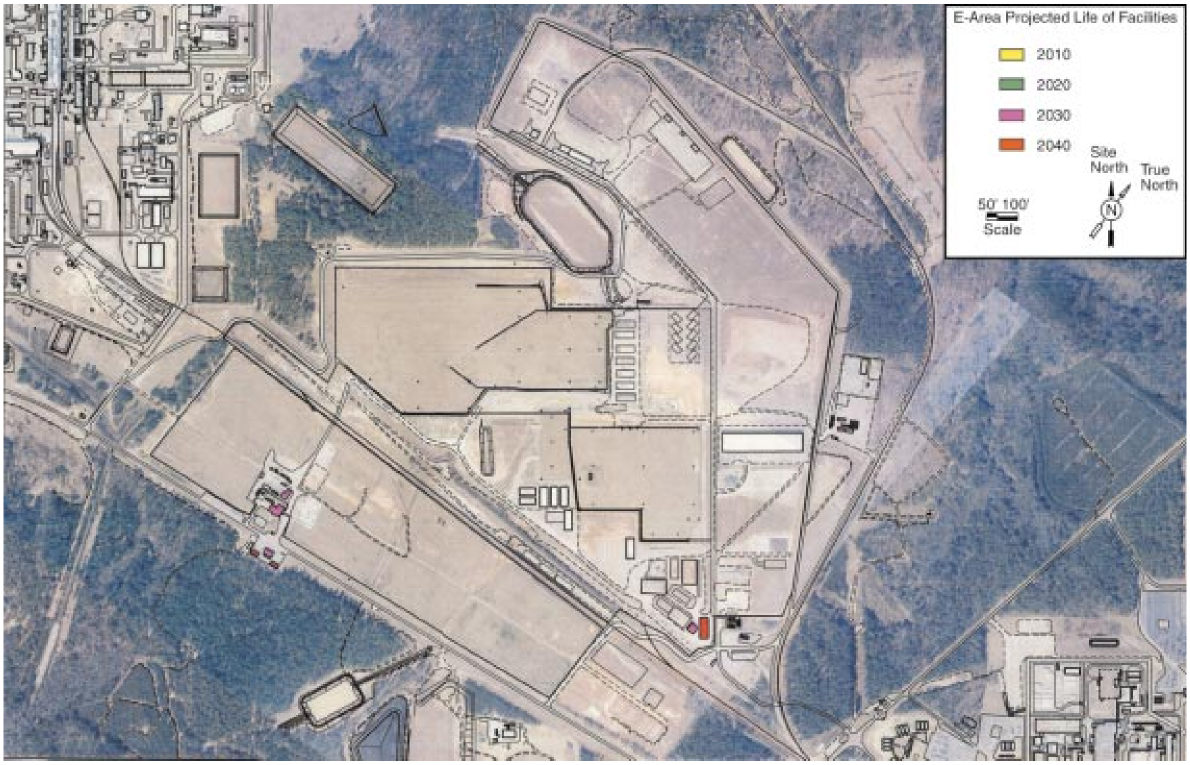


Figure 4.10
Current Configuration and Projected Useful Life of E-Area Major Facilities

Figure 4.11
E-Area Proposed Reconfiguration Scenario in Year 2020

F Area

F-Area Configuration and Current Use. F Area is primarily comprised of heavy nuclear industrial, warehouse, and administrative facilities. F-Area facilities include the F-Canyon Building, Depleted Uranium Processing Facility, FB-Line Facility, Metallurgical Facilities, Naval Fuels Building, Central Analytical Laboratory, the Mock-up/Fabrication Facility, medical facilities, and the F-Area Tank Farm. About 13 percent of site employees work in the F-Area chemical processing, waste management, and medical facilities.

F Area is one of the two areas located near the center of SRS where nuclear chemical separations and waste management operations are performed. The primary function of these facilities is to stabilize special nuclear material from spent fuels, irradiated targets, and other legacy nuclear materials and to evaporate and store the liquid high-level waste generated by these operations.

Chemical separation and purification of these materials is accomplished in facilities known as canyons (see Figure 4.12). The canyons are supported by ancillary facilities that provide further chemical conversion, cold chemical feeds, or general facility services. F-Area Canyon and H-Area Canyon are the only two nuclear chemical processing and separations facilities in the DOE Complex. DOE plans to phase out its reprocessing capabilities and the use of the canyons but must balance this closure with the need to stabilize fissile materials. Implementation of the 1992 decision by the Secretary of Energy to phase out canyon operations at SRS is proceeding. However, the canyons are being used for safety reasons on a limited basis to stabilize certain deteriorating spent nuclear fuel, plutonium compounds, and other nuclear materials to forms that are suitable for safe and secure, long-term storage or disposition. After the F Canyon processing commitments are completed, F Canyon will be deactivated and enter the Facilities Disposition Program and eventually the Long Term Stewardship Program.

High level liquid waste evaporation and storage in accomplished in the F-Tank Farm. This facility consists of the 2F Evaporator, 20 underground waste storage tanks, and associated ancillary support systems and structures.

The former Naval Fuels facility in F Area has been deactivated and is safely maintained in a low cost surveillance and maintenance mode, awaiting final disposition. Management of the facility is in accordance with its auditable safety analysis.

Figure 4.13 depicts the projected useful life of the major facilities in F Area. Based upon these projections, individual

Figure 4.12
F-Area Canyon Building is the large building in the center of this photograph.

building maintenance plans should be developed to determine the extent to which resources would be expended to keep the facilities in operation through their life cycle. As buildings near the end of their useful life, replacement facilities would need to be funded and constructed, and maintenance should be limited to only those items required for the health and safety of the employees.

F-Area Proposed Reconfiguration. Figure 4.14 depicts the projected reconfiguration scenario of F-Area in the year 2020. In reconfiguration, the focus in F Area over the next 20 years would be to transition F Area from its current mission of high level waste storage and nuclear processing in the canyons to an active plutonium stabilization complex. As nuclear materials stabilization missions are completed, the canyon and ancillary facilities may be phased out and declared inactive by 2010. The facilities at that time would transition into FDP, but the maintenance activities in those facilities will remain high due to environmental concerns.

Three new plutonium mission facilities will be constructed in F Area. Security around the new plutonium facilities will increase, commensurate with the requirements to protect these operations. DOE has decided to use a hybrid approach for the safe and secure disposition of up to 50 metric tons of surplus plutonium using both immobilization and mixed oxide fuel technologies in new facilities at SRS. One facility is the Pit Disassembly and Conversion Facility, which will convert plutonium

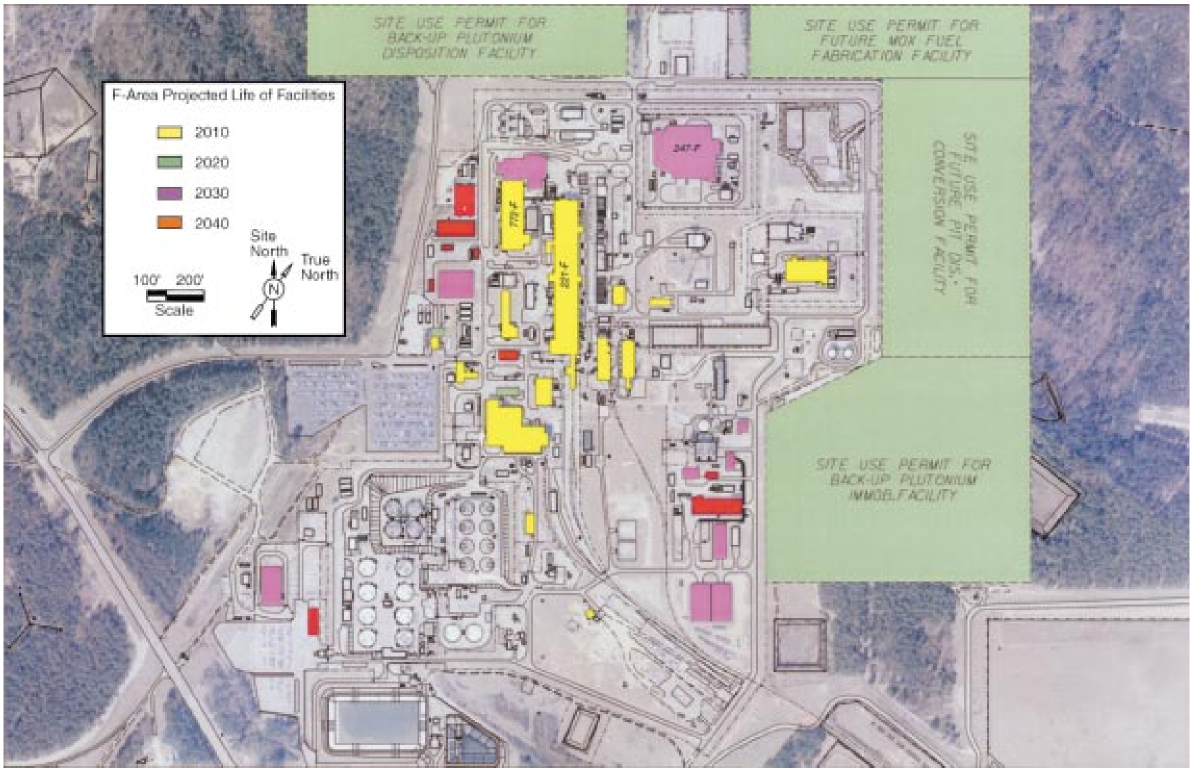


Figure 4.13
Current Configuration and Projected Useful Life of F-Area Major Facilities

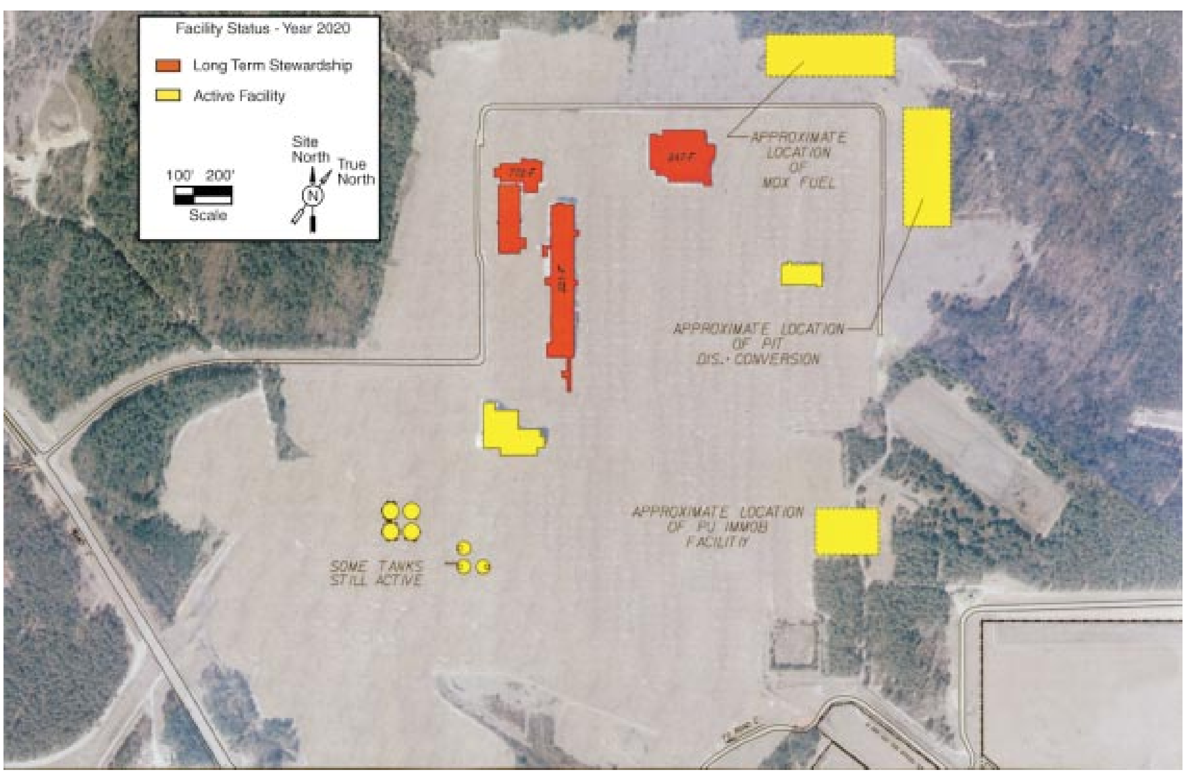


Figure 4.14
F-Area Proposed Reconfiguration Scenario in Year 2020

metal into plutonium dioxide for further processing in either the Plutonium Immobilization Facility or the MOX Fuel Fabrication Facility. Another facility to be built is the Immobilization Facility, which will process the plutonium into a ceramic matrix, load the material into small stainless steel cans which will be placed in stainless steel canisters, and send the canisters to the Defense Waste Processing Facility (DWPF). After DWPF receives the cans-in-canisters, the canisters will then be filled with molten borosilicate glass containing high-level waste, in preparation for shipment to a permanent geologic repository. The third facility is the MOX Fuel Fabrication Facility, which will blend uranium dioxide and plutonium dioxide, form the mixture into pellets, and load the pellets into empty fuel rods for use in commercial nuclear power plants. The mission of these plutonium facilities will continue until 2020.

A new plutonium stabilization and packaging capability will be established in the existing 235-F building to stabilize and repackage plutonium to meet DOE's long-term storage standard. Reusing 235-F is a more cost-effective alternative to building a new building.

A Uranium Storage Facility has also been proposed to safely store over 50 million pounds of depleted uranium trioxide powder (DUO), pending the final disposition. This low-hazard material is currently stored at SRS in approximately 36,000 drums in F, N, and R Areas. These facilities are, in some cases, deteriorating severely and require upgrading simply to keep the already-rusted and dented drums dry. Although this is a low-hazard material, failure to improve storage conditions could increase risk of injury to handlers or release to the environment. This facility and the containers would meet commercial standards and regulatory requirements for use of material handling and drum inspection. The facility will also provide repackaging and decontamination capabilities. However, the cost to construct this facility (not including the significant cost to transfer the DUO from the current facilities into the new building) is commensurate with the cost to dispose this material at a federal disposal site such as the Nevada Test Site. Unless a future need is defined, it is more cost effective to dispose of this material rather than construct a new facility. A possible use has been identified in the use of the DUO as a shielding component for constructing above-ground storage units (casks) to store the DWPF glass canisters after the current storage building is full, in lieu of constructing a new storage building.

New facilities for SRTC may be constructed in F or H Area to be near the missions that SRTC supports and to share the additional security provided for the plutonium facilities. Combination of the capabilities of SRTC laboratories and central laboratory facilities (CLAB) will be evaluated for consolidation in the reconfiguration concept.

The Infrastructure and Reconfiguration Restoration Line Item includes a proposed project, the Central Laboratory Safety, Environmental, and Productivity Restoration Project. Improvements to the CLAB will be analyzed in concert with the SRTC reconfiguration activities to maximize laboratory function and operation prior to implementation of the CLAB upgrades. If cost-benefit studies demonstrate that upgrades at the existing CLAB facilities are required, this project would provide for the replacement of obsolete infrastructure systems and related equipment. These improvements would ensure proper control of nuclear process ventilation systems, renovation of highly contaminated labs to reduce the operating risks to facility personnel, and renovation of facility systems for installation of large contained analytical instruments to improve operational efficiency in the laboratory. Another project planned for CLAB is the Restoration of CLAB Radioactive Liquid Waste Collection Systems Project. This project would provide for the renovation of the radioactive liquid waste collection system in the laboratory. The collection/hold/transfer tanks in 772-F are over forty years old and of original site construction. Upgrades are required in 772-F and 772-1F to reduce operating risks to facility personnel, replace obsolete infrastructure equipment, improve handling, and improve operational efficiency in the facility. Alternatives for upgrading and or replacing the waste collection system will be evaluated based on cost-benefit analysis and plant efficiencies. In addition, this project will be coordinated with the potential plans for a future independent waste handling project for F Area that will allow the continuation of liquid waste handling activities in the 211-F Facility if the F-Canyon Building is deactivated and shutdown.

The Naval Fuels facility has presently been placed in the facility disposition process. However, the building still has over 30 years of useful life and may be considered for beneficial reuse, if possible.

As the high-level waste (HLW) is removed from the HLW tanks in F-Area Tank Farm, the tanks will be closed. The current method of tank closure is described in the *SRS High-Level Waste Tank Closure Environmental Impact Statement* (DOE/EIS-0303). By the end of 2022, all the tanks, the 2F Evaporator, and all ancillary facilities will be closed and transferred to LTS, under the current plans.

Presently, 22 F-Area facilities have been declared inactive. Table 4.7 is an excerpt from the site's list of inactive facilities and identifies inactive facilities or parts of facilities that are candidates for disposition and inclusion on lower level, more detailed facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

Table 4.7. F-Area Inactive Facilities, May 2000

Building Number	Building Name
211-4F	Sampling House
235-F	Actinide Billet Line
235-F	PEFF
235-F	PuFF
235-F	Old Met Lab
242-3F	CTS Pit (IF Evaporator)
242-F	1F HLW Evaporator
247- 10F	Process Waste Building
247-11F	Outside Process Control Room
247-12F	Outside Cold Feed Storage
247-1F	Diesel Generator
247-41F	Outside Storage Building
247-42F	Outside Storage Building
247-4F	Ground Cooling Tower
247-7F	EC Process Tower
247-8F	Compressed Gas Storage
247-F	Naval Fuels Manufacturing Building
254-2F	Diesel Generator Facility
284-F	Power House
607-001F	Sewage Treatment Plant/Digester
607-29F	Naval Fuel Pump Station for Wastewater Treatment

G Area

G-Area Configuration and Current Use. G Area is the area outside of site process areas, encompassing over 95 percent of the site. This area includes USFS-SR facilities, a rail network, Research Set-Aside Areas supporting the National Environmental Research Park (NERP), environmental monitoring activities, and facilities to support sub-contractors. The developed portions of G Area primarily are comprised of light industrial, warehouse, and administrative facilities. Approximately 1 percent of the site's workforce is located in G-Area facilities.

Figure 4.15 depicts the projected useful life of the major facilities for USFS-SR. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources would be expended to keep the facilities in operation through their life cycle. As buildings near the end of their useful life, replacement facilities would need to be funded and constructed, and maintenance should be limited to only those items required for the health and safety of the employees.

G-Area Proposed Reconfiguration. Figure 4.16 depicts the projected reconfiguration scenario, by the year 2020, of the area where the Forest Service-Savannah River is presently located.

There are no new major facilities planned for G Area. Under the proposed reconfiguration, the USFS-SR administrative and educational program functions would be located to new facilities in B Area. In addition to the facilities in B Area, the Forest Service will also maintain strategically placed fire protection equipment and maintenance materials and equipment elsewhere around the site.

The USFS-SR buildings currently located in G Area would transition to the FDP. Presently, four G-Area facilities have been declared inactive (see Table 4.8). The following excerpt from the site's inactive facilities list identifies inactive facilities or

Table 4.8. G-Area Inactive Facilities, May 2000

Building Number	Building Name
628-003G	Propane Gas Tank
681-001G	Up-Stream Pump House for 100 Areas
904-108G	Change House for Contaminated Equipment Workshop
904-108G	Trebler Sampler Pit No. 3

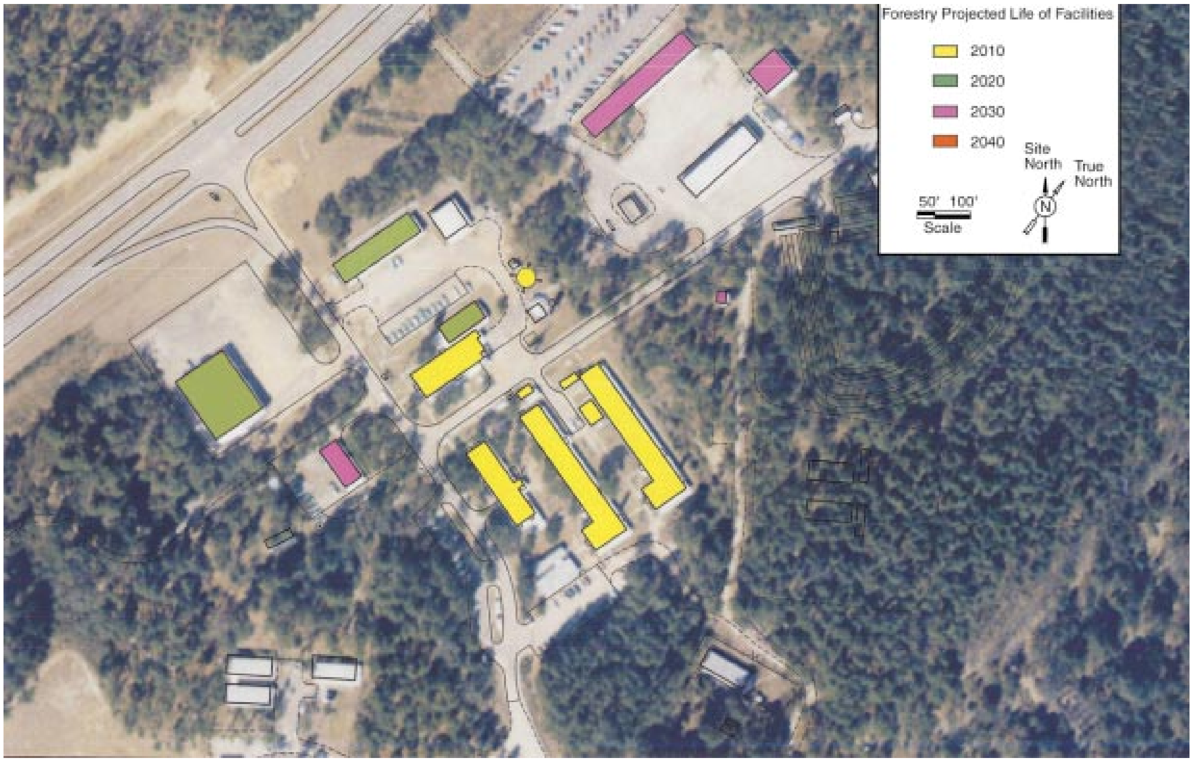


Figure 4.15
Current Configuration and Future Projected Useful Life of Forest Service-Savannah River Major Facilities

Figure 4.16
Proposed Reconfiguration Scenario of U.S. Forest Service Savannah River in Year 2020

parts of facilities that are candidates for disposition and inclusion on lower level, more detailed, facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

H Area

H-Area Configuration and Current Use. Approximately 21 percent of site employees work in H-Area facilities. H Area is the second of the two nuclear chemical separation areas at SRS. H-Area facilities are used to stabilize nuclear material, safely store and pre-treat radioactive liquid waste, and process recycled tritium. Stabilization is accomplished in facilities known as canyons. Ancillary facilities supporting the canyons provide bulk chemical storage, liquid waste disposal, and nuclear material storage.

H-Area Canyon began operations in July 1955 as a Plutonium/Uranium Extraction Facility to recover enriched uranium from spent uranium fuels. The canyon was modified in 1963 to recover neptunium as well as enriched uranium. H-Area Canyon, like F-Area Canyon, is one of two chemical processing and separations facilities unique to the DOE Complex. DOE plans to phase out its reprocessing capabilities and use of the canyons but must balance this closure with the need to stabilize fissile materials. Implementation of the 1992 decision by the Secretary of Energy to phase out canyon operations at SRS is proceeding with the use of the canyons limited to stabilizing certain deteriorating spent nuclear fuel, plutonium compounds, and other nuclear materials to forms suitable for safe and secure, long-term storage or disposition. After the H-Area Canyon processing commitments are completed, H-Area Canyon will be deactivated and enter the Facility Disposition Program.

From 1992 to 1997, H-Area Canyon was maintained in a standby state while DOE evaluated alternatives for the stabilization of aluminum-clad, highly enriched spent nuclear fuel remaining from earlier operations. The H-Area Canyon was restarted to stabilize corroding spent fuel. Phase II of this restart, which includes restarting the HB-Line, has been initiated. The current missions of the H-Area Canyon include dissolution of Mark-16/22 and other spent nuclear fuel , dissolution of plutonium and enriched uranium residues, conversion of plutonium-239 and neptium-237 to oxide, and blend down of highly enriched uranium to five percent enrichment to support the Tennessee Valley Authority program for commercial power reactor fuel. This blend-down will begin until 2003.

H Area also houses the Receiving Basin for Offsite Fuels (RBOF) which, along with the disassembly basins in K and L Areas, plays a crucial role in the DOE spent nuclear fuel mission. Current activities include all programmatic and physical support efforts related to safe storage of spent nuclear fuel in RBOF. These activities help manage the wet basin storage of spent nuclear fuel inventories to allow receipt of shipments and provide safe storage until a new treatment and dry storage facility is available. RBOF maintains a deionizer resin regeneration facility to support basin operations. Surveillance and maintenance activities will continue since the area contains radioactively contaminated facilities. RBOF will be used to receive fuel only in special casks that cannot be handled in L-Basin and will begin deactivation in 2008 if all inventory has been processed.

High-level liquid radioactive waste is stored, evaporated, and pretreated for vitrification in the H-Area HLW facilities. HLW in H Area is stored in 29 underground waste tanks, which are continuously monitored to ensure safety and protection of the environment. Two waste evaporators (2H and 3H) are used to evaporate waste and thus minimize the storage requirements. In addition, sludge waste pre-treatment consisting of aluminum dissolution and sludge washing is also accomplished in the H-Area HLW facilities. This pretreatment process prepares the sludge waste for transfer to DWPF where it is vitrified.

Also located in H Area are the tritium facilities. These facilities are designed and operated to process tritium, the radioactive form of hydrogen gas that is a vital component of nuclear weapons. Tritium is recycled from existing weapons reservoirs. All tritium recycling is conducted within these facilities. The tritium facilities consist of four main process buildings. Three of these, Buildings 232-H, 234-H, and 238-H, are part of the original facility construction. These buildings still house a number of key operations, including reclamation of previously used tritium reservoirs, receipt, packaging, and shipping of reservoirs, recycling and enrichment of tritium gas and several important laboratories and maintenance shops. The reservoir loading facility, Building 233-H, became operational in 1994. Operations in this one-acre underground facility include unloading gases from old reservoirs received from the Department of Defense, separating useful hydrogen isotopes (tritium and deuterium), purifying these hydrogen isotopes, and mixing these gases to exact specifications for re-loading into reservoirs. The reservoirs are then returned to the Department of Defense for use in the nation's nuclear weapons stockpile.

The Consolidated Incineration Facility (CIF), also located in H Area, was designed and constructed to thermally treat and reduce the volume of low-level hazardous and mixed wastes. The process virtually eliminates the waste's chemical toxicity, converts the residue ash to an environmentally friendly form, and reduces or eliminates offsite shipments of incinerable wastes. CIF can incinerate a variety of SRS-generated wastes including oils, paint solids, solvents, rags, organic wastes, miscellaneous waste sludges, and protective clothing.

Currently, the site has determined that the cost of treating wastes in the CIF is too high for the volume of waste; and therefore, the site is suspending operations at CIF. One reason for the high costs is that the benzene waste stream from the In-Tank Precipitation process, which was planned to dilute the PUREX and be co-disposed during incineration, has not materialized as was originally planned. Commercial treatment of PUREX is available at a lower cost than purchasing fuel to dilute the PUREX and incinerating it in the CIF. With plans to restart CIF in fiscal year 2006, Site Treatment Plan commitments can still be met while there is sufficient time to evaluate other cost-effective initiatives and technologies. To restart this facility, a new permit application will be needed. During this suspension of operations, the facility will be cleaned out to levels that protect human health and the environment as described in the approved *Suspension Plan* and applicable environmental regulatory permits.

The Effluent Treatment Facility (ETF) collects and treats low-level radioactively and chemically contaminated wastewater from the High-Level Waste Program and the Nuclear Materials Management Program by removing chemical and radioactive contaminants before discharging the water. The facility also receives and treats scavenger wastewater from various generators, such as groundwater monitoring samples from the Environmental Restoration Program and CIF operations. The treatment process separates influent wastewater into two streams, the high-volume "treated effluent," which is released to the environment, and low-volume "waste concentrate."

The ETF treatment process decontaminates wastewater through micro-filtration, ion exchange, reverse osmosis, and organic removal through carbon beds. The process effluent is stored in treated water tanks for sampling and analysis prior to release through a National Pollution Discharge Elimination System (NPDES) permitted outfall. The waste concentrate is transferred to Tank 50 in H Area for storage before eventual disposal in the Saltstone Facility.

Other H-Area facilities include medical, warehouse, and training facilities. H-Area warehouse facilities provide material coordination, acquisition, and processing for numerous SRS operations, and their condition varies from poor to good. Most H-Area operating facilities are 24-hour operations.

Figure 4.17 depicts the projected useful life of the major facilities in H Area. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources could be expended to keep the facilities in operation through their life cycle. As buildings near the end of their useful life, replacement facilities would need to be funded and constructed, and maintenance should be limited to only those items required for the health and safety of the employees.

H-Area Proposed Reconfiguration. Figure 4.18 depicts the projected reconfiguration scenario of H-Area in the year 2020. The focus of H-Area future activities will concentrate on continued Tritium operations, evaporation, storage, and pretreatment of HLW, and closure of the High Level Waste Tanks, and could include the operations of the Savannah River Technology Center. In fiscal year 2000, construction began on a Tritium Extraction Facility (TEF) in the area adjacent to Building 233-H. The TEF will include three major structures: the Remote Handling Area, Tritium Processing Area, and the Administrative Support Building. It will be an integral part of the Commercial Light Water Reactor (CLWR) option for production of tritium. Approval to begin operations is scheduled for fiscal year 2006. The TEF will safely and efficiently extract tritium-containing gases from Tritium Producing Burnable Absorber Rods irradiated in a commercial reactor. The gases will be delivered to the SRS Reservoir Loading Facility (233-H) for purification and eventual use in meeting nuclear weapons stockpile requirements.

Another potential facility to support the reservoir surveillance mission is currently under consideration by DOE-HQ. Funding for the Conceptual Design Report for a Reservoir Surveillance and Support Facility has been requested. The facility will provide reservoir function testing capacity and a tritium effects laboratory. The exact location and timing has not been fully determined.

As nuclear materials stabilization missions are completed, the canyon and ancillary facilities will be phased out and closed. However, the H canyon will remain operational until alternative treatment and storage options for disposition of spent nuclear fuel are demonstrated. By 2010, these buildings should transition to the FDP for ultimate inclusion in the Long

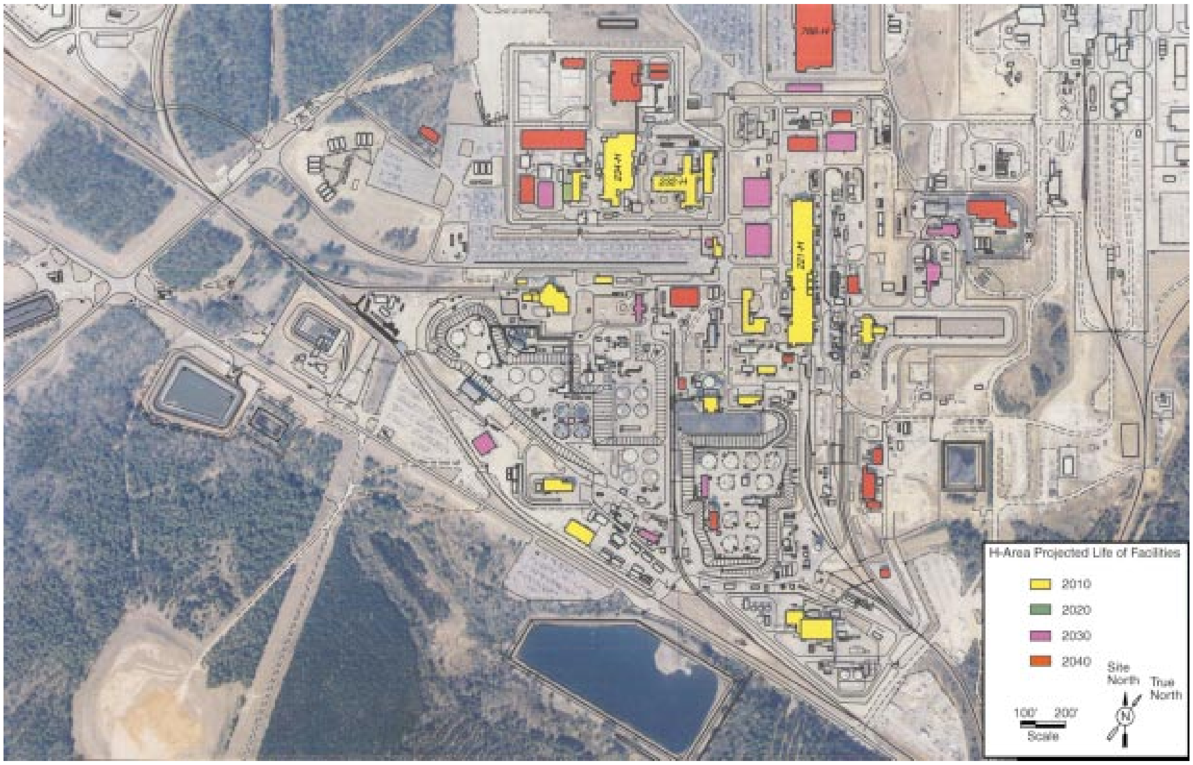


Figure 4.17
Current Configuration and Projected Useful Life of H-Area Major Facilities

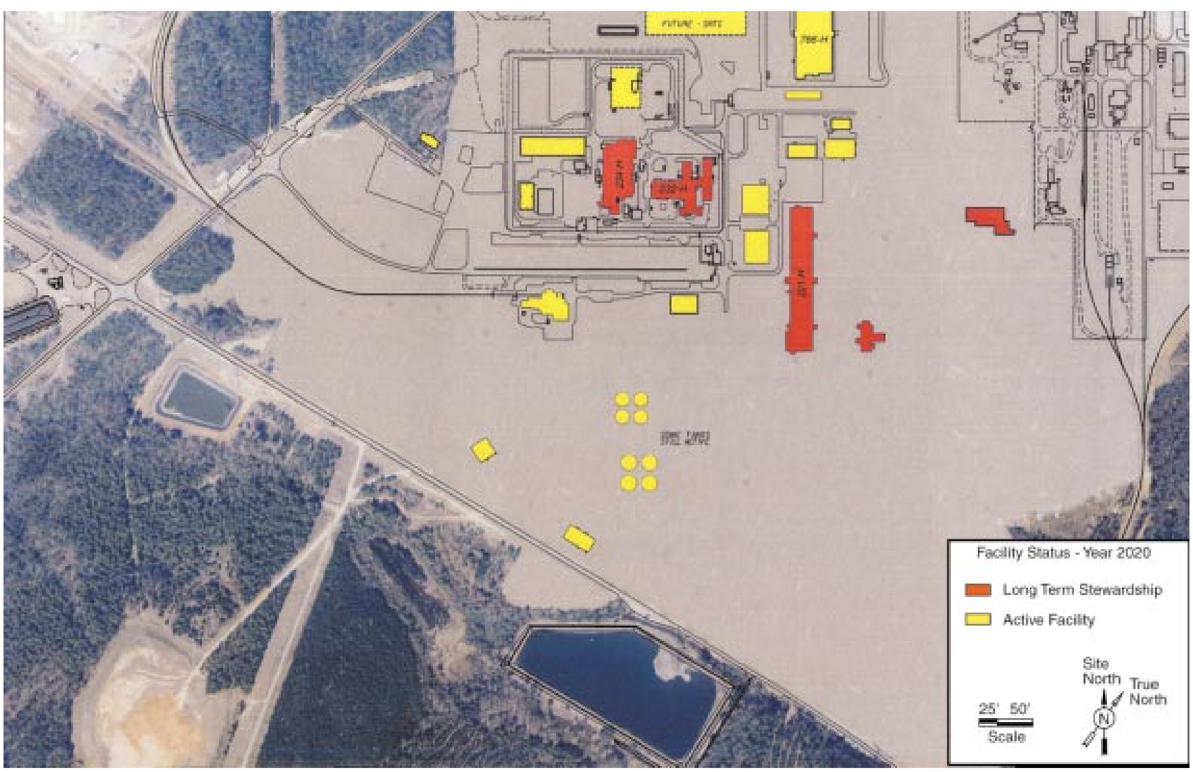


Figure 4.18
H-Area Proposed Reconfiguration Scenario in Year 2020

Term Stewardship Program. In the proposed reconfiguration, by 2010 new facilities may be constructed in F or H Area to house the SRTC laboratory and administrative functions. This construction would include chemical laboratories, office space, and industrial laboratories that support the tritium mission and plutonium missions. Development of new SRTC facilities should include consolidation options with CLAB to streamline site analytical capabilities.

As the HLW is removed from the tanks in the H-Area Tank Farm, the tanks will be closed. The current method of tank closure is described in the *SRS High-Level Waste Tank Closure Environmental Impact Statement* (DOE/EIS-0303). By the end of 2025, all of the tanks, evaporators, and all ancillary HLW facilities, including those required to pre-treat the sludge waste, should be closed and transferred to LTS.

The option of converting the H-Area Training Facility (766-H) to office space to consolidate H, E, and S Area personnel may be evaluated. If studies demonstrate the feasibility of this proposal, site personnel presently located in deteriorating office trailers could be consolidated in the converted office building. The training functions currently located in H Area would be relocated to a new training facility in B Area in the administrative complex. Movement of the training function to B Area would reduce the risk to workers in training, facilitate evacuation in the event of an accident, and improve security in the industrial area.

The H-Area Powerhouse could be upgraded to become the primary site steam generation plant by 2005. In that case, steam operations currently provided by D Area, would transition to H Area to provide a centralized steam source for the Heavy Industrial Zone and to reduce the steam line infrastructure to save operational costs. Design of new facilities would include an evaluation of the most efficient method of heating and cooling to optimize steam use.

Presently, 10 H-Area facilities have been declared inactive. Table 4.9, taken from the site's inactive facilities list, identifies inactive facilities or parts of facilities that are candidates for disposition and inclusion on lower level, more detailed, facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

Table 4.9. H-Area Inactive Facilities, May 2000

Building Number	Building Name
221-H	Old HB-Line
230-H	Beta Gamma Incinerator
234-3H	Hold Volume Enclosure
241-916H	Oxalic Acid Addition Facility
242-003H	Old CTS H Area
242-018H	CTS H Area
242-H	1H HLW Evaporator
254-43H	Secondary Transformer for 230-H
254-6H	Diesel Emergency Generator for 230-H
285-3H	Cooling Tower #2

K Area

K Area Configuration and Current Use. K Area is one of five SRS reactor areas with the original mission of producing material for the Department of Defense nuclear weapons program. K Reactor is similar in size and layout to the other reactor areas. The K-Area production reactor is in shutdown condition with no capability of restart. However, the K-Area Disassembly Basin, along with the L-Area Disassembly Basin and RBOF in H Area, currently play a crucial role in DOE's Spent Nuclear Fuel (SNF) mission. Irradiated fuel assemblies have been stored in the disassembly basins since discharge from the reactors. K Area also serves to temporarily receive and store plutonium, highly enriched uranium fuel, and large amounts of tritiated heavy water consolidated from other facilities. K Area is primarily comprised of heavy nuclear industrial, administrative, safeguards and security, and some warehouse facilities. Less than 3 percent of site employees work in the K Area.

Current K-Area activities include all programmatic and physical support efforts related to safe storage of SNF, shipments of irradiated and unirradiated fuel to the canyons, and the stabilization required to maintain the area. These activities help manage the wet basin storage of SNF inventories provide safe storage until K Basin deinventory has been completed. Surveillance and maintenance activities will continue in K Area because the area contains radioactively contaminated facilities. Several activities must be performed to ensure that the area and associated facilities continue to pose minimal risk to the environment, site workers, and the general public.

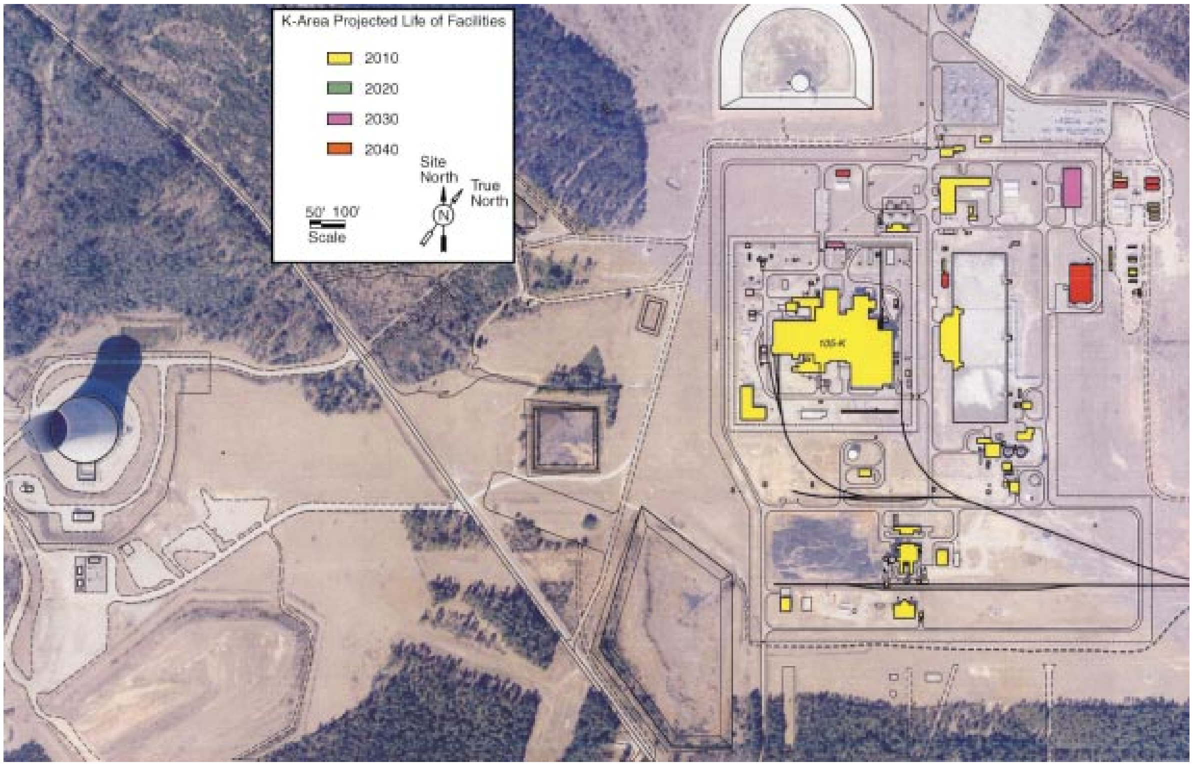


Figure 4.19
Current Configuration and Projected Useful Life of K-Area Major Facilities

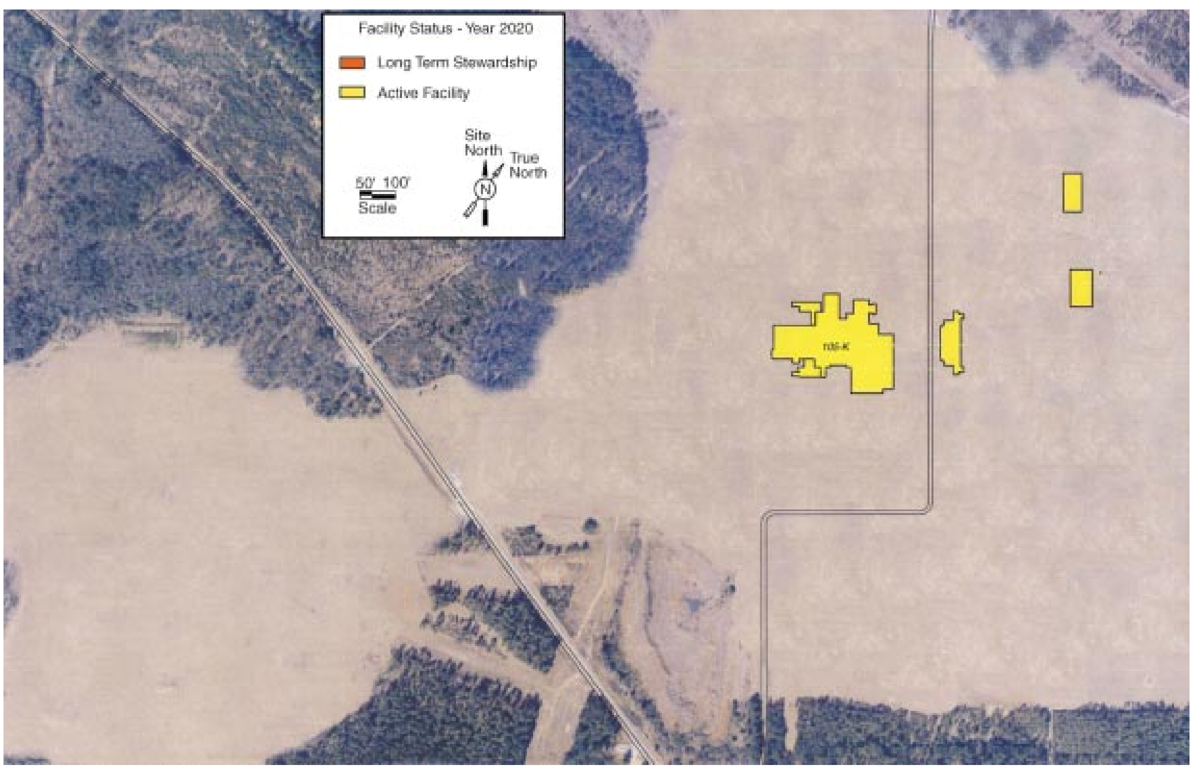


Figure 4.20
K-Area Proposed Reconfiguration Scenario in Year 2020

Figure 4.19 depicts the projected useful life of the major facilities in K Area. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources could be expended to keep the facilities in operation through their life cycle. As buildings near the end of their useful life, replacement facilities would need to be funded and constructed, and maintenance should be limited to only those items required for the health and safety of the employees.

K-Area Proposed Reconfiguration. Figure 4.20 depicts the projected reconfiguration scenario of K Area in the year 2020. Modifications have been completed to allow receipt and storage of plutonium from the Rocky Flats Environmental Technology Site (RFETS). The modifications facilitate the early deinventory and shutdown of the RFETS to avoid an estimated $1.3 billion in operating costs. The storage or receipts from Rocky Flats will occupy a large area within the 105-K Building, including the building's reconfigured reactor room and several adjacent areas. These areas include the Crane Wash Area, Crane Maintenance Area, and Stack Area. All plutonium will be stored in the containers in which they are received. No containers will be opened in the 105-K Building. Instead, containers that must be opened will be shipped to F Area for this purpose. The facility is currently designed to store up to 3000 containers. Containers will be stored for an extended time in 105-K Building. This material will either go to the MOX Facility or the Plutonium Immobilization Facility in F Area.

Presently, ten K-Area facilities have been declared inactive; however, in the reconfiguration scenario, all buildings in K Area will be placed on the inactive list by 2020, except the newer buildings. These buildings include the Administrative Office Facility (705-K) and the Video Safeguards Maintenance Facility (717-K). These buildings could remain active as administrative facilities until 2030, by which time they would be vacated and transition to the FDD program. The K Reactor and associated facilities are designated for eventual inclusion in the LTS program.

Table 4.10 contains an excerpt from the site's inactive facilities list and identifies inactive facilities or parts of facilities that are candidates for disposition and inclusion on lower level, more detailed, facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

Table 4.10. K-Area Inactive Facilities, May 2000

Building Number	Building Name
108-4K	Emergency Diesel Generator and Fuel Oil Storage
110-K	Helium Storage Tank
185-1K	Chlorinator House
185-3K	Cooling Tower
185-K	Cooling Tower (Power House)
186-1K	Sodium Hypochlorite Tank Storage
190-K	Cooling Water Pump House
191-K	Standby Pumphouse
614-2K	Effluent Monitoring Building
701-1K	Area Gatehouse and Patrol HQ

L Area

L-Area Configuration and Current Use. L Area is one of five SRS reactor areas with the original mission of producing material for the Department of Defense nuclear weapons program. The area is similar in size and layout to the other reactor areas. The L-Area production reactor is in shutdown condition with no capability of restart. However, the L-Area Disassembly Basin, along with the K-Area Disassembly Basin and RBOF in H Area, currently play a crucial role in DOE's SNF mission. Irradiated fuel assemblies have been stored in the disassembly basins since discharge from the reactors. Additional SNF is being, and will be, received and stored at SRS from offsite domestic and foreign research reactors, with offsite SNF receipts projected through the year 2035. L Area also provided space for consolidation of the D-Area Heavy Water. L Area is primarily comprised of heavy nuclear industrial, administrative, safeguards and security, and some warehouse facilities. Less than one percent of site employees work in L Area.

Current L-Area activities include programmatic and physical support efforts related to safe storage of SNF, shipments of irradiated fuel to the canyons to complete the basin deinventory, future stabilization of SNF, and heavy water storage. SNF activities help manage the wet basin storage of SNF inventories to allow receipt of projected shipments and pro-

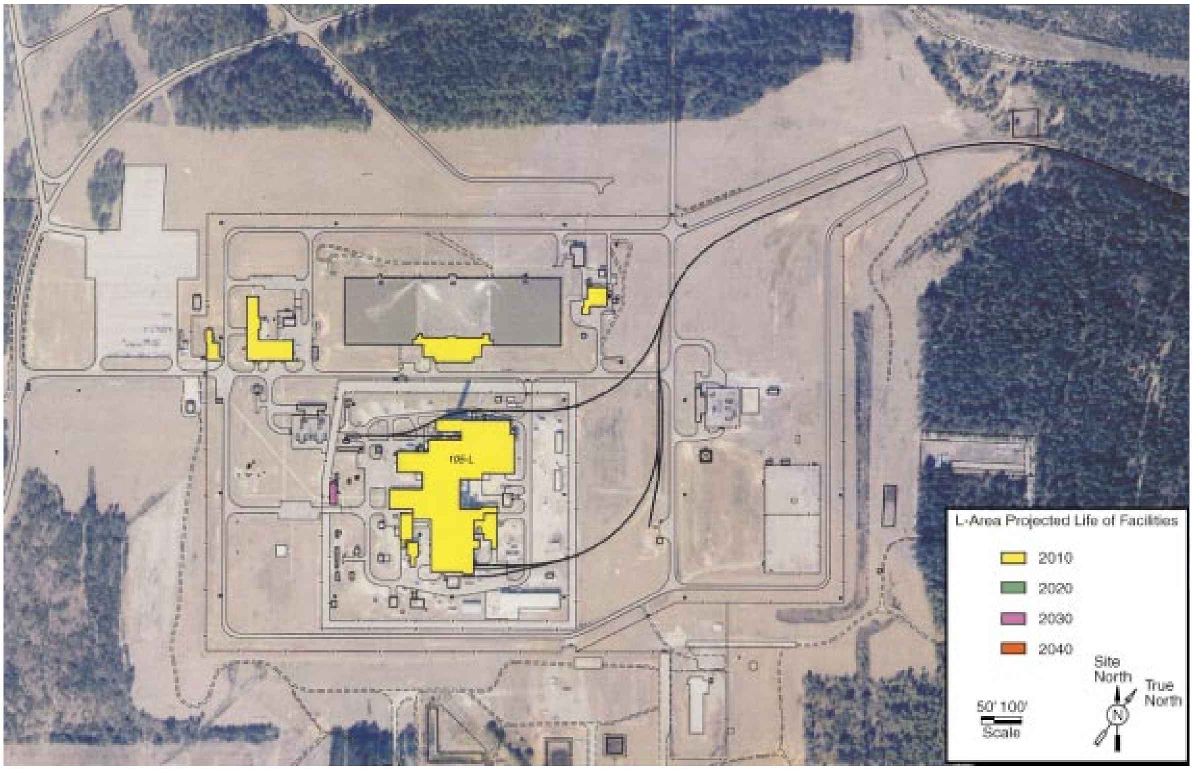


Figure 4.21
Current Configuration and Projected Useful Life of L-Area Major Facilities

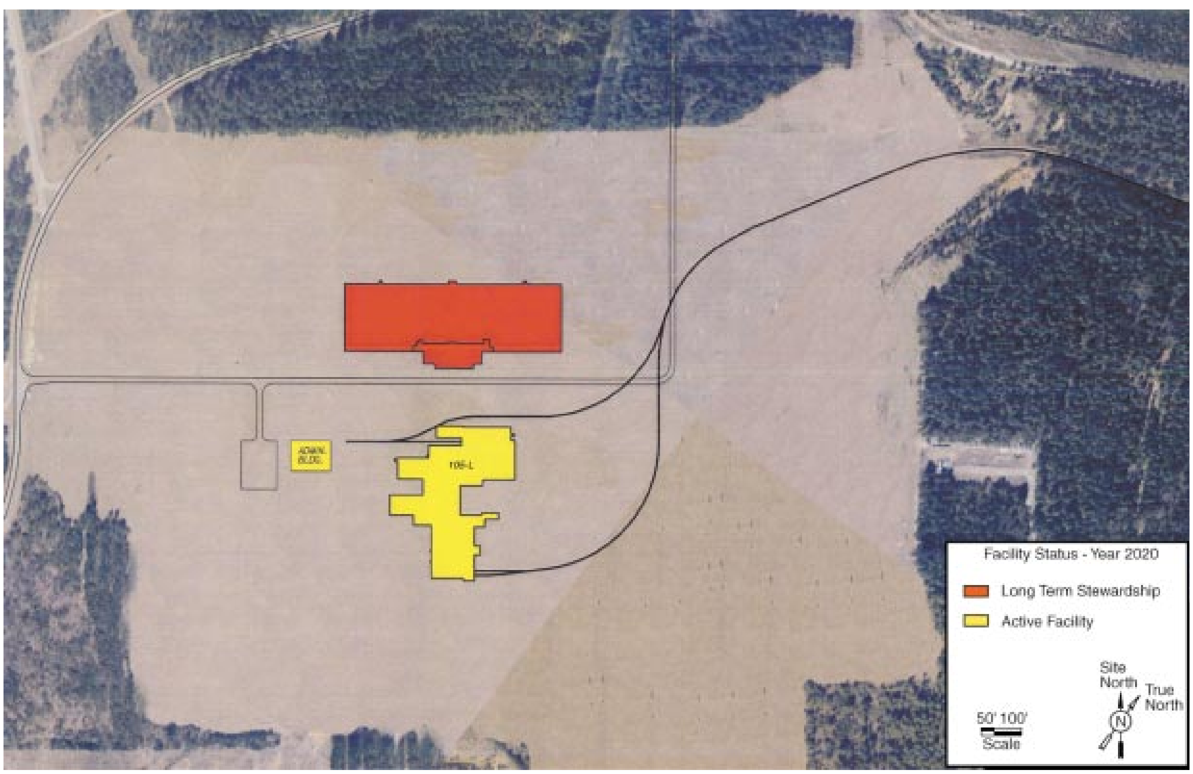


Figure 4.22
L-Area Proposed Reconfiguration Scenario in Year 2020

vide safe storage until a new treatment and dry storage facility is available. Surveillance and maintenance activities will continue as long as the area contains radioactively contaminated facilities. Activities must be performed to ensure the area and associated facilities continue to pose acceptable risk to the environment, site workers, and the general public

Figure 4.21 depicts the projected useful life of the major facilities in L Area. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources would be expended to keep the facilities in operation through their life cycle. As buildings near the end of their useful life, replacement facilities would need to be funded and constructed, and maintenance should be limited to only those items required for the health and safety of the employees.

L-Area Proposed Reconfiguration. Figure 4.22 depicts the projected reconfiguration scenario of L Area in the year 2020.

SRS has proposed construction of a treatment and storage facility for the preparation of aluminum-clad SNF for disposition in a geologic repository in L Area. This Treatment and Storage Facility (TSF) will be located in and adjacent to the existing 105-L Building and will be used to prepare the SNF inventories not scheduled for stabilization processing in canyon facilities. The proposed TSF would include remote handling and existing heavy lifting (cask handling) capabilities and newly constructed outdoor modular dry storage space for SNF assemblies. The TSF will prepare the SNF for interim dry storage in a "road ready" form for shipping and ultimate disposal in a Nuclear Regulatory Commission (NRC) licensed geologic repository. The TSF is anticipated to be on-line by fiscal year 2007, based on completion of the development of the melt-and-dilute technology for SNF disposition.

Once built, the TSF will operate until all spent fuel inventories have been prepared for final disposition in 2037. L-Area facilities that are required to support the TSF will be identified as the design is finalized.

Presently, eight L-Area facilities have been declared inactive; however, all buildings in L Area will be vacated and transition to the FDD program by 2038. The L Reactor and associated facilities are designated for eventual inclusion in the LTS program. Table 4.11 contains an excerpt from the site's inactive facilities list and identifies inactive facilities or parts of facilities that are candidates for disposition and inclusion on lower level, more detailed, facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

Table 4.11 L-Area Inactive Facilities, May 2000

Building Number	Building Name
110-L	Helium Storage Tanks
186-001L	Sodium Hypochlorite Addition
190-L	Cooling Water Pumphouse
191-L	Booster Pump Building
614-2L	Effluent Monitoring Building
701-1L	Area Gatehouse and Patrol HQ
709-1L	Fire Truck Shed
723-3L	Change Building

M Area

M-Area Configuration and Current Use. M Area formerly produced nuclear fuel and targets for use in the production reactors. Due to changes in the missions of SRS, many of the M Area facilities are not being used for their originally intended purpose. The area is composed of three large fuel and target facilities, two laboratories, a wastewater treatment facility, and a low-level waste vitrification facility used to treat waste sludge from M-Area processes. M Area housed materials fabrication facilities to support reactor operations, similar to structures found in non-nuclear metal and finishing operations, and produced special fuel assemblies containing targets for the production of special nuclear materials. Residual contamination exists in most of these facilities, a legacy of past operations. Both laboratories have been deactivated, and the fuel fabrication facility deactivation is scheduled for completion in 2001. Deactivation of the wastewater treatment and the low-level waste vitrification facility will be undertaken in 2001, with the deactivation of the last major contaminated facility to follow in 2002. Approximately one percent of site employees work in M-Area facilities.

Figure 4.1 depicts the projected useful life of the major facilities in M Area. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources should be expended to keep the facilities in operation through their life cycle. Maintenance in M Area should be limited to only those items required for the health and safety of the employees.

M-Area Proposed Reconfiguration. Figure 4.2 depicts the projected reconfiguration scenario of M Area in the year 2020. There are no new facilities currently planned for this area. The focus for M Area in the proposed reconfiguration is to achieve shut down by 2020. In the reconfiguration scenario, M Area administrative functions would be relocated to B Area; and warehouse, maintenance, and vehicular support functions would be relocated to N Area.

Deactivation of the 320-M Chemical Laboratory, the 322-M Metallurgical Laboratory, and the 321-M Fuel Fabrication Facility is scheduled for completion by 2001. A total of 12 M-Area facilities have been declared inactive. The entire M Area will be included in the LTS program.

Table 4.12 identifies inactive facilities or parts of facilities that are candidates for disposition and inclusion on lower level, more detailed facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

Table 4.12. M-Area Inactive Facilities, May 2000

Building Number	Building Name
313-4M	Stack for 313-M
313-M	Slug Fabrication Facility
313-M	Chemical Transfer Facility
320-M	Alloy Fabrication Facility
320-M	Chemical Laboratory
321-M	Fuel Fabrication Facility
322-M	Metallurgical Laboratory
340-M	Lab Waste Treatment Facility
341-8M	Vendor Treatment Facility
701-1M	Main Gatehouse
701-4M	Entry Control Building for 321-M
710-M	Lithium Storage Building

N Area

N-Area Configuration and Current Use. N Area was previously designated Central Shops and contained construction services facilities such as electrical, mechanical, material and equipment lay-down yards to store items until needed for new construction. In addition to construction facilities, procurement and materials management facilities are located in this area. N Area also contains some of the hazardous waste storage facilities for the site, which involves three primary operations: receipt of waste from onsite generators, interim storage, and shipment of the waste for offsite treatment and disposal. N Area is primarily comprised of heavy industrial, administrative, health and safety, and warehouse facilities. The warehouse facilities function to provide material coordination, material acquisition, and material processing for the entire site. Most N-Area facilities were originally constructed in the early 1950s and continue to provide adequate accommodations for their intended missions. Approximately eight percent of site employees work in these facilities.

Figure 4.23 depicts the projected useful life of the major facilities in N Area. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources would be expended to keep the facilities in operation through their life cycle. As buildings near the end of their useful life, replacement facilities would need to be funded and constructed, and maintenance should be limited to only those items required for the health and safety of the employees.

N-Area Proposed Reconfiguration. Figure 4.24 depicts the projected reconfiguration scenario of N-Area in the year 2020. N Area will remain active throughout the planning period as an industrial support area. However, the Transportation Maintenance Facility 705-N and its associated administrative facility, 706-N, in Central Shops have extensive electrical code and asbestos deficiencies. Funding is being sought to construct a new transportation complex. This complex would be used to consolidate maintenance activities in Central Shops, near the center of the site, including excess warehousing operations and vehicle support maintenance from M Area.

Three N-Area facilities have been declared inactive. The following excerpt from the site's inactive facilities list (see Table 4.13) identifies inactive facilities or parts of facilities that

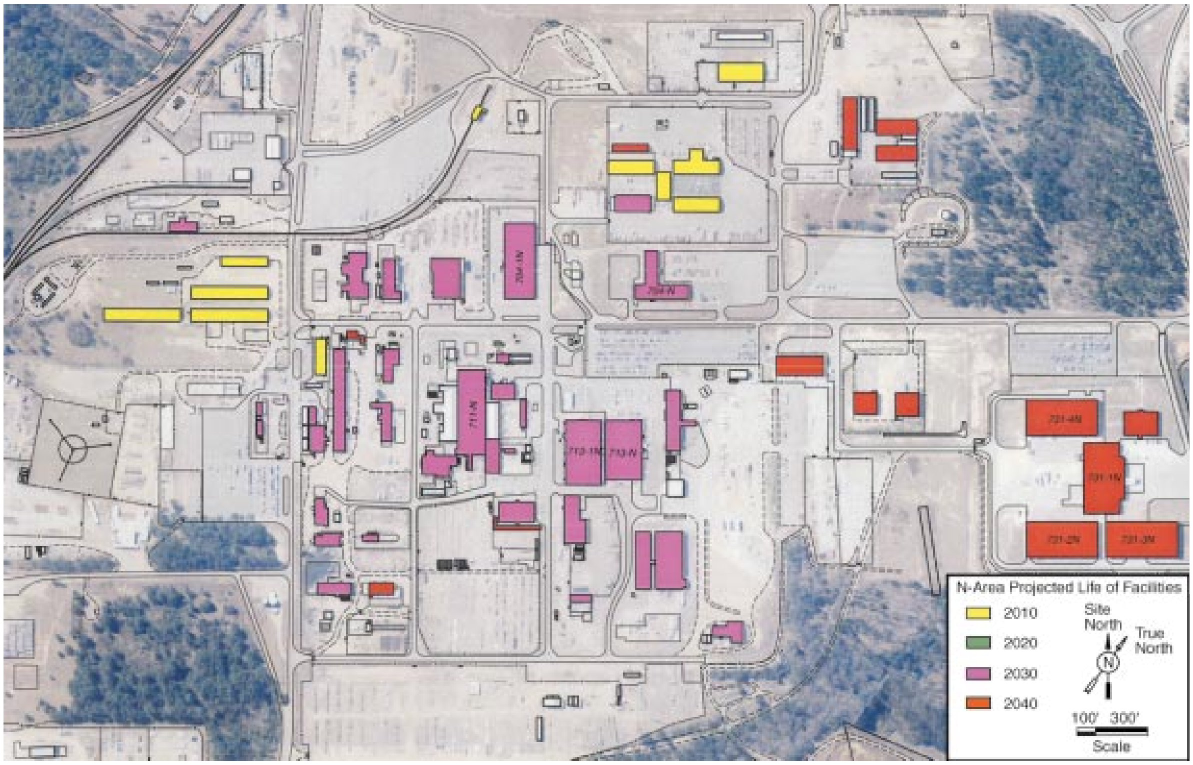


Figure 4.23
Current Configuration and Projected Useful Life of N-Area Major Facilities

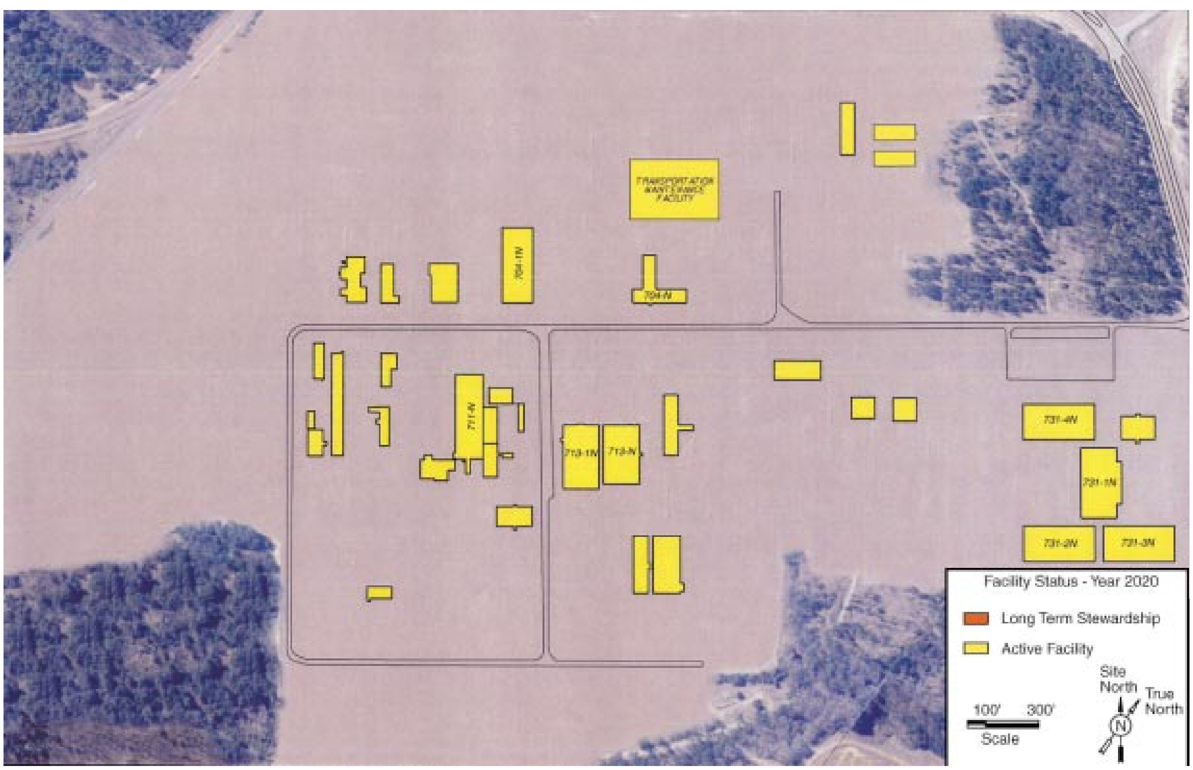


Figure 4.24
N-Area Proposed Reconfiguration Scenario in Year 2020

are candidates for disposition and inclusion on lower level, more detailed, facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

Table 4.13. N-Area Inactive Facilities, May 2000

Building Number	Building Name
619-1N	Fuel Oil Storage Tank
690-000N	Process Heat Exchanger Repair
716-1N	New Steam Cleaning

P Area

P-Area Configuration and Current Use. P Area is one of SRS reactor areas with the original mission of producing material for the Department of Defense nuclear weapons program. P Reactor is similar to other SRS reactors and has two functional areas, referred to as the exclusion area and the administrative area. The reactor exclusion area contains production buildings and all buildings and facilities necessary for operational support. The area surrounding the exclusion area contains the administrative support facilities and the cooling water storage basins. The entire reactor area, both exclusion and administrative areas, is enclosed by fencing to form an operations/administrative compound. The P-Area production reactor is permanently shut down and future operations are not planned. The present reactor deactivation program is scheduled to be completed in 20 years.

P Area is primarily comprised of heavy nuclear industrial, administrative, and some warehouse facilities. Most facilities were originally constructed in the early 1950s. Less than one percent of site employees work in this area, and no employees are housed in the facilities.

Figure 4.25 depicts the projected life of the major facilities in P Area. Maintenance will be limited to only those items required for the health and safety of the employees.

P-Area Proposed Reconfiguration. Figure 4.26 depicts the projected reconfiguration scenario of P Area in the year 2020. The focus of the proposed reconfiguration in P Area is complete shut down by 2010. There are no new facilities planned for this area; however, and all buildings in P Area will transition into the FDD program by 2020. The P Reactor and associated facilities are designated for inclusion in the LTS program.

Presently, 16 P-Area facilities have been declared inactive. The following excerpt from the site's inactive facilities list (see Table 4.14) identifies inactive facilities or parts of facilities that are candidates for disposition and inclusion on lower level, more detailed, facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

Table 4.14. P-Area Inactive Facilities, May 2000

Building Number	Building Name
105-000P	Reactor Building
105-13P	Heavy Water Storage Building
108-001P	Emergency Diesel Room
108-002P	Emergency Diesel Room
110-000P	Helium Storage Tanks
152-7P	Generator Room
183-2P	Filter and Softener Plant
186-001P	Sodium Hypochlorite Facility
190-P	Cooling Water Pumphouse
191-000P	Booster Pump House
608-000P	Change Facility
614-002P	Effluent Monitoring Building
701-1P	Area Gatehouse and Patrol HQ
701-2P	Gatehouse at Building 105
704-P	Area Administration and Services Building
717-009P	Pipe Fabrication Shop

R Area

R-Area Configuration and Current Use. R Area is the oldest of the five SRS reactor areas with the original mission of producing material for the Department of Defense nuclear weapons program. The R-Area production reactor is permanently shut down and future operations are not planned; however, the R-Reactor Building currently serves as a storage area for drums of depleted uranium. The present reactor deactivation

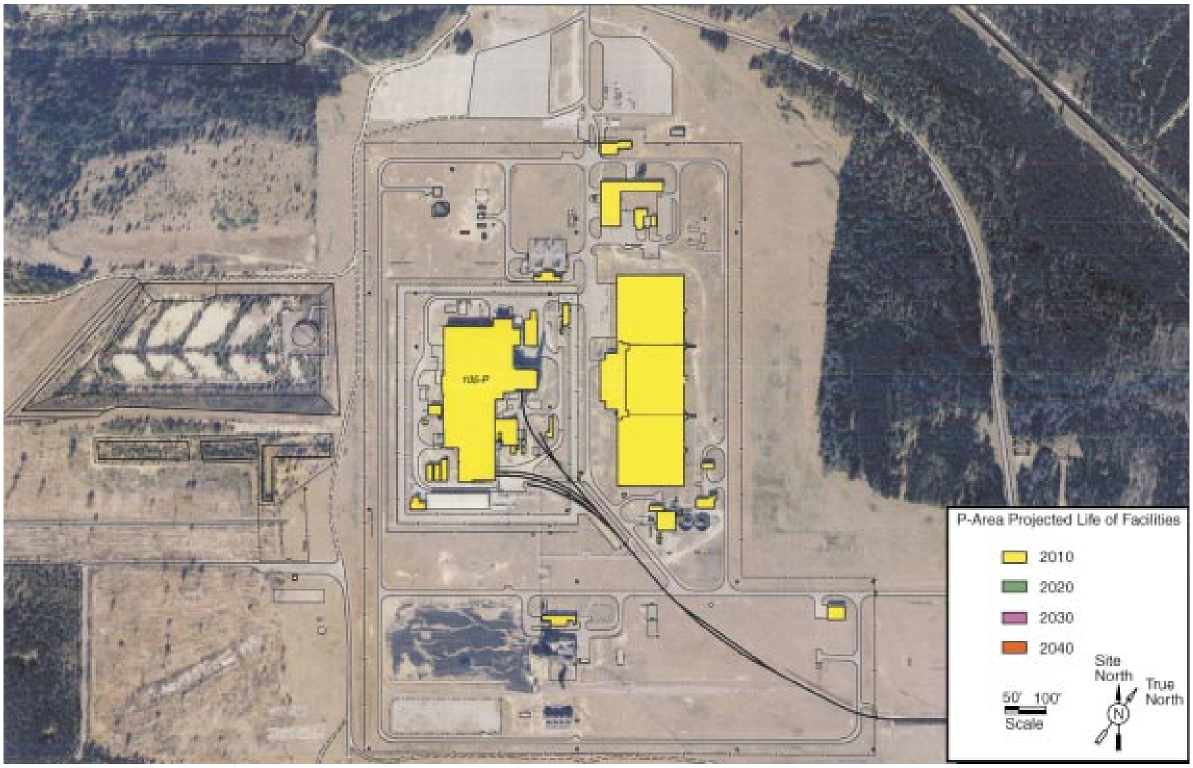


Figure 4.25
Current Configuration and Projected Useful Life of P-Area Major Facilities

Figure 4.26
P-Area Proposed Reconfiguration Scenario in Year 2020

program will be completed in 20 years. R Area is primarily comprised of heavy nuclear industrial, administrative, safeguards and security, and warehouse facilities. Most facilities were originally constructed in the early 1950s. No employees are permanently housed in R-Area facilities.

Figure 4.27 depicts the projected useful life of the major facilities in R Area. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources would be expended to keep the facilities operational. Maintenance should be limited to only those items required for the health and safety of the employees.

R-Area Proposed Reconfiguration. Figure 4.28 depicts the projected reconfiguration of R Area in the year 2020. The focus of R Area is to achieve shut down of operations. When the facility is no longer needed for storage of depleted uranium, the facility will transition to the FDP. There are no new facilities planned for this area. However, R-Reactor Disassembly Basin has been selected to demonstrate several new technologies, funded under the Federal Energy Technology Center. These technologies will demonstrate the treatment of contaminated water, which could result in the closure of the basin. The R Reactor and associated facilities are designated for inclusion in the LTS program.

Presently, five R-Area facilities have been declared inactive. The following excerpt from the site's inactive facilities list (see Table 4.15) identifies inactive facilities or parts of facilities that are candidates for disposition and inclusion on lower level, more detailed, facility disposition plans. The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

Table 4.15. R-Area Inactive Facilities, May 2000

Building Number	Building Name
105-000R	Reactor Building
108-001R	Emergency Diesel Room
108-002R	Emergency Diesel Room
122-R	Heavy Water Storage Building
190-000R	Cooling Water Pump House

S Area

S-Area Configuration and Current Use. S Area contains operating processes for the Defense Waste Processing Facility (see Figure 4.29) to pre-treat and to incorporate high-level waste into glass and houses interim storage facilities for the vitrified waste canisters. The area is primarily comprised of heavy nuclear industrial, administrative, and warehouse facilities, most of which were constructed in the early 1990s and continue to provide adequate accommodations for their intended missions. Approximately six percent of site employees work in S-Area facilities. The present S-Area program is scheduled for completion by 2022.

S Area consists of the Vitrification Building and the Glass Waste Storage Building. The Vitrification Building is a canyon-type building that contains processing equipment to immobilize the highly radioactive sludge and salt components of the HLW in borosilicate glass. The Glass Waste Storage Building provides interim storage of the filled glass waste canisters in highly shielded vaults located below ground level (see Figure 4.30). These canisters will be produced at a rate of about 200 per year and stored at SRS until a permanent geologic repository is available for final disposition.

Figure 4.31 depicts the projected useful life of the major facilities in S Area. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources would be expended to keep the facilities in operation through their life cycle. As buildings near the end of their useful life, replacement facilities would need to be funded and constructed if the mission need still exists.

S-Area Proposed Reconfiguration. Figure 4.32 depicts the projected reconfiguration scenario of S Area in the year 2020. S Area is scheduled to remain active until 2025 when the High Level Waste Tank Closure Program is complete. In the proposed reconfiguration scenario, within the next 10 years, administrative employees could be relocated from trailers to the H-Area office facility if 766-H is converted to office space. Modular office units could be removed from S Area to save on operational and maintenance costs. New facilities being planned for this area include structures that may be required by the Alternate Salt Disposition Program currently under evaluation, facilities for additional glass waste storage, and Failed Equipment Storage Vaults. For the Alternate Salt Disposition Program, there are three preferred alternatives being considered. Each alternative includes a proposal for process facilities, service areas, and chemical storage, with generally similar costs and schedules. The *Savannah River Site Dispo-*

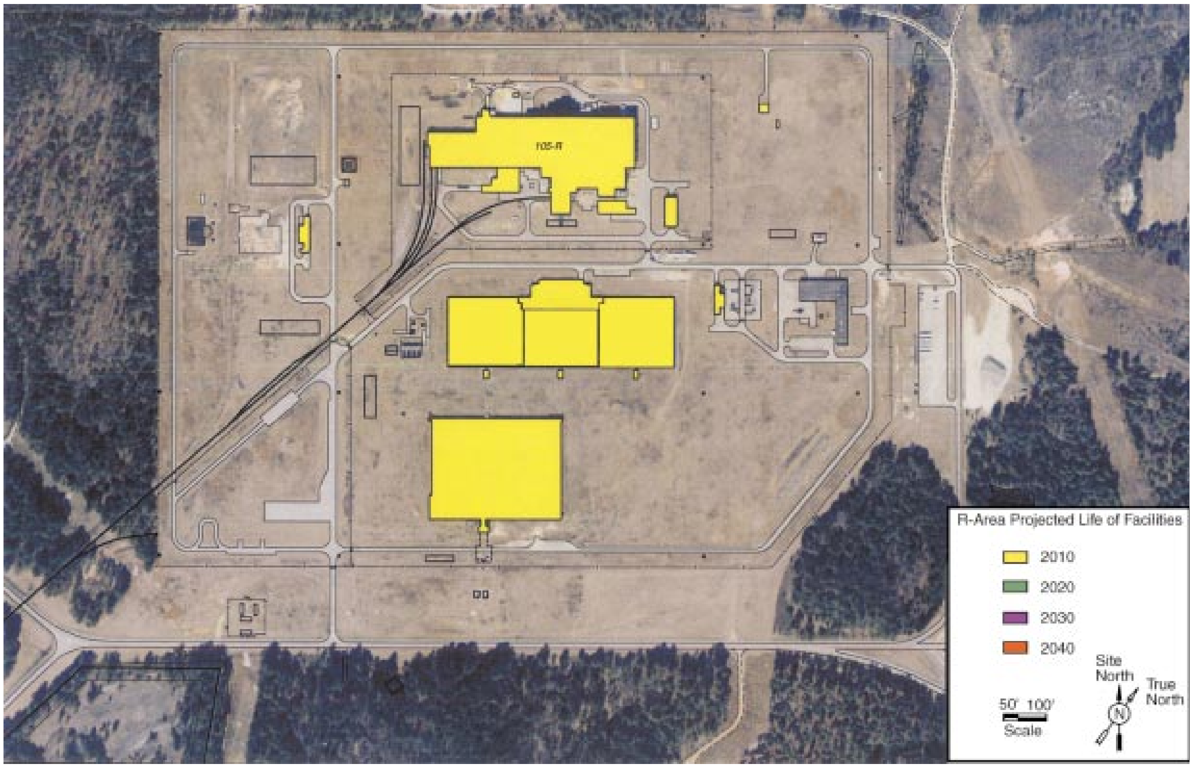


Figure 4.27
Current Configuration and Projected Useful Life of R-Area Major Facilities

Figure 4.28
R-Area Proposed Reconfiguration Scenario in Year 2020

Figure 4.29
High-Level Waste is stabilized in glass in the Defense Waste Processing Facility (right). Canisters containing the glass are stored below ground in the Glass Waste Storage Building (left).

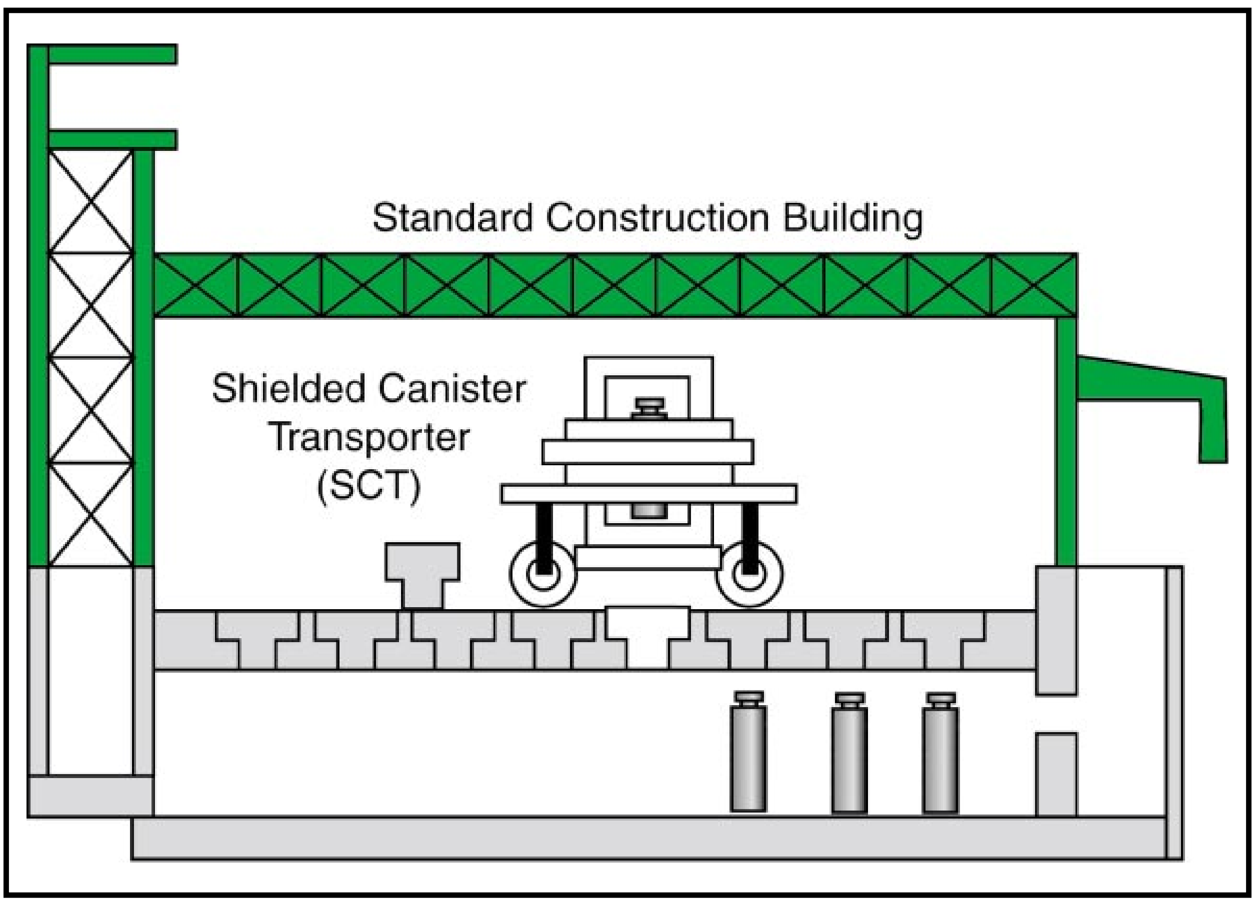


Figure 4.30
Schematic of the below-ground canister storage in the Glass Waste Storage Building.

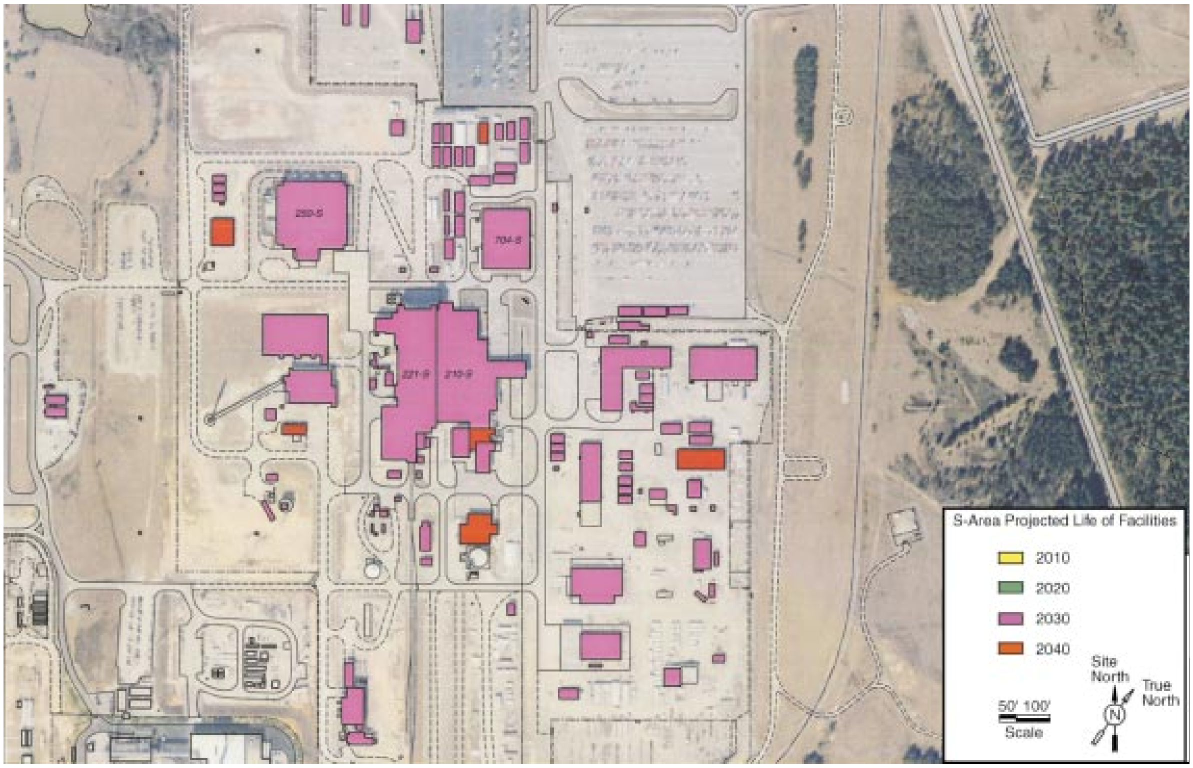


Figure 4.31
Current Configuration and Projected Useful Life of S-Area Major Facilities

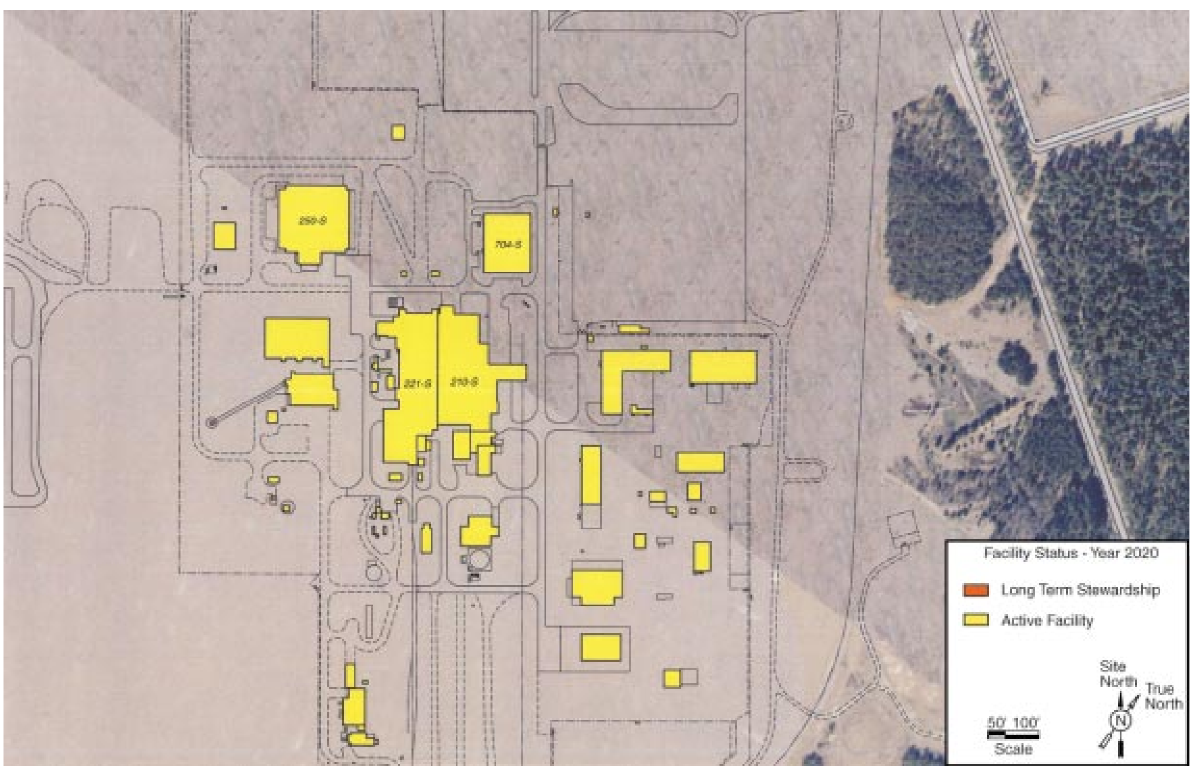


Figure 4.32
S-Area Proposed Reconfiguration Scenario in Year 2020

sition Alternatives Supplemental Environmental Impact Statement (SEIS) (DOE/EIS-0082-S2) is underway to evaluate these technologies for salt processing. Upon selection of a preferred alternative, it is expected that design and construction activities would begin on facilities required to process the salt stream to be operational by 2010. In addition, the *Environmental Assessment to Evaluate an Alternative Approach for the Defense Waste Processing Facility Glass Waste Storage Facility at the Savannah River Site* (DOE/EA-1227, Draft prepared March 2000) evaluates the environmental consequences associated with building and operating an on-site, above-ground, concrete pad for casks containing DWPF canisters. The storage casks may be made using SRS's inventory of depleted uranium trioxide powder. No S-Area facilities have been declared inactive.

T Area

T-Area Configuration and Current Use. This area was originally used as a staging area for receipt and testing of large process equipment destined for use in SRS production facilities. In the early 1950s, it was used to test the plutonium/uranium extraction (PUREX) process. Since that time, T Area, also known as the Multi-Purpose Pilot Plant Campus or TNX has been utilized primarily as a pilot-scale test facility for SRTC. The most significant pilot-scale testing support has been for high-level waste initiatives, particularly DWPF. Since 1978, the area has expanded from three original buildings constructed in 1950 to 32 buildings currently located within the 14-acre fenced facility. The area is primarily comprised of light nuclear industrial, administrative, and warehouse facilities. Less than 1 percent of site personnel work in this area.

The Multi-Purpose Pilot Plant Campus buildings include administrative offices, process buildings for large-scale experimental demonstrations, laboratories for both research and analytical work, pilot scale facilities, bulk tank storage, industrial wastewater processing facilities, and warehouse storage for a wide range of chemical and specialty equipment. The area has adequate infrastructure to perform a multitude of activities. Located outside of the fenced area are additional facilities, including closed underground storage tanks; the TNX Burying Ground and Seepage Basin, currently under evaluation by the Environmental Restoration Program; and the New TNX Seepage Basin.

Currently, the area is used primarily for Defense Waste, Interim Waste, and Environmental Sciences Programs conducted by the Savannah River Technology Center. The area also hosts other site programs, and supports technology transfer initiatives through Cooperative Research and Development Agreements with private industry.

Figure 4.33 depicts the projected useful life of the major facilities in T Area. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources would be expended to keep the facilities in operation through their life cycle. As buildings near the end of their useful life, replacement facilities would need to be funded and constructed, and maintenance should be limited to only those items required for the health and safety of the employees.

T-Area Proposed Reconfiguration. Figure 4.34 depicts the projected reconfiguration scenario of T Area in the year 2020. In the proposed reconfiguration, there are no new facilities planned for this area. Older trailers in the area are being shut down and removed to reduce operational costs. In 1998, DOE prepared an environmental assessment to analyze the potential environmental and safety impacts of proposals to allow asset reuse in the area. An initiative has been established to reduce the footprint of the TNX Prototype Testing Area. This plan results in a preliminary cost savings estimate of $11 million to relocate the functions within this area. However, this calculation was based on the assumption that TNX would be shut down by September 2000. The cost savings will be reduced if the schedule is spread out over the next few years. Current plans are to declare the entire area excess in 2002 and transfer all facilities to the Inactive Facilities List and eventual inclusion in the Long Term Stewardship program.

Twelve facilities in T Area have already been placed on the inactive list, as shown on Table 4.16 . The entire inactive facilities list and a risk ranking for inactive facilities are found in Appendix E.

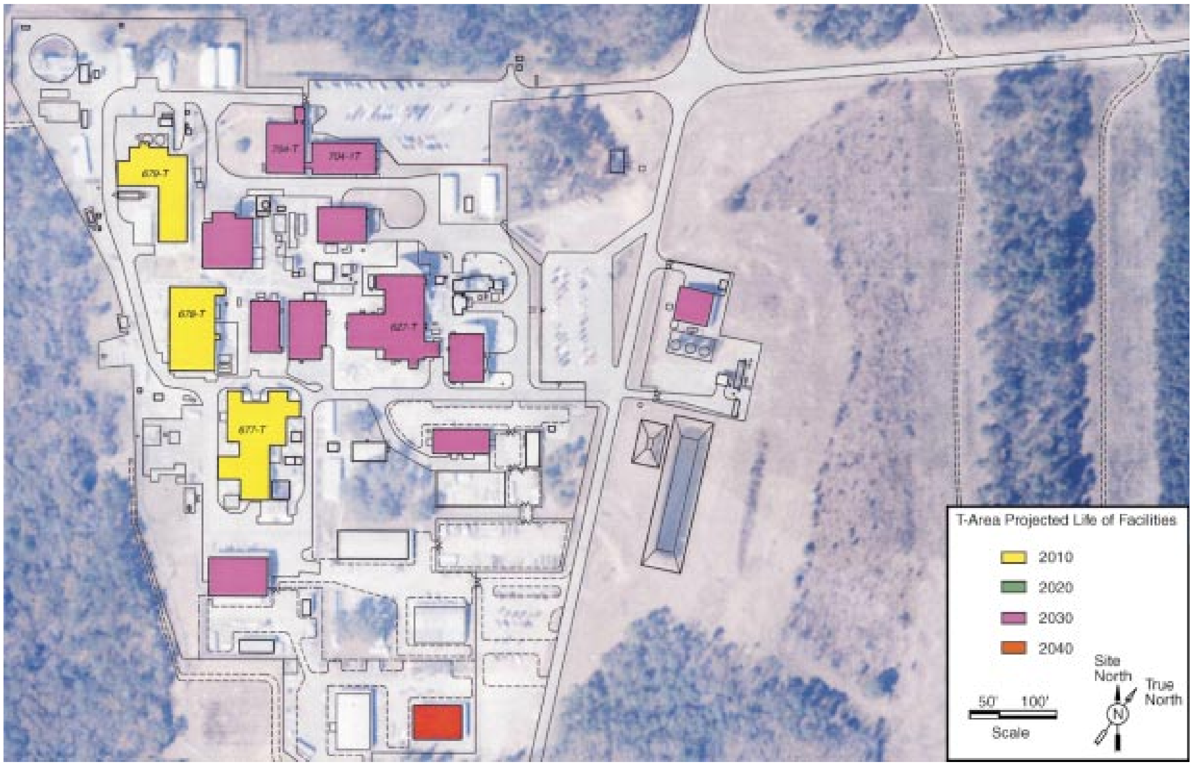


Figure 4.33
Current Configuration and Projected Useful Life of T-Area Major Facilities

Figure 4.34
T-Area Proposed Reconfiguration Scenario in Year 2020

Table 4.16. T-Area Inactive Facilities, May 2000	
Building Number	**Building Name**
670-T	Pilot Plant Robotics Building
677-T	Advanced Contractor Test Facility (ACTF)
677-T	Mixer-Settler Test Facility
677-T	Geometrically Favorable Dissolver
679-8T	Pump House
682-T	PHEF Plant
684-T	Flammable Storage Building
692-T	ECR/ICR Building
692-T	PHEF Control Room
694-2T	Carpenter Shop
711-T	Mechanical Services Building
711-T	E&I Shop

Z Area

Z-Area Configuration and Current Use. Z Area is composed of operating facilities used to treat and dispose of the low radioactivity salt solution resulting from selected salt disposition alternative pre-treatment processes and the concentrate from the Effluent Treatment Facility. The area includes the Saltstone Manufacturing Plant and Saltstone Disposal Vaults. Z Area is primarily comprised of light nuclear industrial, administrative, and warehouse facilities. Less than one percent of site employees work in Z-Area facilities. Currently, the Saltstone Facility is in a lay-up mode due to a lack of feedstock as a result of the shutdown of the In Tank Precipitation (ITP) process. When sufficient amount of feed becomes available from ETF, the Saltstone Facility will continue treatment and disposal operations.

The Saltstone Manufacturing Plant (see Figure 4.35) blends a low radioactivity salt solution with cement, slag, and flyash to create a mixture that hardens into a concrete-like material called saltstone. It treats liquid waste residuals from ETF. This plant works in conjunction with the Saltstone Disposal Vaults, large concrete disposal crypts into which the solution prepared in the Saltstone Manufacturing Plant is pumped. After cells in the vault are filled, they are sealed with concrete. Eventually, the vaults will be covered with soil, and a cap constructed of clay and other materials will be installed over the vaults to reduce rainwater infiltration and leaching of contaminants into the groundwater.

Figure 4.36 depicts the projected useful life of the major facilities in Z Area. Based upon these projections, individual building maintenance plans should be developed to determine the extent to which resources would be expended to keep the facilities in operation through their life cycle.

Z-Area Proposed Reconfiguration. Figure 4.37 depicts the projected reconfiguration scenario of Z-Area in the year 2020. Z Area will remain active over the life of the Saltstone Facility. There are new facilities planned for this area, including approximately 13 more vaults to be constructed over the life of the facility. Presently, no Z-Area facilities have been declared inactive. After cleanup of SRS is complete, this area will be included in the LTS program.

SRS Reconfiguration Scenario Summary

As discussed in Chapter 1, this plan outlines a proposed framework for the reconfiguration of site facilities to consolidate like functions, reduce the infrastructure requirements, and increase the efficiency of operations and management of SRS. This chapter has provided information and maps showing the various areas and how they could be impacted by this

Figure 4.35
Saltstone Manufacturing Facility

Figure 4.36
Current Configuration and Projected Useful Life of Z-Area Major Facilities

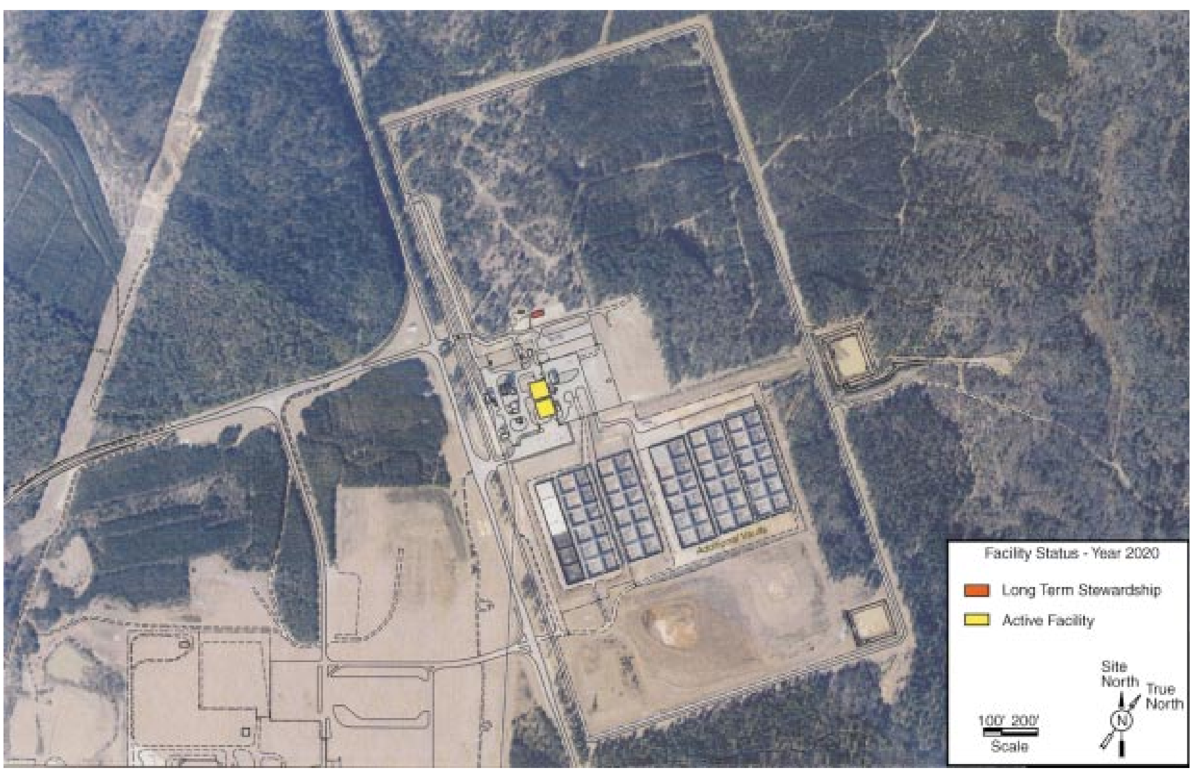


Figure 4.37
Z-Area Proposed Reconfiguration Scenario in Year 2020

reconfiguration. In summary, major components of this proposed reconfiguration include the following:

- DOE-SR, WSRC, USFS-SR, SREL, and WSI-SR administrative functions, site training functions, central medical facilities, and public administration facilities would be located in an administrative complex located in B Area.
- SRTC would be relocated near the missions it supports in either F or H Area in a restricted security area.
- All future site industrial missions would be located in the center of the site.
- Building 766-H, currently used as a site training facility, would be converted to an office building for employees currently located in modular offices in H, E, and S Areas. Modular offices would be removed from the site to save on maintenance and infrastructure costs.
- A Area would be vacated over the next 20 years, including SRTC and SREL facilities, to achieve complete shut down by 2020 to save on infrastructure maintenance costs.
- N Area would be developed to serve as a consolidated industrial support complex for warehousing, maintenance, and transportation.

Figure 4.38 shows a summary schedule of the proposed site reconfiguration.

The SRS vision of becoming "modernized" and "moving into the 21st century" as a site would mean taking the actions necessary to physically reconfigure SRS to cost effectively support the present and future missions. This modernization would prepare the site to take on new, undefined future missions. Reconfiguration of the site would involve significant investment, which would include the construction of new nuclear facilities, modification of existing site facilities for new missions, and modifications in the site's infrastructure. Continuity in support and direction over the course of future administrations will be required to maintain progress.

Most nuclear facilities are currently located in the centralized industrial zone. The siting of new facilities, particularly those related to plutonium disposition activities, would be part of a reconfiguration plan that would consider integration opportunities with other site facilities, as well as assure maximum integration within the plutonium management complex itself. Consideration of life-cycle costs for all facilities, from oldest to newest, will be a vital component of the gradual site reconfiguration.

The phased relocation and/or reconstruction of necessary, "right-sized" facilities and supporting systems within the industrial center of the site should shrink the site's infrastructure requirements with an anticipated reduction in operating costs of some magnitude. It would also provide enhanced operational efficiency and capability required to meet 21st century needs and mission demands.

The criteria to guide the site reconfiguration are as follows:

- Increase the efficiency of operations.
  - Prior to the construction of new facilities, site decision-makers should consider the feasibility of upgrading or retrofitting existing facilities.
  - There should be a reduction in annual operating expenses and improvement of operating efficiency of infrastructure by shrinking the footprint to minimize surveillance and maintenance of outdated infrastructure.
  - There may be opportunities to share facilities. For example, if a plutonium immobilization facility and a pit disassembly facility both require furnaces and vaults, then the function of a vault and furnace should be consolidated to the maximum extent practical, providing the opportunity for reduction in construction and operating costs.
  - As new facilities are planned, decision-makers should consider the life-cycle costs and operational status of associated infrastructure, office space, and laboratories to support these new facilities. By considering entire costs of an area, it may be more cost-effective to replace than repair facilities.
- Consider the interaction among operating organizations.
  - Co-locate similar functions to foster communication and cross-training of the workforce and improve interaction among various organizations.
- Optimize safety and security.
  - Safety and security would remain major considerations during reconfiguration, especially related to new plutonium missions and the research work performed to support the tritium and plutonium mission work.
- Reduce environmental impact.
  - Facilities should be preferentially located within existing areas that may already be contaminated rather than in previously unimpacted areas.

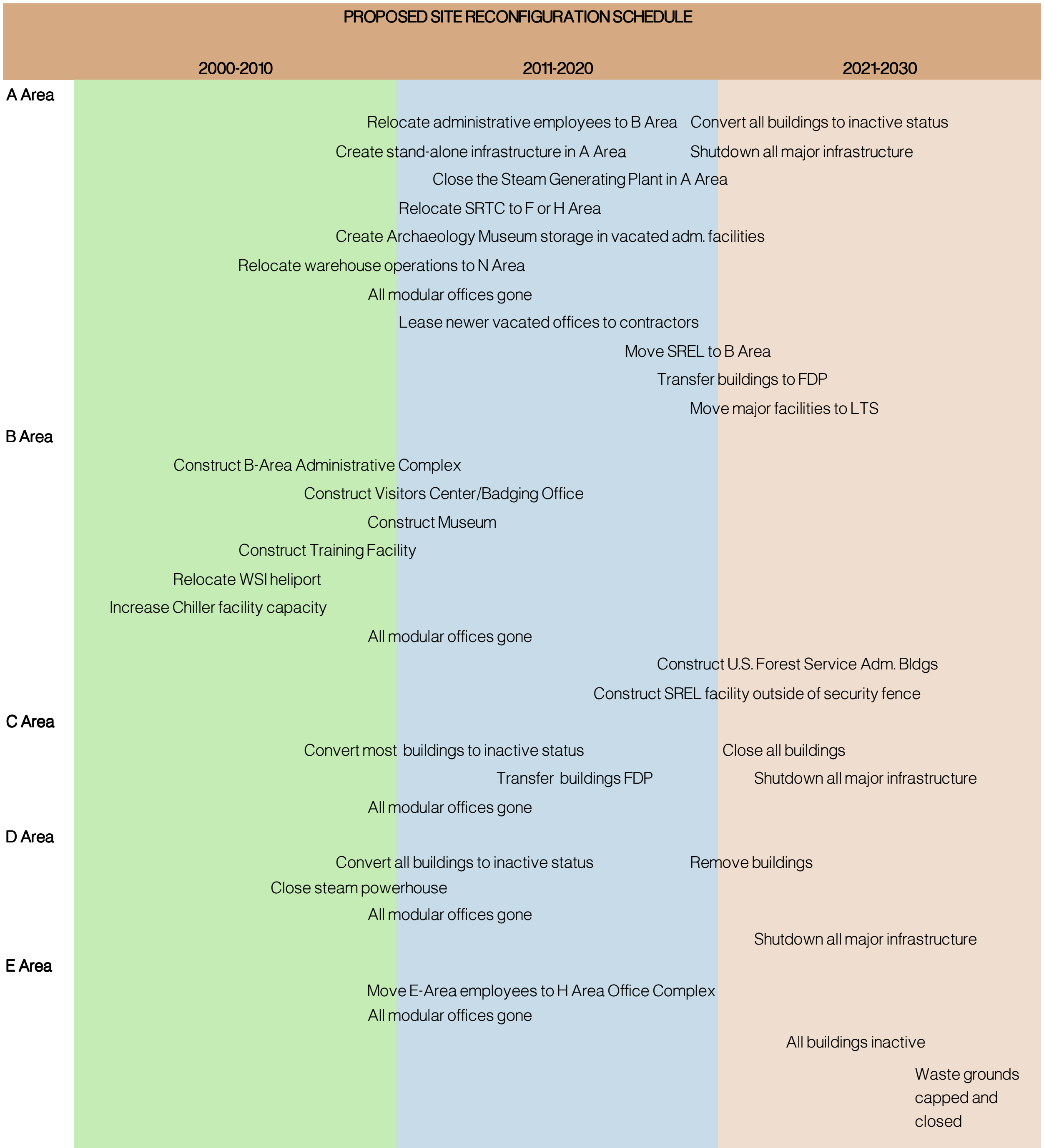


Figure 4.38

Proposed Site Reconfiguration Schedule

Note: This diagram shows a general sequencing of events related to the proposed reconfiguration scenario described in this plan. It does not reflect final decisions about physical assets, which will be determined after detailed analyses are performed.

PROPOSED SITE RECONFIGURATION SCHEDULE (continued)

	2000-2010	2011-2020	2021-2030
F Area	Construct Plutonium Disposition Facilities		Pu facilities missions complete
	Construct TRU Waste Facility		
	Canyon closed		
		C Lab closed	
	All modular offices gone		
			Tank Farms closed and capped
G-Area (U.S. Forest Service)		Admin. moved to B Area	
		All G-Area facilities shut down	
			Buildings removed
			Infrastructure shut down
H Area		CLAB shut down	
	H Area training facility converted to an office building		
	All modular offices removed, employees relocated to 766-H Office Building		
	H Powerhouse upgraded and supplying steam for site		
		SRTC/CLAB relocated to new facilities	
			Tanks closed and capped
K Area		Some buildings inactive	
	All modular offices gone		
		Spent Fuel Project complete	
		All remaining buildings inactive/removed	
L Area	Treatment and Dry Storage Facilities constructed and active through 2037		
	All modular offices gone		
N Area	A Area Warehousing operations moved to N Area		
	New facility constructed for Transportation/Maintenance		
	All modular offices gone		
P Area		All buildings inactive, transferred to FDP	
		All major infrastructure shut down	
R Area	Reactor used for depleted Uranium storage		
		All buildings inactive, transferred to FDP	
S Area			DWPF ops complete
	All modular offices gone		
T Area	All buildings inactive, transferred to FDP		
		All buildings removed	
		All major infrastructure shut down	
Z Area	New vaults constructed		

- Co-locating operations with waste processing facilities would minimize onsite transportation and possible contamination.
- Design and construction of new facilities should maximize the use of energy-efficient systems and operations and incorporate life cycle cost considerations in the preplanning for each facility's deactivation.

When developing cost estimates for this reconfiguration, the site should account for savings resulting from the elimination of upgrading the existing infrastructure, the entire life cycle costs of maintenance of aging facilities, cost estimates for delay of decommissioning, and the opportunity to improve the efficient operation of the site. The opportunity to apply the best practices in new construction planning and design, engineering, energy efficiency, and management should also be considered.

This *SRS Long Range Comprehensive Plan* also outlines the framework for meeting the goals and objectives specified in the Strategic Plan. Together, the *21st Century Stewards for the Nation: A Strategic Plan for 2000 and Beyond* and the *SRS Long Range Comprehensive Plan* provide a basis for planning and scheduling resource requirements.

Figure 4.39 shows the site map under this proposed reconfiguration scenario. Various studies will be conducted to evaluate the feasibility of these proposals prior to implementation.

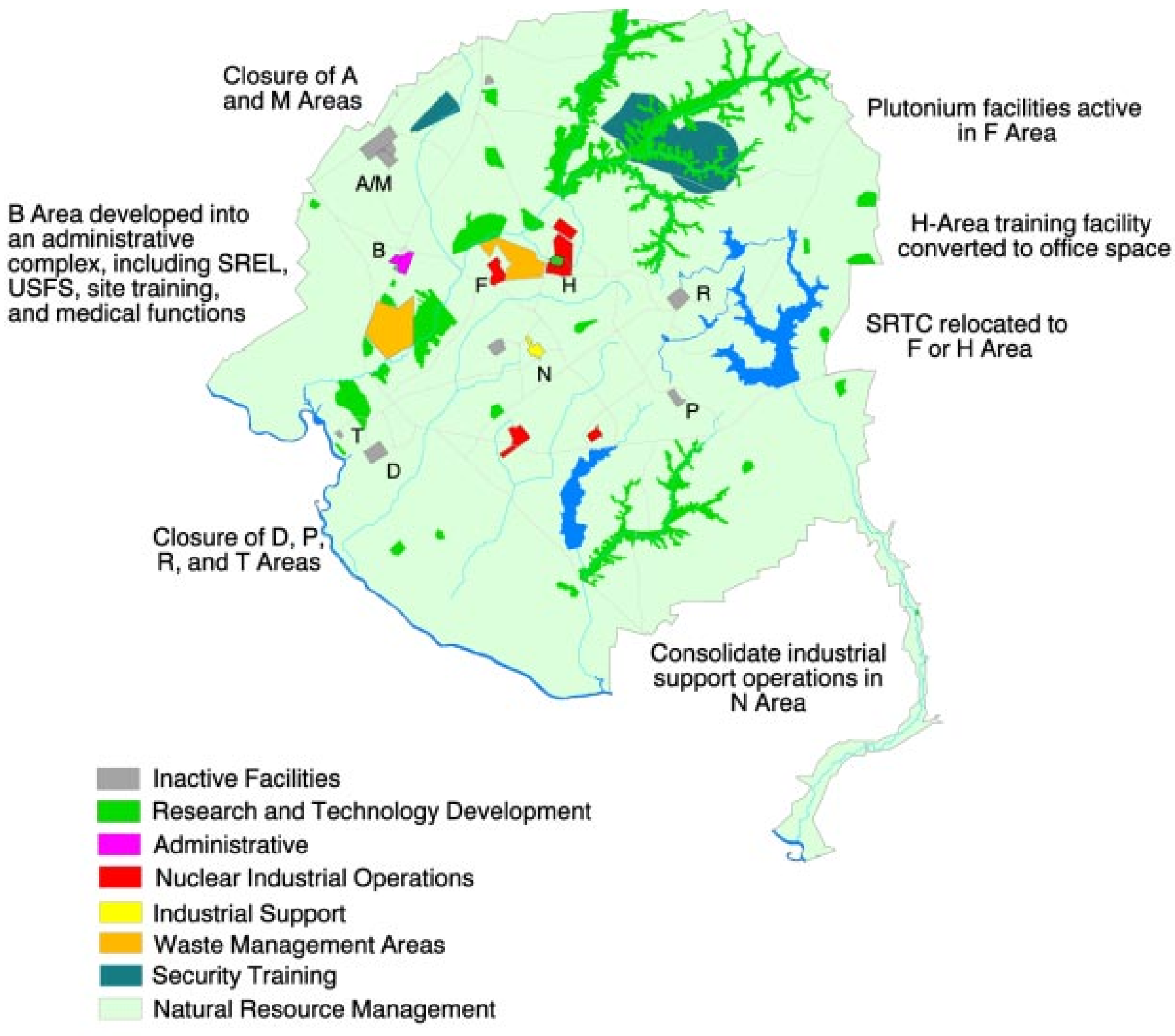


Figure 4.39
Proposed Savannah River Site Reconfiguration Scenario

Chapter 5

Infrastructure Plan

Purpose

The purpose of the Infrastructure Plan is to provide an understanding of the site's infrastructure program, the current physical condition of infrastructure systems, limitations that may exist, and planning strategies to meet future needs. It should be recognized that the guidance contained in this plan is not reflective of final decisions. The *SRS Long Range Comprehensive Plan* provides a vision to optimize and modernize the site functions, facilities, and infrastructure and proposes scenarios to accomplish this gradual reconfiguration. Detailed evaluations of options, cost benefit analyses, and area-specific plans will be executed prior to implementation of the reconfiguration scenarios discussed in this chapter.

Scope

This plan uses a traditional planning definition for infrastructure. Infrastructure, as defined in this plan, includes crosscutting physical assets that support site activities. Specifically, infrastructure is defined as the basic services and equipment needed for the operation of the site's facilities, including the following:

- Electricity
- Steam
- Domestic water
- Process water
- Dams
- Sanitary wastewater
- Chillers
- Roads
- Railroads
- Aviation
- Water transportation
- Telephone networks
- Information technology system networks
- Public address/safety alarm systems

At the time this document was being written, DOE-HQ had requested the site prepare the *SRS Infrastructure Restoration Plan*. Portions of this chapter were used to develop the *SRS Infrastructure Restoration Plan*.

Infrastructure Planning Goals and Objectives

The broad goal of the infrastructure program is to provide reliable and cost effective support to all existing and future site missions. Specific objectives to accomplish this goal include:

- Cost reduction goals as defined in each Annual Operational Plan,
- Innovative efficiencies,
- Privatization and outsourcing options,
- Use of a graded approach and commercial practices,
- Energy and water conservation measures,
- Continued maintenance of infrastructure systems in a safe and environmentally sound state of operational readiness,
- Prompt deactivation of unneeded facilities to reduce surveillance, maintenance, and energy costs, and
- Disposal of facilities in a way that maximizes salvage value.

Infrastructure Planning Assumptions

Four primary assumptions fundamental to infrastructure planning are shown below.

- workload and workforce levels will not increase with respect to mission and program demands on infrastructure systems;
- the site boundaries will remain unchanged;
- infrastructure upgrades will be limited to those facilities expected to remain in operation mid- to long-term, unless there is an immediate health or safety issue; and
- utility systems will be redistributed as appropriate in consonance with the reconfiguration concept.

While demands for infrastructure in individual areas may increase or decrease, the overall capacity may remain fairly constant.

One strategy is that existing systems will be maintained in a safe state of readiness through an appropriate reinvestment program of maintenance, repair, and upgrade as long as each system is considered necessary to support site operations.

Another strategy that could be used to fund upgrades related to energy efficiency is the Energy Savings Performance Contract (ESPC). An ESPC awarded in fiscal year 1998 provides for a vendor to make proposals for energy-related improvements to facilities and equipment across the site. The vendor funds the initial cost of the improvements, and the site repays the vendor through a mortgage arrangement over a prearranged term that can last up to 25 years. Payments are taken as savings from future operating budgets due to reduced costs of energy consumption and related operations and maintenance. The ESPC could be applied on a phased approach and could ultimately cover all site energy-consuming facilities and activities, including many infrastructure systems.

Infrastructure System General Analysis

Much of the SRS infrastructure is approaching fifty years of age. Many of the systems have degraded to conditions that require major upgrades, which are beyond the financial capabilities of the site's current annual funding allocations. New and existing missions can only be performed safely and efficiently with a highly reliable infrastructure supporting both facilities and staff. The lack of a stable infrastructure leads to increased facility operating costs and increased risk in meeting production requirements, maintaining regulatory compliance, and maintaining adequate emergency response capabilities. Due to funding constraints at SRS since 1993, the small projects annual capital budget for infrastructure has been reduced by almost 80 percent, from an average of $60M to $12M. This, coupled with changing missions, safety, and regulatory requirements, has caused many infrastructure-related systems to become inefficient or obsolete. The lack of attention to infrastructure has resulted in increased maintenance costs, which have negatively impacted both overall operating costs and operating efficiency.

Because SRS houses an extensive, interrelated, and complex infrastructure, DOE-SR asked Logistics Management Institute (LMI) to review infrastructure management operations at SRS to identify improvements that would help ensure the highest yield on its investment over the life-cycle of the site, both in dollars and quality of operation. Below are some of the specific recommendations LMI made regarding infrastructure.

- Formally approve the *SRS Long Range Comprehensive Plan*, including the site reconfiguration plans.
- Direct WSRC to complete and maintain an accurate inventory of all infrastructure assets and to periodically assess the condition of all assets in the inventory.
- Investigate the feasibility of outsourcing the operating and maintenance of the SRS electrical distribution and steam systems.
- Install utility meters (steam, electric, and water) at all facilities and implement conservation initiatives for high utility consumers.

Since the early 1990s, the site's domestic water, sanitary wastewater, chillers, bridges, telecommunications system, information technology systems, and radios were replaced or upgraded or are being replaced or upgraded as part of a major capital improvement program. The electrical and steam distribution systems, primary roadways, and the railroad system were not part of this major capital improvement program and will continue to require higher levels of capital investment to maintain reliability. While many systems are currently in good condition, tight budgets and priorities on nuclear and environmental restoration activities have not allowed the reinvestment levels necessary to maintain these and many other non-nuclear support infrastructure facilities in a manner that will assure reliability and cost effectiveness beyond the next five years. Due to the advanced age of many components in these systems, maintenance costs are very high and parts are often hard to obtain. The Infrastructure Restoration and Reconfiguration Line Item is being developed to address this problem; however, all investments in infrastructure upgrades will be evaluated for consistency with the site reconfiguration concept. This line item will provide adequate reinvestment for upgrades to support infrastructure facilities over a ten-year period. Most systems have adequate reserve capacity to accommodate significant additional consumption or use requirements before additional upgrades are necessary.

The sections below provide a detailed description of the proposed line item and the following site infrastructure systems: electrical, steam, domestic water, sanitary wastewater, central chillers, primary and secondary roads, and railroads. Other infrastructure systems include aviation, waterborne transportation, voice communications networks, and information technology system networks, and the public address/ safety alarm system.

Proposed SRS Infrastructure Restoration and Reconfiguration Line Item

The proposed Site Infrastructure Restoration and Reconfiguration Line Item has been initiated to restore critical infrastructure. This line item project, estimated at $600 million over 15 years beginning in fiscal year 2002, would cover all of the support facilities that provide necessary services to the nuclear production and waste processing facilities.

Specific projects within the line item would focus on process and domestic water distribution systems; intra area sanitary sewer systems; roads and railroads; communications systems, including emergency systems; waste handling systems; and administrative and analytical facility upgrades, including roof repairs.

Below is an alphabetic listing of the 13 specific infrastructure categories represented by these projects:

- Administrative Facilities Refurbishment and Improvements
- Central Laboratory Facility (CLAB)
- Computing/Telecom Improvements
- Dam Restoration
- Electrical Distribution Upgrades
- Heating, Ventilation, and Air Conditioning (HVAC) System Replacements
- Roof Replacements
- Sanitary Sewer Upgrades
- Savannah River Technology Center (SRTC)
- Sitewide Safety Alarm System Improvements
- Steam System Upgrades
- Transportation Improvements (Site Roads & Railroads)
- Water Systems Upgrades (Process & Domestic Water)

Prioritization of infrastructure-related projects in the scope of this line item would be managed through an infrastructure steering council composed of senior site officials who are most aware of overall infrastructure conditions. The process would include an evaluation of infrastructure needs and priority ranking of proposed infrastructure projects based on several key criteria. The process would focus on health and safety and environmental protection as the highest priorities, and it would consider changing site conditions, site reconfiguration, mission duration, and emerging work.

The basic planning assumptions of the *SRS Long Range Comprehensive Plan* also serve as the basis for this proposed project. It is anticipated that the base load of activity at Savannah River Site will remain essentially at current levels, and that the site boundaries will remain essentially unchanged. The planning assumptions also include the concept of site reconfiguration, which would prioritize and concentrate infrastructure improvements and upgrades in areas that have viable, long-term missions. Adequate capacity and reserve exist within all existing infrastructure systems to accommodate these assumptions. Workload and headcount will remain fairly constant with respect to demands on infrastructure is another assumption. Any new mission with extraordinary infrastructure requirements, which cannot be accommodated within the capabilities of the existing site systems, will be expected to provide for that added capacity. In addition, new missions will also be responsible for costs of tying into existing site systems as part of the project development and funding of that new mission. Such extraordinary requirements will not be part of this restoration project.

Infrastructure Systems

The following sections provide detailed descriptions of each system's current condition and use and a projection of the future configuration consistent with the reconfiguration concept. The future configuration sections describe scenarios and proposals that will be analyzed in detail in lower level planning documents prior to implementation.

Electrical Systems

Current Condition. Primary electrical power is delivered to SRS through a 115 kilovolt (kV) electrical transmission system operated and maintained by the South Carolina Electric & Gas Company under a lease arrangement. In addition to three commercial off-site feeds, the D-Area Powerhouse is capable of generating up to 70 megawatts of electrical power through the 115 kV transmission system. The system includes approximately 100 miles of transmission lines and 15 substations (see Figure 5.1). Voltage is stepped down through area or facility transformers to the preferred medium voltage level, typically 13.8 or 4.16 kV. Backup or emergency power is provided within each area or facility, as needed.

The 13.8 kV distribution system portion of the primary electrical system is operated and maintained by the site's primary contractor, Westinghouse Savannah River Company. It is comprised of radial feeders from substations located in the process and administrative areas. This distribution system includes approximately 86.7 miles of overhead lines, 17.6 miles of underground cable, and 649 pole- and pad-mounted transformers.

Ten areas have substations that reduce the 115 kV to the 13.8 kV distribution voltage (A, B, C, D, F, H, K, L, P, and R Areas). Four areas reduce the voltage to 4.16 kV (the 681-1G, 681-3G, and 681-6G Pump Houses and the K-Area Cooling Tower). The site's electrical requirements have been greatly reduced over the years, and the available capacity far exceeds the current demand. Average demand for all combined loads is about 45 megawatts and the available capacity is 620 megawatts.

While all key components of the electrical distribution system are generally in fair condition, most of the system components are old and are beginning to incur significant maintenance costs. Many of the site's electrical transmission lines

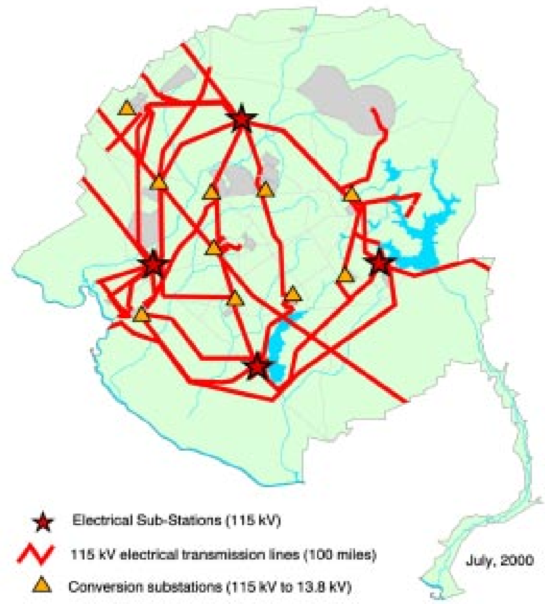


Figure 5.1
SRS Electrical System

have gone beyond their design life and are in need of replacement or upgrade. In addition, accumulated weather damage and lightning strikes have caused portions of the system to fail more frequently causing increases in maintenance costs and decreases in reliability and availability for power consumers. Low-voltage switching and distribution systems in older facilities are in very poor condition due to their age. Cracked and worn insulation, loose connections, and unreliable breakers are not uncommon. There are no significant physical constraints affecting the 13.8 kV distribution system. There is more than adequate capacity to meet the current and normal growth loads in the future. However, due to the configuration of some radial feeds, in some cases an entire site area may need to be isolated during an outage because there are no alternate feeds to that area. These outages are usually scheduled for off-shift and usually do not impact operations.

Future Electrical Configuration. In order to assure long-term reliability and cost effectiveness of those areas in the proposed reconfigured site footprint, many components of the system will have to be replaced or upgraded. As part of the Infrastructure Restoration and Reconfiguration Line Item, the proposed site is proposing the Electrical Infrastructure Restoration and Reconfiguration Project, which provides for the replacement and upgrade to current codes and standards of critical portions of the site's 113,800 volt electrical distribution lines, substations, poles, supports, and related switching equipment. This project will address only those portions of the system that support active missions.

In the reconfigured site, the electrical requirement in A Area would drastically decrease by 2010 if functions are relocated to other site areas. The reduced demands may be met by offsite electrical suppliers, such as South Carolina Electric and Gas Company. By 2030, all activities may have been relocated away from A Area, and only the minimal electrical service required for environmental restoration and Long Term Stewardship activities may be available.

The proposed relocation of most site administrative activities by 2010 would increase demand for electricity in B Area through the remainder of the planning period.

By 2010, all buildings in D and T Areas may be inactive, and only the minimal electrical service required for environmental restoration and Long Term Stewardship activities would be available.

In the proposed reconfiguration, there would be no administrative buildings in E Area by 2010. Only the minimal electrical service required for environmental restoration and Long Term Stewardship activities would be available.

Through 2020, the current level of electrical service will remain in F Area. Reduction in canyon operations will coincide with increased activity in the new plutonium facilities. Depending on extension of the plutonium missions and new mission work, electrical demand in F Area could remain fairly constant beyond 2020.

The proposed relocation and restructuring of the Savannah River Technology Center (SRTC) may increase electrical demand in F or H Area. H, S, and Z Areas will remain active industrial facilities throughout the planning period with electrical demand remaining relatively constant.

By 2010, C, P, and R Reactor Areas will only require minimal electrical service required for environmental restoration and Long Term Stewardship activities. K Area will be involved in the excess plutonium program through 2018; L Area will be involved in the Spent Fuel Program through 2037; and electrical service will be maintained in those areas for those respective periods of time.

Electrical service to N Area will remain constant throughout the planning period and demand may increase as warehousing and maintenance operations are consolidated.

Steam System

Current Configuration. The D-Area Powerhouse provides most of the production steam used for heat, hot water, and process functions for the site. The steam is transported from D Area to F, H, S, and C Areas through a 24-inch inter-area steam line approximately seven miles long. Steam is also supplied from the D-Area Powerhouse to TNX. The D-Area Powerhouse is operated by the South Carolina Electric & Gas Company under a lease agreement, and the steam is purchased by SRS under a long-term contract. A backup powerhouse in H Area is currently maintained in a standby status (see Figure 5.2).

Other site areas utilizing steam are A, K, and L Areas. Steam in A Area is supplied by the A-Area Powerhouse, which operates 24 hours per day. The steam is transported to numerous buildings in the area via an aboveground, intra-area distribution system. The primary use of steam in A Area is for heat and hot water for buildings and some process functions in SRTC and the Savannah River Ecology Lab (SREL). Two fuel oil-fired package boilers, located in K Area, supply the steam to K and L Areas. The steam is primarily used for heating, and the system is not used during the warmer months. The steam is transported in each area through an aboveground distribution system, and the two areas are tied together via a six-inch inter-area steam line.

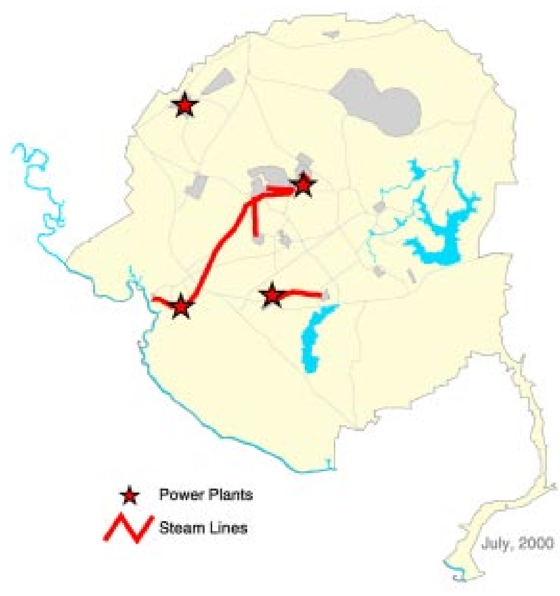


Figure 5.2
SRS Steam System

Current Capacity/Demand. The D-Area Powerhouse has four 330,000-pounds per hour (lbs/hour) boilers and three high-pressure and four low-pressure electrical turbine generators. The average current steam load is approximately 120,000 lbs/hour, 24 hours per day, at a pressure of 385 pounds per square inch gauge. Peak winter loads reach approximately 280,000 lbs/hour. The average electricity generated to support the steam requirements is approximately 20 megawatts. Maximum electrical design capacity is 70 megawatts.

The H-Area Powerhouse includes three 60,000-lbs/hour boilers that are currently out of service. Recent studies have shown that rehabilitation of the H Area Powerhouse to replace the D-Area facility that currently supplies steam to F and H Areas would be cost effective

The A-Area Powerhouse produces only steam and has two 60,000 lbs/hour boilers. The average load is 30,000 lbs/hour with a winter peak average of 40,000 lbs/hour. This powerhouse has no electrical generation capacity.

K Area has two package boilers with capacities of 30,000 and 60,000lbs/hour. The average load for the two boilers is approximately 15,000 lbs/hour, and either boiler is capable of supplying the load.

Condition. The steam systems at SRS are aging and require a high level of maintenance. The A-, H-, and D-Area facilities were constructed in the early 1950s and the boilers have been overhauled numerous times. The A-Area plant and the steam distribution system are generally in good condition. The D-Area Powerhouse was designed to last 40 years and has exceeded that timeframe. Through good maintenance, the facility has managed to operate without any major unplanned outages. However, some equipment and components have begun to fail. In order to ensure that a reliable steam supply continues into the future, capital upgrades or total replacement will be necessary.

The K-Area boilers are in a standby mode and do not provide continuous steam. The H-Area boilers were shutdown in January 2000 and will be overhauled or refurbished in the near future to meet all of the F- and H-Areas future steam needs. The K-Area package boilers were installed in 1991 and are in good condition. During the summer months the boilers are shutdown and a nitrogen blanket is applied to the system to reduce the possibility of corrosion to the waterwall tubes. With good maintenance, these boilers should be available for many years.

Constraints. The current condition of the D- Powerhouse increases the risk that the supply of steam to the major process facilities could be interrupted. If steam is lost in D Area or if the main 24-inch inter-area steam header fails, no steam will be available to the process areas. Therefore, planning is currently in progress to replace the D-Area facility and greatly reduce the length of the supply header.

Future Requirements. Under the proposed reconfiguration, steam may not be required in A Area by 2010; however, steam will be required for F, H, L, K, and S Area, which may be supplied by the upgraded H-Area Powerhouse starting around 2006. No change to the current loads will occur, as facilities are shutdown over the next 25 years. Use of the D-Area Powerhouse will be discontinued in 2006, and the upgraded H-Area Powerhouse will assume responsibility for steam generation. A study should be performed to assess the future steam demands in the reconfigured site and to evaluate the H-Area Powerhouse ability to supply that capacity. This analysis should include the option of using energy efficient, non-steam heat sources for new facilities including SRTC.

The Steam System Upgrades Project, as part of the proposed Infrastructure Restoration and Reconfiguration Line Item, would provide for the replacement and upgrade of critical portions of the site's steam distribution and production systems. Included in this scope are steam lines, supports, hangers, poles, steam trap stations, control systems, boilers, and steam metering equipment. Many of the steam systems, lines, and components have aged past their design life and are in need of replacement and upgrade. This proposed project will align production capabilities with demand, replace aged equipment, and bring systems into alignment with current codes and standards.

Domestic Water System

Current Configuration. Nearly all of the site's domestic water is provided by a single-loop system completed in 1997. The Consolidated Domestic Water Project replaced ten smaller, outdated water plants with a treatment plant in A Area, a 37-mile loop distribution system, and three elevated storage tanks. Water for the system is furnished from three existing wells near A Area. The primary loop serves eight major site areas, as follows: A/M, B, C, F, H, N, S, and the U.S. Forest Service-Savannah River (USFS-SR). An existing water plant in B Area was upgraded to serve as a backup. As part of the same project, TNX was tied to an existing plant in D Area, and L Area was connected to an existing K-Area plant (see Figure 5.3). Some of the more remote areas and barricades are still served by small well systems and bottled water.

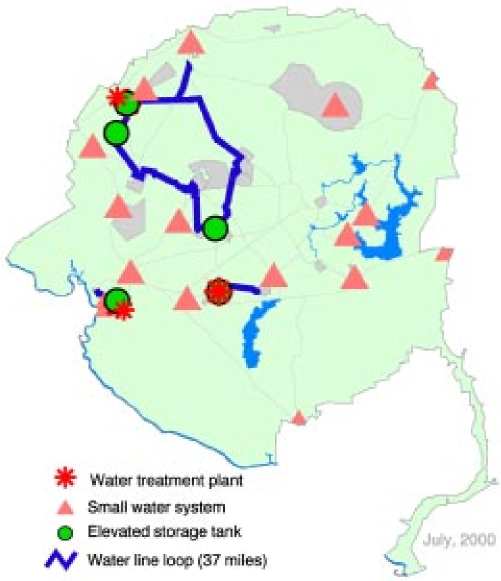


Figure 5.3
SRS domestic water system

Current Capacity/Demand. The site's total water production capacity is 8.5 million gallons per day (mgd). Total elevated storage tank capacity is approximately 1.625 million gallons. Water production capacity is distributed as shown in Table 5.1.

Average demand on all combined domestic water systems is about 1.2 mgd, approximately 19 percent of capacity. Peak demand is about 2.4 mgd, 38 percent of capacity. This significant reserve is available because, there were more than 25,000 people working at SRS in the early 1990s when the upgrade projects were initiated and a significant program of reactor operations was anticipated.

Condition. All primary treatment and distribution systems are relatively new. The K/L-Area treatment facility was completed in 1993, the D-Area facility and wells were completed in 1995, and the consolidated site-wide water system facilities were completed in 1997. The wells in K and A Areas were in place at the time the new facilities were constructed and are generally in good condition. Intra-area domestic water piping is of various ages and conditions; most of the piping still in place from the original site construction in the early 1950s will require repair and maintenance.

Currently the site has one well that is more than 25 years old, and in two years, the wells that are the primary source of drinking water for over 90% of the site will be 20 years old.

Table 5.1 Domestic Water Capacity

Location	Production Capacity (mgd)	Storage Capacity
Central Plant 782-3A	4.4	1.4 million gallons
B-Area Backup Plant	2.2	—
K/L-Area (K Area)	0.7	100,00 0 gallons
D/TNX	0.6	125,000 gallons
15 smaller systems	0.6	

The loss of the 104-L well would drop the rate of production of domestic water in L Area below the design maximum daily demand.

Approximately 10% of the isolation valves on the F- and H-Area domestic water distribution systems fail per year. These failures result in leaks that require service interruptions to repair. The service interruptions often impair processes and deprive personnel of potable water. The type of valves installed is not typically used for domestic water distribution isolation. Replacing these valves with standard designs will greatly reduce maintenance cost for domestic water in the affected areas.

The domestic water supply to F-Tank Farm also supplies E Area. It is undersized for the current demands, and since it is the only source of water to these facilities, the domestic water supply is vulnerable to a single point failure. The primary concern with loss of domestic water is loss of safety showers, which are supplied by domestic water. The project will provide for an alternate supply of domestic water to both E Area and F-Tank Farms.

Currently, the Central Sanitary Waste Treatment Facility (CSWTF) is supplied with domestic water from a well located in the vicinity. The water supplied by this well is high in iron content. Connecting CSWTF to the main domestic water distribution system will eliminate the need for this well and dramatically improve water quality.

Constraints. There are no significant physical constraints. This fairly new system has significant reserve capacity and covers all major areas of the site. It meets all currently known and anticipated regulatory requirements. However, some intra-area piping is old, and complete configuration and conditions are not well documented. Operational constraints exist within some areas where domestic water is used to cool breathing air compressors, provide a source of water for fire protection, and/or supply emergency eye washes and showers. The need to maintain continuous operation of these safety-related items makes any outages unacceptable.

Future Water Requirements. It is anticipated that future demand for domestic water will remain fairly constant. Because of the excess reserve capacity, a significant additional load from new missions can be accommodated.

As part of the proposed Infrastructure Restoration and Reconfiguration Line Item, domestic water upgrades will be considered, including a project to replace three domestic water production wells and convert remaining wells to submersible style pumps. It would also replace valves on the F- and H-Area domestic water distribution systems, connect the CSWTF to the main domestic-water distribution system, and will provide an alternate source of domestic water to the F-Tank Farm and E-Area facilities.

Under the proposed reconfiguration, the water requirements in A Area would drastically decrease by 2010 as functions are relocated to other site areas. By 2020, all activities would have been relocated away from A Area, and water would not be required in A Area. The water lines that connect A Area with the Site Industrial Zone may be discontinued by 2030.

The proposed relocation of most site administrative activities by 2010 would increase demand for water in B Area that should remain at a relatively constant level throughout the remainder of the planning period.

By 2010, all buildings in D, T, P, and R Areas will be inactive, and water service will not be needed. Through 2020, the current level of water service will remain in F Area. Depending on extension of the plutonium missions or new mission work, F area water service demand could remain fairly constant throughout the planning period.

The proposed relocation of SRTC would increase water demand in F or H Areas. S and Z Areas will remain active industrial facilities throughout the planning period with water demand remaining relatively constant.

K Area will continue to support the excess plutonium program through 2018, and L Area will be involved in the Spent Fuel Program through 2038. Water service will be maintained in those areas throughout the planning period.

Water service to N Area will remain constant throughout the planning period.

Process Water System

Current Conditions. SRS uses several different water sources depending on need. Deionized Water (DI) is used when water is in direct contact with a process product. Well water is used for non-contact cooling, and Savannah River water is used for maintaining SRS pond and lake levels.

The existing DI system in H Area is located within the confines of the H-Area Powerhouse with a rated capacity of 500 gpm. The existing demand on the system is around 100 gpm. The resin beds are not performing well because the velocity is too low. Lower-than-designed-flow rate causes channeling in the resin bed, resulting in premature resin exhaustion, even if much of the resin bed is in a regenerated state. Operation and chemical costs greatly increase when the water flow is not within the equipment operating conditions.

Untreated well water is used for non-contact process cooling water and also for makeup to the cooling towers. Both the well water and cooling tower systems have undergone significant degradation and demand changes over the years. Additionally, changes in the environmental laws governing water quality being discharged to National Pollutant Discharge Elimination System (NPDES) outfalls have placed operating constraints not addressed by the original design of the system. Stopgap measures have been put in place but the system has reached a point where an entire system rework is necessary.

The river water system, which was originally designed to provide cooling water to the reactors, now only provides water to maintain L Lake and Par Pond water levels. To address this reduced load, a small pump was installed to provide a stopgap until the *Record of Decision for Shutdown of the River Water System Environmental Impact Statement* (FR Vol. 63, No. 18, January 28, 1998) was made. The decision to keep the lake full now necessitates the installation of a backup to the smaller pump. The use of river water for some process water requirements will be evaluated.

Constraints. The ability to handle process water upsets is restricted by the lack of meaningful operating data such as the most fundamental information such as pressure and flows.

Future Requirements. The proposed Infrastructure Restoration and Reconfiguration Line Item would replace the DI Water System in H Area with a 120-gpm skid-mounted system, which would be located away from the powerhouse. This project would reconfigure and install new instrumentation on the well water and process water systems in F, H, and L Areas. The project would rework system piping to match current demands on the system in F, H, and L Areas; it would install a small backup pump on the River Water Distributions System; and it would add variable speed drive on the wells.

SRS Dams

Current Conditions. The site has a variety of dams with varying needs for maintenance. Repair and restoration of the integrity of the earthen dams for low hazard (pre-cooler) Ponds B, 5, and 2 are ongoing efforts due to the nature of these structures. In addition, other site dams are subject to aging and deterioration and must be periodically restored. Failure of any dam has far-reaching environmental impacts. In some cases, there are contaminated sediments that would be exposed and possibly spread by dam failure. In addition, destruction of valuable habitats could occur.

Constraints. Action on dams may be limited because of radioactivity levels in the sediment and the resultant potential for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) applicability. Budgetary limitations may result in the rate of deterioration exceeding the rate of repair and maintenance, causing a continually increasing gap between the restoration requirements and the implementation of corrective actions.

Future Requirements. The proposed SRS Infrastructure Restoration and Reconfiguration Line Item would provide the funding necessary to bring dams up to an acceptable condition to meet current codes and standards. Upon completion of a detailed evaluation of the condition of site dams and an investigation of the radioactivity levels in the sediment, a repair strategy would be developed and the applicability of CERCLA will be determined. The evaluations will be conducted in fiscal years 2000–2004. Prior to fully developing the scope of work required to maintain dams in a safe and functioning condition, a detailed evaluation of deficiencies needs to be conducted. This evaluation would include the rationale for maintaining the dam, environmental impacts associated with dam failure or removal, and long-term costs associated with the dam.

Sanitary Wastewater Systems

Current Configuration. Most domestic sanitary wastewater is treated by the primary system, the Central Sanitary Wastewater Treatment Facility (CSWTF). This system was completed in 1996 and replaced 14 smaller systems. It includes 18 miles of gravity and force main collection pipe and 35 lift stations. The system's coverage includes A, B, C, F, H, N, and S Areas. Small "package" plants are used to treat TNX, D, K, L, and P Areas. Disinfection at CSWTF and the package plants is by state-of-the-art ultraviolet light systems.

SRS has established a program to treat wastewater containing very low levels of radionuclides within the sanitary wastewater treatment system. Treating these wastes in this manner provides a cost-effective method of wastewater management equivalent to commercial wastewater standards. Taking this approach ensures better management of wastewater, cost savings, and operation to commercial practices. This waste, deposited in the sanitary sewer, is bound in the biosolid sludge, which is applied to the site's forested areas.

Septic systems are in use at S Area and the Effluent Treatment Facility (ETF). H-Tank Farm has sanitary systems in the area, but these are not available to most facilities due to existing interference. This interference includes line and lift stations along E Road that do not extend under the railroad track to most office facilities.

Current Capacity/Demand. The CSWTF collection system has a capacity of 1.05 million gallons per day (gpd). The average demand on the CSWTF is about 200,000 gpd, or about 20 percent of capacity. The other package plants are all very lightly loaded at 5 to 25 percent of capacity due to the recent reduction of the number of personnel. The small "package" plants, each of which discharges to an individual NPDES-permitted outfall, have capacities as follows:

B Area	In standby
D Area	14 gallons per minute (gpm) (20,160 gpd)
TNX Area	14 gpm (20,160 gpd)
K Area	17 gpm (24,480 gpd)
L Area	24 gpm (34,560 gpd)

Condition. The CSWTF was completed in 1996, and the smaller package plants are approximately 5 to 16 years old but in good condition. Intra-area collection piping is in various ages and conditions, much of it existing from the original plant construction. The condition of at least eight of the 35 intra-area lift stations make operating costs and risk of failure high. Most of the interconnecting pipe has degraded to the point that rainwater seeps into unpressurized sections. Rainwater infiltration can adversely impact treatment of the sanitary waste. In addition, many of the lift stations are reaching the end of their expected life and are in various states of disrepair. The rusty and deteriorated control panels present safety risks and, when compounded with a lack of spare parts, have resulted in improvised repair methods. Most lift stations are not equipped with remote alarms that alert of impending spills or pump failures. Operating experience at the CSWTF has shown that waste does not adequately mix during the treatment process, making the site vulnerable to NPDES violations.

Constraints. There are no significant physical constraints in the CSWTF. In fact, the system has excess capacity and is relatively new. Unfortunately, older lift stations could fail, causing localized problems within the system. The CSWTF is classified as an industrial wastewater facility, and the operating permit and NPDES permit granted by the South Carolina Department of Health and Environmental Control (SCDHEC) define operational constraints.

Future Requirements. A cost analysis has shown that, due to the low flows in L Area, the installation of septic tanks would be more cost-effective than operating the package wastewater plant. The B-Area plant is being studied for use as pretreatment of special waste streams. An engineering study of intra-area collection systems and lift stations is necessary to determine if upgrade or replacement is necessary.

The Sanitary Sewer Upgrades Project, as part of the proposed Infrastructure Restoration and Reconfiguration Line Item, would provide for the replacement and repair, as necessary, of the intra-area sanitary collection system, along with process improvements for the CSWTF. This project would replace degraded pipe and older pump stations and install alarms at the pump station, which will report back to a monitored location. Process improvements to the CSWTF would include installation of propellers in the oxidation ditches and upgrades to the existing ultra-violet disinfection bank.

In the proposed reconfiguration scenario, the sewer requirements in A Area would decrease by 2010 as functions are relocated to other site areas. By 2020, all activities would have been relocated away from A Area, and sewer would not be required in A Area. The sewer lines that connect A Area with the Site Industrial Zone may be discontinued by 2020.

The proposed relocation of most site administrative activities by 2010 would increase demand for sewer service in B Area. Other than increases due to the proposed reconfiguration, the demand should remain relatively constant throughout the remainder of the planning period.

By 2010, all buildings in D, T, P, and R Areas will be inactive, and sewer service will not be needed.

Through 2020, the current level of sewer service will remain in F Area. Beyond 2020, sewer service requirements will depend on extension of the plutonium missions and other possible new missions in F Area.

Relocation of SRTC may increase sewer demand in F or H Areas. S and Z Areas will remain active industrial facilities throughout the planning period with sewer demand remaining relatively constant.

K Area will be involved in the excess plutonium program through 2018; L Area will be involved in the Spent Fuel Program through 2037 and sewer service will be maintained in those areas for those respective periods of time.

Sewer service to N Area will remain constant throughout the planning period. All investments in infrastructure upgrades should be evaluated for consistency with the reconfiguration concept.

Central Chillers

Current Configuration. The A-Area central chilled water system is supplied by a 3,600-ton chiller plant completed in 1996. This facility houses three 1,000-ton chillers and one 600-ton chiller. The facility, which has a state-of-the art control system allowing operation with minimal human operator input, provides chilled water for nine A-Area buildings through approximately 10,000 feet of underground supply and return chilled water piping.

The A-Area chilled water system is the only area-wide system at SRS. Most of the other chiller plants on site service individual production facilities.

Current Capacity/Demand. The A-Area Central Chilled Water Plant has 3,600 tons of cooling capacity. Average demand on this chilled water facility is approximately 1,500 tons on a normal summer day. Peak demand is approximately 2,200 tons when Fahrenheit temperatures reach the upper 90s. Because the optimum energy efficiency of chillers is typically at the 50 to 75 percent load range, this facility begins losing energy efficiency at any conditions requiring 2,700 tons or more. When this chiller was built, there were more than 20,000 people working at SRS, and M Area was included in capacity requirements. Since then, there have been staff reductions and M Area has been disconnected from this facility with a resultant reduction in cooling demand.

Condition. The A-Area chiller plant has been operational since 1996 and is in excellent condition. However, the chilled water distribution piping is the original piping installed in the 1950s. It is asphalt-lined cast iron and remains in excellent condition despite its advanced age.

Constraints. There are no significant physical constraints. This fairly new plant has significant reserve capacity and covers all major facilities in A Area, meeting all currently known and anticipated regulatory requirements.

Future Requirements. Under the proposed reconfiguration, the chiller requirements in A Area would drastically decrease by 2010, as functions would be relocated to other site areas. By 2030, all activities would have been relocated away from A Area, and a chiller system would not be required in A Area.

All other site areas have independent chiller systems, which will be discontinued as buildings are no longer used or upgraded as needed.

The proposed relocation of administrative functions to B Area would require upgrading the chiller facility in B Area to accommodate the increased demand. Construction of new facilities would include evaluation of the use of energy-efficient cooling systems and the most cost-effective way to supply cooling to the administrative complex.

Primary Roads

Current Configuration. Four state highways, as described below, provide primary access to the site.

- S. C. Highway 19, a four-lane highway, provides primary access from Aiken, South Carolina.
- S. C. Highway 125, a four-lane highway, provides access from Augusta, Georgia. From the opposite direction, Highway 125 provides access from Allendale, South Carolina as a two-lane road and passes through the site as a two-lane road open to the public.
- S. C. Highway 64, a four-lane road, provides access from Barnwell, South Carolina.
- S. C. Highway 39, a two-lane road, provides access from Williston, South Carolina.

Within the site, the primary road system consists of nine bridges and approximately 130 miles of paved roads (see Figure 5.4). Major site arteries intersecting the state road system are Roads C, B, 1, 2, 3, 6, and 8. The highest traffic routes are Roads C, E, F, 1, 2, and 4. Table 5.2 and Table 5.3 provide basic data on the current capacity and demand for SRS roads and bridges.

Condition. SRS roads generally have stable or free flow traffic, with the exception of Roads 4, D, E, and F. There is visual evidence of sub-grade and pavement distress such as cracks, depressions, rutting, shoving, and spalling throughout the road system. All roads are experiencing reflective, block, alligator, and linear cracking. Pavement replacement during bridge reconstruction and core sampling indicates that the existing roads were constructed with minimal or no structural granular base. Lack of seasonal inspection, shoulder grading, and cleaning of the drainage systems over the years has contributed to the present conditions. Existing maintenance has kept the number of potholes and pavement raveling to a minimum. The roads have narrow traffic lanes compared to current state standards. These narrow lanes have resulted in pavement edge raveling, shoulder rutting, and water infiltration into the sub-grade. A recent condition assessment study will help in the prioritization of future road repair/upgrade projects.

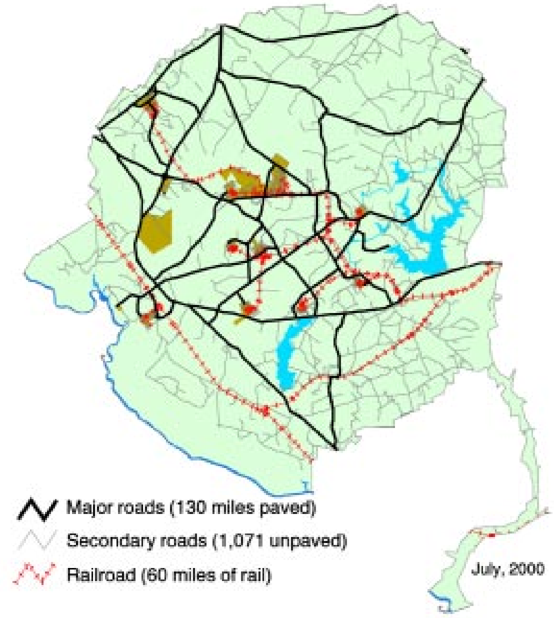


Figure 5.4
SRS primary and secondary roads and railroad systems

All primary road bridges were recently replaced, except for Bridges 603-44G (Road 8) and 603-71G (Road B). Posted load ratings for the replaced bridges are 45 tons for tractor-trailers and 20 tons for single axles.

Due to an overall decrease in funding for SRS infrastructure support, road repair projects have received insufficient funding to allow adequate maintenance to site roads on an annual basis. Normal practice is to resurface roads on a routine schedule. However, the last major resurfacing at SRS was more than 5 years ago. Since then, funds have been available only to patch.

Table 5.2. Current Capacity/Demand for SRS Roads

Road	Number of Lanes	Average Daily Traffic	Level of Service*
A (SC125)	2	1,600	Stable Flow
B	4	1,650	Free Flow
C	4	11,000	Free Flow
D	2	3,800	Unstable Flow
E	2	5,900	Unstable Flow
F	2	6,400	Approaching Unstable Flow
1	2	N/A	Stable Flow
2	2	3,400	Stable Flow
3	2	N/A	Stable Flow
4	2	7,000	Unstable Flow
5	2	N/A	Stable Flow
6	2	1,500	Stable Flow
7	2	N/A	Stable Flow
8	2	750	Stable Flow

** See Appendix F for an explanation of levels of service*

Constraints. The significant physical constraints to the primary road system are lane widths, and for some roads, the number of lanes. Primary roads and bridges are rated to carry most heavy loads associated with construction and operation. As is standard with over-the-road shipments, heavy loads to be carried on site- or state-maintained roads require necessary permitting and preplanned route approval from the agency responsible for the roads.

Future Requirements. The existing system has adequate reserve for normal demands and is in adequate physical condition to handle that demand. However, significant additional load from new missions cannot be accommodated on all roads. Mission changes may alter the volume, type of traffic, and loading on sections of the road system, which would require widening affected roads from 10-foot lanes to 12-foot lanes, adding extra traffic lanes, resurfacing, increasing the structural capacity, or discontinuing maintenance, as appropriate. In addition, with the traffic into B Area expected to significantly increase due to the proposed reconfiguration, it may be necessary to widen Road 2 from a two-lane road to a four-lane road.

Table 5.3. Current Rating for SRS Bridges

Bridge	Location	Rating	Number of Lanes
603-1G	Upper Three Runs (Road C)	45 tons T/T*, 20 tons S/A	4
603-2G	Fourmile Branch (Road C)	45 tons T/T, 20 tons S/A	4
603-3G	Upper Three Runs (Road F)	45 tons T/T, 20 tons S/A	2
603-4G	Fourmile Branch (Road 4)	45 tons T/T, 20 tons S/A	2
603-11G	Fourmile Branch (Road 5)	45 tons T/T, 20 tons S/A	2
603-67G	Cloverleaf (Road 2/Road C)	45 tons T/T, 20 tons S/A	4
603-72G	Lower Three Runs (Road B)	45 tons T/T, 20 tons S/A	2
603-71G	Lower Three Runs (Road B)	36 tons T/T, 20 tons S/A	2
603-44G	Par Pond (Road 8)**	14 tons T/T, 8 tons S/A	2

** T/T – Tractor Trailer; S/A – Single Axle*
*** Construction of a new bridge is in progress*

The Transportation Improvement Project of the proposed Infrastructure Restoration and Reconfiguration Line Item would reconstruct the most deteriorated site roads to meet American Association of State Highway and Transportation Officials (AASHTO) standards and restore deteriorated subsurface structures, replace collapsing culverts, improve drainage and erosion control, and rework road shoulders. Approximately 70 miles of road would be repaved. This reconstruction will return loading capacity to meet present and future traffic demands.

As areas close, the roads that service the area will only be maintained sufficiently to support access for Long Term Stewardship and environmental monitoring activities.

Secondary Roads

Current Configuration. The current secondary road system consists of 1,071 miles of unpaved roadways and 31 miles of low-traffic-volume paved road. Secondary roads are a dynamic system with new roads being constructed frequently to serve various site needs. The majority of new secondary road construction is required for access to test wells, utility lines, or research sites. A small portion of the new construction is to access areas for logging. Most of these are temporary and are seeded and abandoned following the logging operation. Locations of all secondary roads are planned and coordinated through the Site Use System.

Current Capacity/Demand. The capacity of the present secondary road system adequately meets current and projected traffic loading. Increased demand comes from the need for new access.

Condition. The current condition of the secondary road transportation system is good. All major secondary road bridges have been replaced or are under replacement. Culvert replacement is averaging 1000 linear feet (5 percent) per year. Gravel replacement is occurring at a rate of two miles of road per year. New road construction averages between three and five miles annually.

Constraints. Constraints include those typically considered for development, such as Research Set-Aside Areas, funding, topography, and soils.

Future Requirements. Additional work currently planned includes paving Burma Road, increasing the frequency of gravel replacement, providing dust abatement on arterial roads, and improving ditching and tree removal on some collector and local roads. Future requirements for secondary road systems primarily depend on site mission decisions. In addition, new and existing secondary roads may need to be constructed to a higher standard to allow heavier environmental monitoring equipment access to present and future well sites. In the proposed reconfiguration scenario, the primary roads in B Area would need to be appropriately sized to handle the demand of additional staff in that area.

Railroads

Current Configuration. The SRS railroad system consists of approximately 60 miles of rail line, including 35 miles of main line track and 25 miles of yard, spur, and lead tracks. The site currently maintains 45 miles of track to Class III American Railway Engineering Association (AREA) standards. Thirteen miles of track are not being used and have been abandoned. Three miles of track in D Area are leased to the South Carolina Electric & Gas Company. SRS operates two late-model diesel-electric locomotives and has an assortment of flat cars and cask cars for inter-area shipments. Of the 38 highway grade crossings, 21 are protected by automatic crossing protection devices.

The South Carolina Department of Highways, the CSX Railroad, which provides commercial railroad service to SRS from Augusta, Georgia, and the South Carolina Electric and Gas Company hold rights-of-way for SRS railroads.

Current Capacity/Demand. Current railroad operations include onsite movement of spent nuclear fuel rods from former reactor areas to nuclear materials stabilization facilities; movement of foreign reactor spent nuclear fuel rods and primary Naval Reactor components from the railroad classification yard to receiving locations; and movement of piping and mixing assemblies from separations areas to the site Burial Ground. Currently, no coal, steel, rock, sand, or other raw materials transit through the site railroad. The current locomotive equipment fleet and tracks are capable of handling both current and future site missions.

Condition. In-service track is maintained to AREA Class III standards. Condition assessment surveys of track have been performed twice in the last four years, and deterioration is maintained to an acceptable degree. Abandoned track is deteriorating at a normal rate.

Approximately 90 percent of the site's tracks are 90-pound AREA rail with approximately half its usable life remaining. The rail is not suitable for most commercial railroad operations but could be utilized for industrial facilities, short line railroads, and sidings. Abandoned rail is therefore more valuable if retained for future SRS missions and spare materials than if sold as salvage steel. Both SRS locomotives are late models, less than 10 years old, and in good operating condition. Although over 20 years old, flat cars and cask cars have been well maintained and are in good condition.

Constraints. Normal railroad service is provided 12 hours per day, seven days per week. Customer requirements beyond this schedule involve additional overtime costs. Also, due to limited budgets in recent years, it is difficult to maintain all main line track to Class III standards.

Future Requirements. The SRS railroad system will be important throughout the planning period to support the Spent Fuel Program and the shipment of waste. In addition to truck shipments, the Defense Waste Processing Facility (DWPF) is expected to eventually ship radioactive glass canisters by rail to a final federal repository. Approximately 3,000 to 10,000 feet of track would be required for a new loading facility at DWPF, as well as new equipment for shipping canisters. The tritium-producing burnable absorber rods will be transported by truck, but the railroad system will be considered as backup capacity.

As part of the Transportation Improvement Project, the site is proposing to refurbish selected site railroads to meet Federal Railroad Administration (FRA) standards Class III or better and rehabilitate deteriorating railroad crossings, ditches, and signals. This project would allow refurbishment of approximately 50 miles of SRS primary railroad. The reconstruction would return loading capacity to meet present and future traffic demands, return track speed to 40 miles per hour (mph) rating from the current 25 mph, and improve safety for SRS employees and subcontractors.

Aviation

Current Configuration. SRS aviation capability consists of two Eurocopter BK-117 helicopters stationed in B Area. These helicopters are used for security activities and are operated and maintained by the site's security contractor. The B-Area facility is adjacent to the security contractor's site headquarters and consists of a landing pad and operations/maintenance facility. Aviation obstruction lights and other safety equipment are provided at all key locations site-wide.

Current Capacity/Demand. Each aircraft is capable of carrying nine personnel (including pilot), and each is outfitted with additional specialized security equipment. The two craft and their associated facilities are deemed adequate for the existing security mission. The craft are available to support other site activities, including aerial photography and mapping, emergency evacuations, forest and wildlife monitoring, and fire surveillance. Special requirements for fixed wing or other special purpose aircraft are accommodated by contracting with outside commercial aviation services.

Condition. The two helicopters and their support facilities were placed in operation between 1984 and 1986. They are maintained in excellent condition and are considered capable of supporting all current and anticipated future missions.

Constraints. Adequate budget has been provided to keep the aviation system in a good operating condition. The only constraints on the system are the normal constraints of any aircraft, primarily inclement weather.

Future Requirements. The existing aviation equipment will be replaced with aircraft to meet optimum program requirements. This replacement will occur at the end of the life cycle (approximately 2006) of the BK-117 helicopters. There are no known or anticipated future missions that would require additional in-house aviation capability. Conversely, there is no anticipated reduction in the need for the existing fleet. Construction of additional administrative facilities in B Area due to the proposed reconfiguration would require the relocation of the heliport and its support building to a less congested area. The optimal location of the heliport would be evaluated with safety, security, and medical evacuation needs taken into consideration.

Accessibility of Airports. Two commercial airports in the vicinity of SRS provide commercial service to major U. S. cities and other major airports. Bush Field in Augusta, Georgia, is located approximately 21 miles from SRS. Columbia Metro airport in West Columbia, South Carolina, is located approximately 56 miles from SRS. Both Bush Field and Columbia Metro are fully capable of handling anticipated site needs.

Both airports provide air cargo service including the capability of shipping and receiving major non-nuclear weapon components. Experience at Bush Field includes handling a variety of cargo airplanes, including the C-5A with a cargo capacity greater than 400,000 pounds. Columbia Metro, which has a runway with a Category II approach and a centerline separation from the runway of 700 feet, is also able to facilitate the easy maneuvering of large, heavy, wide-bodied aircraft such as the C-5A.

Water Transportation

Current Configuration and Future Requirements. Approximately 40 watercraft, ranging from 14-foot skiffs to a 24-foot pontoon boat, operate for research, monitoring, and security patrols. Waterborne activities primarily occur on the site's lakes and ponds and the Savannah River along the site's southern boundary. The Savannah River is a navigable river, and SRS has a dock facility near T Area. Although there is not an anticipated need for the dock facility given present operations, minimal maintenance of the facility is necessary to ensure potential future use.

Voice Communications Network

Current Configuration. SRS telephone service is currently provided by dual AT&T central office switching systems, acquired in 1994 as part of the Replacement Telecommunications System Project. An extensive fiber optic network supports the configuration across the system's 12 individual area switching nodes in the site's operating areas. Off-site network services are provided under the Federal FTS-2000 contract agreement and are routed in a redundant and route-diverse "smart-ring" configuration, which offers additional reliability.

The systems are managed under a subcontract agreement with Bell Atlantic's Federal Systems Group (BAFIS).

Current Capacity/Demand. Current system capacity of 30,000 lines significantly exceeds the needs of the current site population though additional growth is forecast to support new missions in the future. Traffic load remains stable and well within system capacity.

Condition. Overall condition of voice communications is excellent. Service availability remains high, and system useful life is projected to extend through 2015 with regular software and hardware upgrades as required to maintain vendor support.

Constraints. There are no significant physical constraints. This system has significant reserve capacity and covers all major areas of the site.

Future Requirements. Realignment of existing system components would be required to support expected population upturns in B Area and F Area as a direct result of new mission activity and finalized site reconfiguration plans.

Data Communications Network

Current Configuration. A robust site-wide data network infrastructure is in place that supports data communications in both the classified and unclassified environments. Current network architecture consists of shared Ethernet segments supporting approximately 30,000 access points, which are interconnected by a high-speed fiber backbone. Transmission Control Protocol/Internet Protocol (TCP/IP) remains the site standard routing protocol.

In response to recent technical advances the site has moved to a strategy to employ more effective Ethernet technologies in favor of a substantially more cost-effective approach which utilizes Ethernet technologies (Switched Ethernet, Fast Ethernet, and Gigabit Ethernet). Transition to that environment is expected in fiscal year 2002.

Offsite connectivity is provided by high-speed access to the DOE network backbone, and protected access to the Internet is also provisioned by this facility.

Backup, recovery, and protection capabilities for all components of the network are in place consistent with evolving mission requirements and best business practices.

Current Capacity/Demand. The site's current network capacity remains adequate to meet existing demand though internal data traffic loads continue to increase at rates in excess of 20 percent per year as a result of legacy applications replacements and the increasing use of technology to automate site business processes.

Condition. Overall condition of the equipment and backbone elements of the network is good. However, rapid change in technology continues to drive obsolescence within the installed configuration. Older inside wiring in many site facilities will be unable to support the high bandwidth requirements of the site's more strategic systems, and replacement will be necessary as these needs arise.

Constraints. Security is an issue of growing concern in the network area. A conservative posture in the security area continues to limit more open network communication between SRS, its external partners, and stakeholders.

Future Requirements. Obsolescence issues, growing traffic load, and related assurance of vendor support will continue to drive a need to refresh and expand major network components across the site. Additionally, specific investments will be required to provide network connectivity for new mission and site reconfiguration requirements.

Potential impacts of new DOE security requirements on the existing network configuration are also an area of significant potential impact. At present, the network is authorized to carry sensitive unclassified data and, despite increasing demand for off site connectivity and the segregation of sensitive unclassified data, only one small open network is being used to support site interaction with the public. Though the site's recently approved *Cyber Protection Plan* does not alter this approach, SRS expects pressures in this area to intensify. To address these requirements, the site is working to identify and implement acceptable solutions that will support separation of network traffic.

Additionally, questions have been raised regarding the vulnerability of the site's wiring closets, many of which exist in unsecured office and plant areas. Funding to protect these areas (partitioning, access control, mechanical upgrades, etc.) is required to assure that they are compliant with new security requirements.

Computing Infrastructure

Current Configuration. The site's shared computing infrastructure provides processing and storage facilities for site-wide software applications, centralized file, print and desktop software services for over 11,000 personal computers, and several site-wide information delivery products including electronic mail, data warehousing, and Intranet/Internet services

(ShRINE). Operations are highly centralized in the 703-A/703-44A Central Computing Facility (CCF) and are supported by both on-site backup (707-C) and off-site disaster recovery support. An industry-recognized Customer Response Center (CRC) provides integrated help desk support across the site.

The site continues to migrate toward a shared set of strategic technologies including UNIX/Oracle for applications delivery and WINTEL products at the desktop. However, a significant mainframe operation remains in place to support the site's legacy business applications portfolio.

Leasing strategies, already in place for MVS, UNIX, NT operating systems' environments, as well as personal computers, continue to demonstrate the most cost-effective approach to the site's technology requirements, and the site is quickly moving toward that configuration.

Current Capacity/Demand. Though requirements for most of the services identified above will continue to correlate closely with overall site population trends, demand for increased processing and storage of electronic information continues to grow at all levels as this technology assumes a more integral role in site business process automation.

Condition. Overall condition of the computing infrastructure is strong, and the site is well positioned from a strategic perspective. However, rapid technological change in this area will impose significant obsolescence risk throughout the planning term. Experience shows that continuing vendor support of the technology will continue to be a primary for replacement activity. With the exception of the 703-A basement area, both data center facilities are in good condition.

Future Requirements. After factoring annual improvement in the cost performance of the technology in the future, SRS anticipates increases in server and storage needs through fiscal year 2010 to support expanding requirements. Additionally, significant upward impacts are expected from the Core Applications Replacement, expansion of the Passport software suite (managed maintenance), and the Automated Information Management Program (AIM) (automated engineering technical baseline management). Recent directives in the DOE Computer Security Program would also suggest that potentially significant changes to the site's unclassified computing configuration will be required to support the physical segregation of sensitive unclassified information. Pending final decisions regarding the reconfiguration of SRS administrative facilities, the Central Computing Facility may need to be relocated in B Area.

Core Business Systems Software

Current Configuration. This component of the SRS infrastructure provides the primary set of applications supporting the SRS prime contractor's business operations. Specific business functions supported include human resource/payroll, financial planning and management, procurement and accounts payable, property and materials management, and training. These systems are primarily mainframe-based and were custom developed in the late 1980s and early 1990s to support SRS-specific business processes and reporting requirements.

In addition to this core applications configuration, the Passport software product is being implemented to provide integrated management of the site's maintenance operations including work management and maintenance employee qualifications. Other modules of the Passport product are being evaluated to provide expanded integration in the inventory and exposure management areas.

Current Capacity/Demand. Demand for added functionality, automation, and integrated information remains a primary driver in the site's business reengineering efforts. The site will continue to rely on strategic software investment to improve cost effectiveness in both the support organizations and in the field.

Condition. For some time, SRS has recognized the deteriorating condition of the site's core set of legacy business systems. In the current environment, the urgency for replacement has risen considerably. The age of the current software portfolio is a primary factor with impacts on several fronts. Two of the three primary applications are nearly ten years old, and the third is nearing twenty. All are based in dated mainframe technology and have significant custom-coded components. Years of modification and enhancement of these systems have left them extremely complex with the result that software quality assurance is increasingly difficult. The underlying technology supporting the environment is equally dated, and the site, for the first time, now faces the actual withdrawal of vendor product support for the current human resource/payroll system configuration at the end of fiscal year 2003. Also, technical staff knowledgeable in these systems' functionality has eroded considerably through attrition and retirement. The threat of a substantial disruption to business operations in the event of a major system failure with potential for extended business interruption is now an increasingly recognized operational risk.

In the maintenance area, the Passport work management system implementation in fiscal year 1999 was an important step in improving the site's strategic position in that it replaced a much older and deteriorating system. The product is stable and capacity has been provided to support site-wide operations. At present the core Passport environment has been rolled out site-wide and efforts are underway to leverage its capabilities through implementation of additional modules and by integration with other site systems.

Future Requirements. To address immediate concerns, SRS has formally proposed replacement of the human resource/payroll system with an integrated commercial software product as a first step in an overall strategy for overall replacement of the legacy systems portfolio. Current projections are that proposed project will extend through fiscal year 2003.

Longer term, a comprehensive applications replacement strategy has been developed that will mitigate increasing risk and better position the site for business demands in the future. The human resource/payroll replacement represents the first step in execution of that strategy.

In the maintenance support area, expansion of the Passport product implementation presents further opportunity to reduce risk, improve productivity, and reduce costs in the maintenance and operations environments. Specifically, lockout, inventory, and materials management modules all offer significant opportunity to better integrate the maintenance function with materials acquisition and overall work management requirements.

Public Address/Safety Alarm System

Current Configuration. The Public Address/Safety Alarm System (PA/SAS) is the primary means for notifying onsite personnel of emergencies. The system uses audible alarms and a public address system to inform personnel of emergency conditions and to provide instruction for required protective actions. In areas not served by the PA/SAS, tone-activated radio receivers, pagers, sirens, and other radio systems are used to provide emergency notifications. The existing PA/SAS is not a site-wide integrated system; most areas have stand-alone systems operated by area control room personnel.

Current Capacity/Demand. Due to the steady growth of personnel and facilities in F and H Areas, the PA/SAS has been loaded beyond desirable levels. Overloading has caused reduced audible levels and increased maintenance problems in some areas. Specifically, dozens of "dead" zones, where the PA/SAS cannot be heard, have been identified in FB-Line and HB-Line, and compensatory measures must be employed in these areas. Administrative controls are in place requiring sweeps of these areas during emergencies; however, this creates an added level of hazard for the personnel who conduct the sweep.

In N Area, a standard safety alarm system using distinct audible signals is not installed. Instead, there is a temporary setup using steady sirens to alert employees of emergencies. Current plans are for these sirens to be replaced with the standard SRS safety alarm system.

The current system of relaying notifications from the Emergency Duty Officer via the control rooms reduces time that could be used for taking shelter or implementing other emergency instructions. Other area PA/SAS deficiencies are being corrected as they are identified at the facility level.

Condition. The current system is in need of replacement and/or upgrade. Occupational Safety and Health Administration (OSHA) regulations (29 CFR, Part 1910) require an alarm system to alert employees to dangerous situations, e.g. nuclear incidents, toxic gas releases, tornadoes, and other evacuations. Several DOE-SR Facility Evaluation Board findings and a DOE-SR deficiency have been logged against the Emergency Services Department concerning the inadequacies of the site-wide Safety Alarm System (SAS). Although the concerns address audibility and intelligibility of the system, an underlying cause is the poor conditions of many parts of the system due to age. Alternative administrative controls and other emergency notification processes have been implemented, but these controls are labor intensive and drive operating costs higher.

Future Requirements. A project is being proposed to upgrade and enhance the PA/SAS as part of the proposed Infrastructure Restoration and Reconfiguration Line Item. The Site-Wide Safety Alarm System Project would systematically analyze targeted buildings in all areas of the site for potential major repair/replacement of the SAS. The scope would involve replacing SAS speakers that are also used in conjunction with the site PA System, replacement of severely degraded cable which in some buildings is 45 years old, replacing amplifiers, adding new speakers in dead zones, and upgrading the system for inter-area communications.

The project will improve the transmission of emergency information to personnel over the entire site by upgrading the inter-area site infrastructure and intra-area deficiencies. Code deficiencies exist in the area of system supervision and backup power supplies. Operational and maintenance deficiencies exist in the form of overloaded amplifiers, dead zones, and deteriorated outdoor equipment and wiring. Communication links from the recently upgraded SRS Emergency Operations Center and SRS Emergency Response Organization will be upgraded to utilize fiber optic network, telephone ring down systems, radio systems, and paging systems. Other alternatives will be evaluated to ensure selection of the most cost-effective options.

Demand and future requirements of the PA/SAS system are related to the activities in facilities; therefore, these systems will be adjusted and maintained appropriately to meet demand in the areas.

Chapter 6

Natural Resources Plan

Purpose

The Natural Resources Plan provides an overview of the site's natural resources. It also provides information to ensure natural resources are considered in site decisions concerning land use, new missions, and natural resource constraints that could affect proposed changes in land use. This plan also provides a link between the high-level, SRS strategic plan, *21st Century Stewards for the Nation: A Strategic Plan for 2000 and Beyond,* and more detailed site operational plans, such as the *SRS Natural Resources Management Plan (1991).*

Scope

The Natural Resources Plan covers the physical and biological components of the site's natural resources, such as plant communities and air and water quality. It provides a description of natural resources and present conditions, current management, and future actions. It also describes the site's natural resource education and research activities. More detailed information concerning resource management and research strategies can be found in organization-specific planning documents.

Natural Resources Planning Goals And Objectives

The site has three natural resource goals. These goals and the objectives to accomplish each are as follows.

Goal 1. Demonstrate excellence in environmental stewardship.

Specific objectives include:

- Efficiently and compatibly join industrial production, environmental protection, and natural resource management within the same energy complex;
- Maintain biological productivity and diversity for viable populations of all plant and animal species native to SRS;
- Maintain a healthy forest so as to produce a sustained yield of high quality sawtimber and other marketable forest products;
- Identify additional long-term research opportunities;
- Provide maximum protection and rehabilitation of the site's soil and water resources;
- Establish and demonstrate techniques for restoring and maintaining threatened and endangered species on site;
- Incorporate the Presidential policy of "no net wetlands loss;" and

- Integrate business and environmental goals using a systematic approach to environmental management, in compliance with International Standards Organization (ISO) 14001. (The ISO is comprised of groups representing 120 countries that set environmental management standards. Standard application of ISO 14001 increases cost effectiveness and environmental compliance efficiency.)

Goal 2. Provide natural resource information critical to the DOE science base.

Specific objectives include:

- Apply the principles of sustainable forest management to SRS natural resources, and
- Maintain and support a well-planned and coordinated research program under the charter of the National Environmental Research Park.

Goal 3. Provide cost-effective, flexible, and compatible programs to support SRS missions.

Specific objectives include:

- Preserve, maintain, and protect natural resources, while achieving site missions, and
- Deliver leading edge natural resource research critical to supporting DOE's mission needs.

Natural Resources Planning Assumptions

The following assumptions, based on the SRS Strategic Plan and developed in cooperation with internal and external stakeholders, will guide the future development and use of the site's natural resources.

- SRS will continue to protect and manage the site's natural resources;
- Environmental stewardship activities will be compatible with future SRS missions;
- A sustainable base of natural resources will be maintained, in addition to research efforts supporting stewardship objectives;
- Restoration of native vegetative communities and species will continue, including red-cockaded woodpecker habitat, hardwood habitat, pine savannas, and wetlands;
- The revised Red-cockaded Woodpecker Management Plan will be implemented;
- SRS natural resource operations will continue their certification under ISO 14001;
- Application of the principles of sustained yield forest management will continue to be used to protect the site's natural resource assets;
- SRS will maintain and optimize the site as a National Environmental Research Park; and
- SRS will continue to establish large-scale areas for wildlife and other research activities, to evaluate increased public requests for diverse recreational use, to strengthen biodiversity, and to allow access to the site by educational institutions for science literacy programs.

Natural Resources System Description

When the Atomic Energy Commission purchased the site in 1951, over 50 percent of the area were depleted agricultural fields and pastures. Since that time, the condition of SRS natural resources has improved significantly. Since 1952, the U. S. Forest Service has planted over 135 million seedling trees. Natural succession and the extensive forest management program have converted many open fields to forestland, and at present more than 90 percent of the site, more than 180,000 acres, is forested. In 1972, SRS was designated the country's first National Environmental Research Park (NERP). A proactive threatened and endangered species program has been established, including habitat restoration. Attempts are being made to restore Carolina bays and to initiate large-scale research projects. Currently, natural resource management is actively practiced on over 80 percent of the total site area (see Figure 6.1) and will continue to be practiced based on the concept of environmental stewardship, with an increasing emphasis on reducing costs.

As part of the SRS Red-cockaded Woodpecker (RCW) Management Plan, the site is divided into three natural resource habitat management zones (see Table 6.1). These natural resource habitat management areas are: (1) the 86,069-acre Red-cockaded Woodpecker Habitat Management Area, (2) the 48,167-acre Supplemental Red-cockaded Woodpecker Habitat Management Area, and (3) the remaining 64,111 acres, designated as the Other Use Area (*Savannah River Site Red-cockaded Woodpecker Management Plan*, 1999, unpublished report, USDA Forest Service-Savannah River). For natural resource management purposes, the site also is divided into over 90 natural resource compartments, formerly identified as timber management compartments. The boundaries for the three habitat management areas were developed in cooperation with the U.S. Fish and Wildlife Service and are based on the location of current site operations, red-cockaded woodpecker colonies, recruitment stands, and foraging areas.

The 10,012-acre Crackerneck Wildlife Management Area and Ecological Reserve is part of the Other Use Habitat Management Area (*Crackerneck Wildlife Management Area and Ecological Preserve, Comprehensive Natural Resources Management Plan*, 1999, unpublished report, South Carolina Department of Natural Resources) (see Figure 2.9). An agreement was signed in June 1999, between the Department of Energy (DOE) and the South Carolina Department of Natural Resources (SCDNR), giving the State of South Carolina the overall management responsibility for the reserve and its wildlife species. The Crackerneck area is recognized as a habitat for several wildlife species. The agreement formally establishes the ongoing preservation and maintenance of the reserve by designating a portion of the site to be made available for the use and enjoyment of the surrounding community. The goals for this area are to conserve and enhance its natural attributes, preserve its natural state, conserve its valuable resources, and provide for its continued use as a public recreation area. At the conclusion of the Department's mission at SRS, DOE and the State of South Carolina will work together with local communities and the public to propose guidelines and explore options to ensure that the Crackerneck Wildlife Management

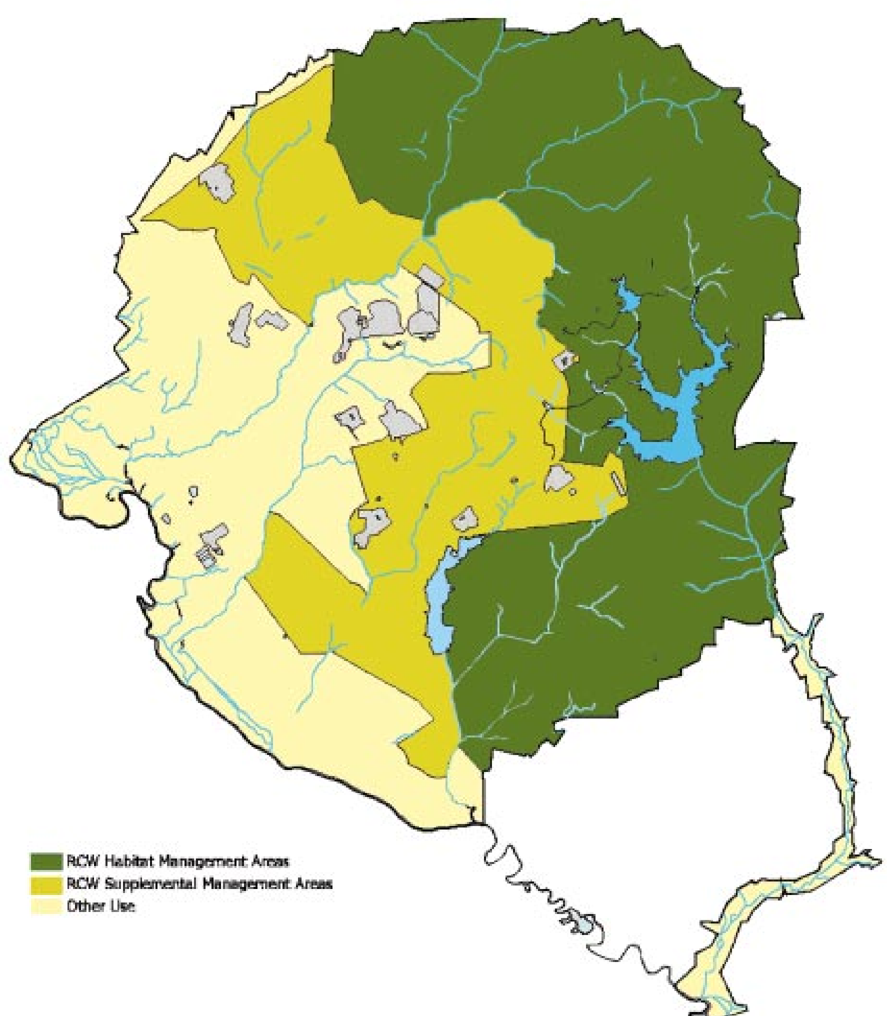


Figure 6.1
Natural resource habitat management areas

Area and Ecological Reserve remains protected, conserved, and managed. This will include the option of eventual transfer to the South Carolina Department of Natural Resources.

Natural Resources System Components

The Natural Resources Plan encompasses nine components: plant communities, renewable forest products, wildlife, surface water, soils, air quality, recreation, education, and research activities. For each component, the discussion that follows addresses existing conditions, current management activities, constraints that could affect proposed land use changes, and planned or expected future actions.

Plant Communities

Existing Conditions. As shown in Table 6.1, nine general plant communities are present on SRS. Each plant community can be sub-divided into habitat-specific units that are more vegetation-specific but have general features in common. Five of the plant communities are considered to be upland vegetation: longleaf pine, mixed yellow pine, southern mixed hardwood, dry longleaf pine-scrub oak, and permanent upland meadows. Four are wetlands: bottomland, southern swamp, freshwater marshes, and Carolina bay communities (see Figure 6.2). Each habitat is important to a variety of wildlife species. The presence of general plant communities in any location can usually be attributed to past land use and physical environment. The site's nine plant communities are a typical representation for this area of the Southeast but are substantial in relation to areas outside site boundaries. Prior to 1950, long-term agricultural practices reduced soil fertility levels and eliminated natural flora seed pools. Through time, some na-

Table 6.1. Dominant SRS Plant Communities. 1998.

	Habitat Management Areas (In Acres)			Acreage	
Dominant SRS Plant Communities	Red-cockaded Woodpecker	Supplemental Red-cockaded Woodpecker	Other Use Area	Total Acres	Percent of Total Acreage
Upland Vegetation					
Dry Longleaf Pine-Scrub Oak	6,490	75	986	7,551	3.9
Longleaf Pine	24,572	6,268	7,513	38,353	19.3
Mixed Yellow Pine	31,118	21,232	14,366	66,716	33.6
Southern Mixed Hardwood	11,096	10,273	10,249	31,618	16.0
Permanent Upland Meadow	1,047	2,763	3,431	3,322 *	3.6
Wetlands					
Bottomland	8,029	6,507	16,405	30,941	15.6
Southern Swamp	373	173	10,035	10,581	5.3
Freshwater Marshes	2,605	77	725	3,407	1.7
Carolina Bays	739	799	401	1,939	1.0
Total	86,069	48,167	64,111	194,428 **	100.0

* Does not include 3,919 acres for industrial uses in this area.

** Total figure represents all SRS acreages with the exception of industrial areas. Inclusion of industrial areas increases total acreage to 198,347 acres

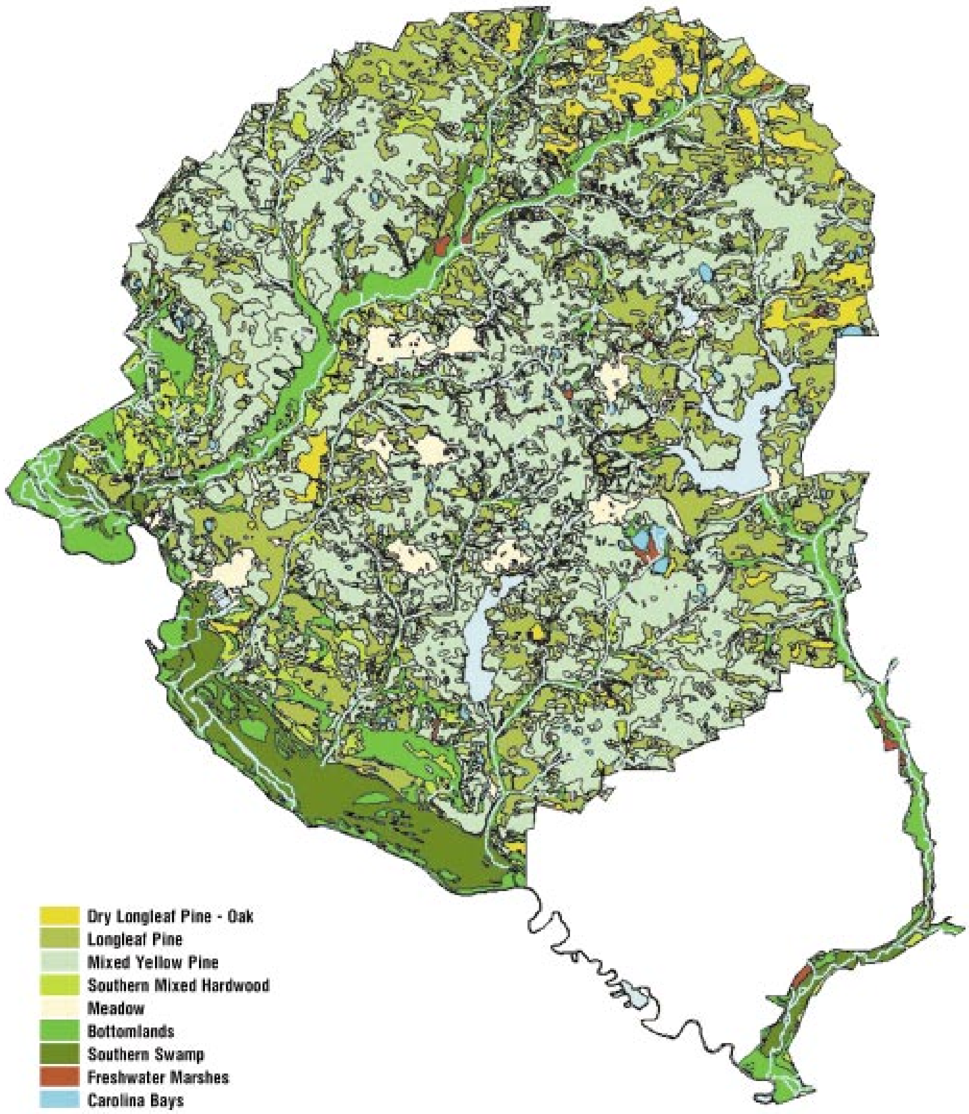


Figure 6.2
Distribution of Savannah River Site Plant Communities Map

tive species have become reestablished through natural seed migration and the reintroduction of fire.

Upland Vegetation Plant Communities

Dry Longleaf Pine-Scrub Oak. The dry longleaf pine, scrub oak communities have a sparse longleaf pine canopy with a nearly continuous hardwood mid-story. Most of these hardwoods are drought-tolerant oak species.

Longleaf Pine. Most SRS longleaf pine forests are young, planted stands associated with dry soils. A few examples of mature longleaf pine forest are present on SRS, in some cases with an intact under-story and ground-story vegetation. Elsewhere, well-developed ground-stories exist, but the mature longleaf pine canopy has been removed and replaced with other pine species.

Mixed Yellow Pine. This forest type is the most predominant type on SRS, with about 34 percent of the site in loblolly, slash, or longleaf pine forests. Most existing pine-dominated areas are on abandoned agriculture land. Much of the mixed yellow pine forest on SRS was established by planting, with a small percentage established through natural seeding. Current pine management practices result in a variety of habitats being created, ranging from temporary meadow to dense pine stands and mature open pine forests.

Southern Mixed Hardwood. Southern mixed hardwood communities are typically dominated by a variety of oaks, hickories, and other species. These forests offer a high diversity of trees, shrubs, vines, and herbs. However, the under-story and ground-story species associated with all southern mixed hardwood forests are often unique to these communities because they demand moderately moist to moist conditions, moderate to high fertility, and are relatively intolerant of fire.

Permanent Upland Meadow. The site's permanent upland meadow communities exist under a variety of conditions, including utility corridors, some burial sites, roadsides, and some borrow pits. Warm-season perennial grasses and forbs dominate nearly all permanent meadows. SRS meadow communities have a mosaic of species present and all are strongly influenced by herbicide use, planting, fertilizing, and soil conditions.

Figure 6.3
Carolina Bay

Wetland Vegetation Communities

Bottomland Forests. Bottomland forests exist in seasonally wet or flooded areas along streams and rivers. A significant portion of wetland vegetation of the site is occupied by bottomland forest. Flora and fauna are highly diverse in bottomland forests, in part because of the diverse soil and hydrologic conditions. Most bottomlands are dominated by a mixture of hardwood species. The distribution of flora within bottomland areas is highly influenced by fertility and hydrology. Bottomland forests are highly fertile and aided by year-round moist conditions and periodic nutrient additions via infrequent flooding.

Southern Swamp. Southern swamp communities dominate areas that have prolonged growing season flood conditions. These include sloughs and swales along blackwater streams and the Savannah River as well as stream ponds and river front swamps. Southern swamps are dominated by bald cypress and tupelo species with a sparse shrub and mid-story layer and light-dependent ground cover. Frequent flooding and shady conditions result in a near absent under-story.

Freshwater Marshes. Freshwater marshes occur naturally during early successional stages of bottomlands and swamps or along stream margins. Several near-permanent marshes are present in the wettest portions of the site's thermally disturbed deltas. These areas are associated with muck or unconsolidated sediments. Marsh vegetation is also present along the margins of artificial ponds and lakes. Like bottomlands and swamps, floral diversity and composition of marshes is highly dependent upon hydrology and soil. Floating aquatic and submergent species are present in deeply flooded areas, while emergent species are present in shallower flood zones.

Carolina Bay. Carolina bay communities are unique wetland habitats resulting from seasonally flooded conditions and isolation from other wetlands. Seasonally changing hydrology allows for the development of several habitat types during a growing season. The bays' diversity and composition change during the growing season, but the change is generally limited to species already present onsite. Year-to-year variation in flooding also influences plant and animal composition and diversity. Isolation is important because many wetland species have limited movement into and from other wetlands. Carolina bays do not receive sedimentation from clay, sand, silt, and gravel, or chemical input from other wetlands. Even with similar hydrology and soil conditions, plant community composition varies among Carolina bays because of their isolation. Many of the unique plant species associated with Carolina bays are adapted to withstand or be dependent upon seasonal flooding, as well as nutrient-poor conditions and periodic burning during dry periods (See Figure 6.3).

Current Management. Several management practices are utilized to improve or enhance habitat conditions for various sensitive species or to avoid impacting these species. Appendix C contains a listing of the sensitive plant species, their status, and habitat preference. Many of the listed sensitive species, particularly those associated with upland pine savannas, benefit from burning and a reduction of shade either through burning or harvesting. Most species associated with wetlands are not impacted because of limited management practices within these areas. Similarly, species associated with upland or bottomland hardwood communities require mature forest habitat. Because the smooth purple coneflower is a federally protected species, activities near the site's coneflower populations are highly restricted (*Smooth Purple Coneflower Management Strategy for the Savannah River Site, draft,* Imm and LeMaster, USFS-SR, 2000).

Over most of the site, pine-dominated uplands are periodically burned to reduce flammable material and to enhance the development of fire-tolerant plant communities and animal habitats. SRS burns approximately 15,000 to 18,000 acres each year. Improved planting techniques and seedling survival have resulted in the conversion of a significant proportion of loblolly pine and slash pine forests to longleaf pine over the past ten years. To improve survival of planted seedlings, herbicides are used to control hardwood sprouting and reduce competition. Herbicide use is restricted to an "as needed" basis and rare plant populations are avoided.

One of the main objectives of hardwood management is to provide a wide variety of wildlife habitats while furnishing a high-quality product to local wood processing facilities. Except for salvage harvesting and collecting for research studies, site hardwood harvesting has been limited. Hardwood management in uplands and bottomlands focuses on the establishment of later successional species, such as oaks and hickories. The site's southern swamps are not currently managed because of restricted access and contamination concerns. Due to previous "high grading" practices in the site's southern swamp plant communities, these areas have been planted with improved genetic stock to improve the gene pool for future stands. Few forest management options exist for deeply flooded swamps, and natural succession is utilized in a few locally disturbed areas. Thermally created freshwater marsh deltas are being actively restored to swamp forest in some locations as part of a number of research studies. Elsewhere, natural succession is being relied upon for the gradual reestablishment of forested communities.

Because of the unique qualities of Carolina bays, several management practices are currently employed. A vegetation buffer of at least 100 feet from the high-water flood zone is maintained around each bay. In addition, no more than 50 percent of the forested stand adjacent to the buffered bay can be less than 20 years old. Both strategies are designed to allow for the movement of fauna into and away from the isolated wetland. Harvesting of the forested interior of Carolina bays is restricted to research projects and restoration operations.

A few Carolina bays have been restored by "plugging" the existing ditch, then removing and burning the remaining vegetation. These attempts were made to reestablish natural vegetation from the seed bank and modify the existing habitat structure to a more favorable habitat setting. Though over 400 seasonal wetlands are present on SRS, many ditches have naturally filled in. Additionally, many bays that have functional ditches remain as functional wetlands, with reduced flooding regimens. When burning adjacent areas, fire is allowed to move into the margins and interiors of Carolina bays. In a few cases, bays have been intentionally ignited to reduce shrub story development and enhance recruitment of ground cover species from existing seed in the soil, promoting increased flower production.

Constraints. Land and forest management is restricted by a series of laws, regulations, acts, and accepted guidelines developed at the federal, state, and site levels. Although these requirements result in constraints on land management activities, all are designed to protect natural resource condition, air and water quality, endangered species, as well as meet human health standards and guidelines. Additional restrictions concerning facility areas, contaminated areas, endangered species, and areas dedicated to the DOE Research Set-Aside Program have been developed. SRS has also developed its own land management standards and guidelines and processes that place additional restrictions on the range of natural resource management alternatives that can be used.

Prior to the implementation of any land management activity, each resource area is assessed and surveyed for threatened, endangered, or sensitive species that may require consideration or protection. In addition, natural resources are assessed from the standpoint of wildlife habitat value, timber, road access, wildfire threat, future needs, concerns for soil water and air resources, restoration opportunities, conflicting research or management activities, and opinions of all site internal stakeholders. After an area is identified, management plans may be prepared to improve the condition or alter the habitat of specific areas to achieve a desired future condition.

SRS reportedly contains 1,322 vascular plant species from 152 plant families. One of these species, the smooth purple coneflower, is classified as federally endangered and protected by the Endangered Species Act of 1973. An additional

52 vascular plant species are considered to be sensitive, as determined by state, federal, and global rankings. SRS contains three populations of federally endangered smooth purple coneflower and nearly 300 populations of sensitive species (*Vegetation of the Savannah River Site: Major Community Types*, Workman and McLeod, SRO-NERP-19, 1990).

Future Actions. Timber production will continue to provide revenue to DOE to support the SRS natural resource program. The site's supply of sawtimber is expected to increase in value because of the site's prime location for winter harvesting, proximity to local mills, maturation of the site's timber resources, and the recent over-cutting trend on private lands within South Carolina. Within the next 50 years, SRS forested lands will increasingly consist of hardwood acreage designated for uses other than timber production, such as habitat management and limited recreational use. However, revenues from pine timber purchases are expected to increase as larger diameter trees are offered to the market, and special forest products like aromatics, pine straw, forest botanicals, and floral products become greater income producers. Because the site's commercial forestland now grows at a rate about twice that of the amount harvested, future harvests can be sustained indefinitely at the present level, assuming the land base for forestry is not reduced.

The site has initiated an accelerated program to restore Carolina bays. A total of 20 bays have been reviewed, and 16 of the 20 are slated to be restored. The other four bays are planned for "no action" and will act as controls for the restoration project for four years and then they will be restored. The purpose of the project is to restore an under-represented site plant community, and it will also assist in fulfilling one of the primary goals established as a part of the SRS Wetland Banking Project (*Memorandum of Agreement for the Savannah River Site, Wetland Mitigation Bank*, 1997).

Renewable Forest Products

Existing Conditions. The site is divided into three management areas guided by the *RCW Management Plan*: the Red-cockaded Woodpecker Habitat Management Area, the Supplemental Red-cockaded Woodpecker Habitat Management Area, and the Other Use Area. These management areas are based upon red-cockaded woodpecker recovery efforts that impact the silvicultural prescriptions for site timber harvesting. Within the Red-cockaded Woodpecker Habitat Management Area, where major red-cockaded woodpecker recovery efforts are concentrated, the harvest rotation for loblolly and longleaf pine is set at 100 and 120 years respectively. These long rotations are designed to increase the number of cavity nesting trees. The rotation age for all pine species within the Supplemental and Other Use Areas is 50 years. This shorter rotation age encourages woodpecker recovery to occur within the Red-cockaded Woodpecker Habitat Management Area.

In all timber management areas, bottomland hardwood, upland hardwood, and mixed pine hardwood stands continue to be managed on 100-year rotations.

Current Management. The United States Forest Service-Savannah River (USFS-SR) is responsible for planning and directing a timber management program (*SRS Natural Resources Management Plan*, 1991). Primarily using even-aged management practices, the timber program includes inventory, sale, harvest, reforestation, and silvicultural treatment of forestlands. USFS-SR annually harvests about one percent of the standing volume of the site's commercial forestland, which amounts to about 50 percent of the annual growth. Total timber harvest is approximately 4,000 acres per year. This includes about 750 acres per year of clearcuts and about 3,600 acres per year of thinnings and partial cuts (including the 500 acres per year of slash and loblolly pine conversion). Fewer than 80 acres of the total projected annual harvest are bottomland hardwoods. Hardwood harvests are limited to tracts of 40 acres or less and pine harvests are limited to tracts of 100 acres or less. Since SRS has extensive areas of young, relatively open stands of sawtimber-sized longleaf pine trees, USFS-SR is selling pinestraw. To limit the impact of pinestraw harvesting, sale areas are distributed throughout the site, and harvest is limited to one- and two-year-old needles.

The site prepares and sells about 5.5 million cubic feet of timber annually, approximately half in sawtimber with the balance in roundwood. About 200 to 300 acres of pinestraw are also sold. These activities generate an average income to the U.S. Treasury of about $5 million per year.

Potential erosion on sites that are being harvested and regenerated is mitigated through proper sale administration and engineering practices. In addition, maintenance of streamside and Carolina bay buffers and the use of waterbars, culverts, and expeditious revegetation of disturbed areas help to control erosion. The SRS Wet Area Logging Guides require contractors to take specific measures to protect soil and watershed values and to further mitigate impacts to wetlands from harvesting activities.

Constraints. Constraints are limited to the normal impacts from logging operations, such as erosion potential and impact on threatened and endangered species. Also, future site missions could preclude logging in some areas.

Future Actions. In conjunction with increased rotation lengths in the Red-cockaded Woodpecker Habitat Management Area, the site will convert about 500 acres per year from slash to longleaf pine and loblolly pine, depending on the local soils. Conversion efforts, where suitable, are expected to occur in all habitat management areas. Conversion to longleaf will work for the long-term benefit of the woodpecker and other species associated with the longleaf pine/savanna ecosystem.

Wildlife

Existing Conditions. SRS is home to a diverse and abundant wildlife population, in part due to the area's temperate climate and numerous aquatic habitats. Several of the site's wildlife species are listed and protected under federal and state legislation, including the Threatened and Endangered Species Act and the State of South Carolina's Nongame and Endangered Species Conservation Act of 1974. Restoration of rare or unique communities is increasing the site's landscape and species diversity and providing habitat for threatened and endangered species. Herpetofauna, mammals, birds, fish, invertebrates, and threatened and endangered species are discussed below.

Southern hognose snake

Herpetofauna. Over 100 species of amphibians and reptiles are found on site. Amphibians include approximately 17 species of salamanders and 25 species of frogs and toads. Reptiles include 9 lizard species, 36 snake species, 13 turtle species, and one crocadillion, the American alligator. SRS has among the highest biodiversity of herpetofauna in the United States, primarily due to the warm, moist climate and the wide variety of habitats found here.

Mammals. Fifty-four species of mammals are found at SRS, including 17 species of rodents, 11 species of bats, 5 species of insectivores, 14 species of carnivores, and 7 other species including deer, feral swine, rabbits, and opossum. Currently, populations of white-tailed deer, wild hogs, and beaver are controlled through selective harvest strategies.

Birds. The site's isolation from urban areas and proximity to the Atlantic Flyway contribute to its ability to attract avifauna. SRS provides habitat for a great diversity of migrant and resident birds. A total of 258 species, including 35 breeding species of neotropical migrants, 15 breeding species of shore and water birds, 28 wintering/breeding waterfowl species, and at least 180 other landbirds have been observed on the site. SRS provides habitat for one of the largest inland concentrations of wintering waterfowl in the Southeast.

Fish. At least 81 species of fish are known to inhabit SRS lakes and streams, including 18 species of bass and sunfish, 15 species of chubs, minnows, and shiners, 10 species of mad toms and catfish, gar, carp, herring, shad, and pickerel.

Invertebrates. Most of the faunal species found on SRS are invertebrates. Upper Three Runs Creek supports the richest diversity of aquatic insects of any sampled stream in North America, and perhaps the world. At least 551 species were identified in a 1976-77 study. One mollusk species, *Elliptio hepatica*, is rare and is found only in portions of Mill Creek and Tinker Creek (*Species Status of Mill Creek Elliptio*, 1993 (Davis and Mulvey. SRO-NERP-22). Although invertebrates comprise a large portion of the biodiversity of the SRS, little is known about many of these species, especially the microinvertebrates.

Threatened, Endangered, and Sensitive Species. Five federally protected animal species are found at SRS (Figure 3.1.) The shortnose sturgeon is anadromous, spending a portion of its life in the ocean and part in freshwater. In a three-year time span, SRS researchers collected eight shortnose sturgeons in the Savannah River adjacent to SRS. The American alligator is listed as threatened due to similarity in appearance with the American crocodile, even though the alligator is fairly common in most large water bodies and slow-moving streams in the South. PAR Pond is home to over 200 alligators. Endangered wood storks are known to forage in the Savannah River swamp and Carolina bays, but are not known to nest onsite. Two pairs of the threatened southern bald eagle regularly nest onsite, foraging primarily at PAR Pond and L-Lake. The site also houses two sub-populations of the endangered red-cockaded woodpecker, found in mature longleaf and loblolly pine stands. These social birds live in clusters with no more than one breeding pair per cluster. The site currently has 26 active clusters comprised of over 160 individual birds.

Current Management. Management for wildlife species is achieved through timber harvest, manipulation of habitat, hardwood, and wetland restoration, and prescribed fire operations. Other habitat considerations include ensuring the availability of cavity and den trees and feeding areas in red-cockaded woodpecker restoration areas. Wildlife management efforts focus on the entire ecosystem and not one particular species. Significant effort is placed on the restoration of degraded systems such as Carolina bays and the longleaf pine/fire maintained savanna, critical to red-cockaded woodpecker management and recovery.

Nuisance animal populations are controlled to reduce vehicular/animal collisions, to prevent resource and infrastructure damage, and to ensure healthy wildlife populations. Controlled hunting helps control nuisance populations and provides a recreational benefit to the community.

The Crackerneck Wildlife Management Area and Ecological Reserve (discussed earlier in this chapter) is opened for hunting on a limited basis, Fridays and Saturdays only, from October through January and again in April. The primary game species hunted in this area are deer, feral hogs, wild turkey, waterfowl, and small game such as rabbits, quail, and squirrel. Fishing in the eight-acre Skinface Pond within the Crackerneck Wildlife Management Area and Ecological Reserve is also allowed on the same limited basis.

Controlled hunts for white-tailed deer and feral hogs also occur in the general site area. The deer herd is estimated at about 3,000 animals, with harvests averaging about 1,580 animals per hunting season over the past five years. The feral hog population is estimated to exceed 2,500. The hogs are considered a nuisance animal and are trapped wherever they are found. Beavers are also trapped in areas where they compromise the safety and operation of roads, railroads, culverts or research plots, or wherever they are causing significant resource damage.

SRS has had a management and research program to establish a viable red-cockaded woodpecker population since 1986. Because the red-cockaded woodpecker is listed as an endangered species, federal agencies are required to be proactive in recovery efforts in accordance with the Endangered Species Act of 1973. The *SRS Red-cockaded Woodpecker Management Plan* has been updated to reflect over 10 years of research efforts. The site's revised habitat management areas provide increased flexibility to accommodate changing SRS missions and to provide more cost-effective woodpecker recovery efforts. The site's recovery efforts have increased the number of birds from 4 in 1985 to almost 150 in 1999.

The management strategy for the federally threatened southern bald eagle emphasizes the protection of current and possible future nest sites. A 1,500-foot radius from each eagle nest forms a primary protection zone. Consequently, timber management and industrial uses in these zones are restricted. A secondary zone with a 3,200-foot radius extends beyond the primary zone. Structural development is restricted in this zone as well, but timber regeneration harvests may take place except during the nesting season.

Constraints. The Endangered Species Act mandates that the habitat of protected species cannot be degraded. The possibility that habitat degradation could occur constrains activities in the protection zones around bald eagle nests and within the Red-cockaded Woodpecker Habitat Management Area.

Red-cockaded woodpecker removal is allowed only within the Supplemental and Other Use Habitat Management Areas and is accomplished under incidental take regulations. Removal is not allowed within the Red-cockaded Woodpecker Habitat Management Area, but limited flexibility exists for future development (e.g., new facilities) and for relocation of existing groups. The U. S. Fish and Wildlife Service has allowed the site to relocate red-cockaded woodpeckers.

Bald eagle nesting sites are buffered by primary and secondary zones. The 1,500-foot primary zone surrounding the nest tree is the most critical area for nest protection; and, therefore, this area is the most constrained. Potential conflicts most often associated with eagle disturbance are construction and aircraft noise.

Controlled public use of the Crackerneck Wildlife Management Area and Ecological Reserve influences management decisions in that area. Although specific constraints have not been identified, any significant variation from current use strategies (e.g., limited public hunting) would be noted by regulatory agencies and stakeholder groups.

Future Actions. The designation of the SRS Crackerneck area as the Crackerneck Wildlife Management and Ecological Preserve will mesh with the forest and wildlife management strategies for the other parts of the site. Management of this area is the responsibility of the South Carolina Department of Natural Resources and is supported by the USFS-SR and other site partners. Public use of the site's natural resources is presently limited to controlled hunts and fishing; however, non-consumptive public uses are allowed in the Crackerneck Management Plan. In addition, this area is available to various science literacy programs encompassing elementary through graduate school levels. However, trends in population migration to the Southeast and increasing interest in outdoor recreational activities indicate that public pressure for onsite dispersed recreation use, such as hiking and bird watching, could increase.

Recent improvements to Skinface Pond have improved the artificial spawning beds for bream. The increasing numbers of non-indigenous species, such as coyotes and armadillos, may require the site to initiate additional control measures for these species. Comprehensive long-term wildlife management monitoring will increase, along with the continued development of effective management techniques for propagation of native species and for the restoration of native ecosystems.

The site will continue its threatened and endangered species protection program through its close relationship with the U.S. Fish and Wildlife Service. In conjunction with increased timber rotation lengths in the Red-cockaded Woodpecker Habitat Management Area, the site plans to improve habitat by converting approximately 800 acres per year from slash and loblolly pine to longleaf pine. Comprehensive long-term wildlife management monitoring will increase with the continued development of effective management techniques for propagation of native species and for the restoration of native ecosystems. The University of Georgia Savannah River Ecology Laboratory (SREL), Savannah River Technology Center (SRTC), U. S. Forest Service Southern Research Station, and archeological research will also continue to be an important part of the future of the site due to their contributions to research and protection of natural and cultural resources.

The site's significance as a large-scale facility available for wildlife management and research activities is expected to increase. Economic development and increasing population migration to the southeastern United States will continue to increase pressure on wildlife species. Additionally, SRS will remain a desirable location for research and externally funded studies conducted as a part of the site's National Environmental Research Park designation, which continues to be supported at the local and national levels.

Surface Water

Existing Conditions. The Savannah River borders SRS for about 27 miles on its southwest side (see Figure 6.4). From east to west, the site's main streams are Lower Three Runs Creek, Steel Creek, Pen Branch, Fourmile Branch (also known as Fourmile Creek), and Upper Three Runs Creek. The drainages of Steel Creek, Pen Branch, and Fourmile Branch are contained entirely within SRS, and all three flow through the Savannah River Swamp prior to discharging to the river. Lower Three Runs Creek originates within SRS and flows directly to the Savannah River, with the lower reaches of its drainage located outside the site's boundaries. Upper Three Runs Creek, which originates outside the site's boundaries, is the largest of the streams, with the majority of its drainage basin located on site. Other main streams include Tinker Creek, Meyers Branch, and Tims Branch. Beaver Dam Creek is a small stream that drains D Area and may have been a seasonal stream prior to SRS operations (*SRS Land Use Baseline Report*, 1995).

About 20 percent of the site is classified as wetlands, including open water. Bottomland hardwood forest, occurring mostly along stream corridors and in the Savannah River Swamp, and cypress-tupelo forest, are found predominantly in the swamp and account for about 78 percent of the wetland area. SRS surface waters include more than 50 artificial impoundments, six tributaries of the Savannah River, and the Savannah River Swamp.

The 2,640-acre Par Pond and the 1,000-acre L-Lake are the site's largest artificial impoundments. Par Pond and L-Lake are formed by the impoundment of the headwaters of Lower Three Runs Creek and Steel Creek, respectively. In addition to the main reservoir, the Par Pond system contains a series of small pre-cooler ponds and canals that were used to transport water from P and R Reactors to Par Pond. The site also has nu-

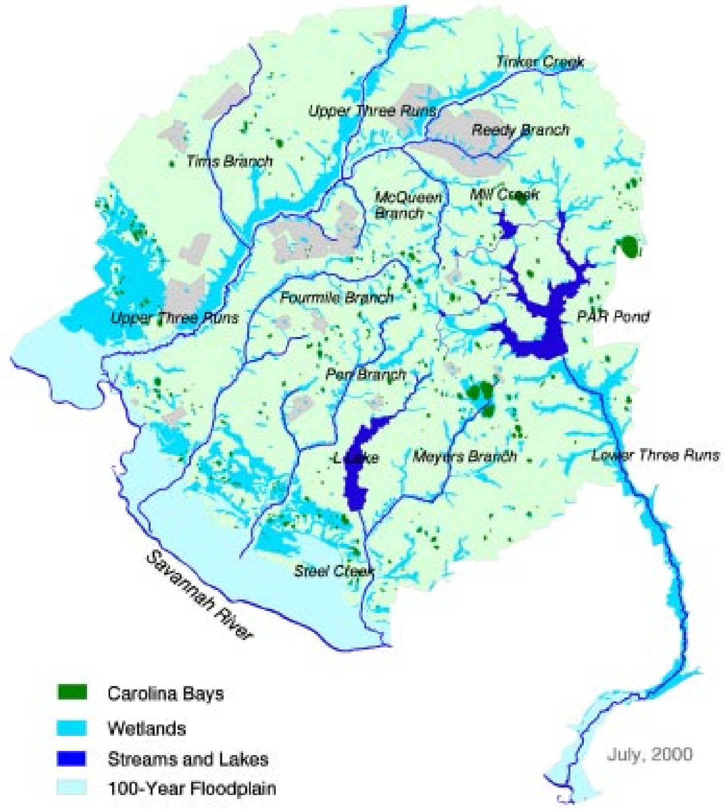


Figure 6.4
SRS surface waters and wetlands

merous small ponds and many Carolina bays, a natural wetland feature unique to the Atlantic Coastal Plain.

The South Carolina Department of Health and Environmental Control (SCDHEC) classify SRS streams as "freshwaters". Freshwaters are defined as surface water suitable for primary- and secondary-contact recreation and as a drinking water source after conventional treatment in accordance with SCDHEC requirements. They are suitable for fishing, survival, and propagation of a balanced indigenous aquatic community of fauna and flora, and industrial and agricultural uses.

Current Management. All site streams, except Upper Three Runs Creek, Tinker Creek, and Meyer's Branch, have received thermal effluents from SRS operations. The effects of these discharges are evident but are diminishing over time. Major thermal discharges have been eliminated and past effects are being mitigated. All drainages, however, receive effluents from National Pollutant Discharge Elimination System-permitted discharges and significant sediment transport because of erosion of upland areas and channel degradation (*SRS Environmental Report for 1998*, published 1999).

Stream samples are collected every two weeks. Determination of the frequency and type of analyses performed on a sample is based on the potential quantity and type of radionuclides or chemical contaminants likely to be present in the water at the surveillance station. River sampling sites are located up river of, adjacent to, and down river from the site to compare the site's contribution of pollutants with background levels from natural sources and from contaminants produced by municipal sewage plants, medical facilities, and other up river industrial facilities. To monitor water quality and ensure that standards are met, field measurements for conductivity, dissolved oxygen, pH, and temperature are taken monthly and laboratory analyses are conducted for other water quality parameters such as metals, chemicals, and physical and biological properties.

Constraints. Some SRS surface waters are classified as Category I resources, defined by the U.S. Department of the Interior as unique and irreplaceable on a national or eco-regional basis. The definition includes Carolina bays and cypress-tupelo swamps because of the limited number of undisturbed habitats of these types occurring elsewhere. Any surface waters supporting species of concern would also be considered unique or irreplaceable. Site areas containing high-quality wetlands or headwater streams, particularly portions of Upper Three Runs, would also be considered for Category I status.

Under Phase II of the National Pollution Discharge Elimination System (NPDES) regulations, the Environmental Protection Agency (EPA) is shifting emphasis to non-point sources, and control or mitigation of these pollutants. Additionally, under Section 303 (d) of the Clean Water Act, each state must prepare a list of waters that are not meeting their water quality standards. These lists must be submitted to EPA for review and approval every two years. Portions of the Middle Savannah River subwatershed are listed for both South Carolina and Georgia.

Future Actions. There are no plans for future improvements, modifications, or changes to the management of SRS surface waters.

Soils

Existing Conditions. The site's 29 identified soil series are grouped together in seven soil associations. Each association consists of one or more major and minor soil types. Most SRS soils are in the Carolina and Georgia Sand Hills Land Resource Area, generally referred to in soil surveys as the Sand Hills. Some broad upland areas are in the Southern Coastal Plain Land Resource Area, referred to as the Coastal Plain (*Soil Survey of Savannah River Plant*, NRCS, USDA, 1990).

SRS soils are generally gently sloping to moderately steep. Some upland soils are nearly level, and those on bottomland along the major streams are level with slopes ranging from one to eight percent. The soils in small, narrow areas adjacent to drainage-ways are steep with slopes up to 40 percent. Most of the soils are well drained to excessively drained. Well-drained soils have a sandy surface layer above loamy subsoil. The somewhat excessively drained soils have a thick, sandy surface layer that extends to a depth of 80 inches or more. The site contains more than 300 Carolina bays ranging in size from less than an acre to many acres. Water can stand in most of these depressions for long periods. Bottomland soils range from well drained to very poorly drained. In the Sand Hills area, some soils on the abrupt slope breaks have dense, brittle subsoil.

Current Management. Industrial development at SRS has caused site-specific erosion and watershed management problems. Parking lots, buildings, and other developments have changed the natural flow of water, and as a result many stream channels have failed. Continued replacement of site facilities and closure of old facilities has caused increased runoff, requiring the development and implementation of stormwater management, erosion and sediment plans to protect construction sites and downstream areas.

In many areas, watershed restoration is occurring through the use of mainly passive, non-intrusive methods. These include mechanical seeding with no surface disturbance; mulching; planting trees, grasses, and shrubs to hold the soil; construction of drainage structures; and installation of erosion control mats to establish vegetation and control storm runoff flows. Technical support is provided to operations personnel through workshops on erosion control and conservation, helping develop sediment and erosion control plans, and providing advice on erosion control methods.

Sediment samples are collected at eight onsite stream locations and three Savannah River locations, including Upper Three Runs Creek, Tinker Creek, Fourmile Creek, Pen Branch, and Steel Creek. Samples are analyzed for various metals and pesticides. In 1997, no pesticides or metal contaminants above acceptable limits were found in sediment samples.

Constraints. SRS soil limitations can affect shallow excavations, small structures, and local roads and streets. Soil limitations are considered slight if the soil properties and site features are generally favorable for the indicated use, and if limitations are minor and easily overcome. Conversely, soil limitations are considered to be severe if site features are so difficult to overcome that special design, significant increases in construction costs and increased maintenance are required. Therefore, special feasibility studies are required where the soil limitations are severe.

Future Actions. One systematic approach to repairing eroded areas across the site is watershed planning. Areas of the site are inventoried, problems described, priorities are established, and projects are implemented. Watershed plans are being prepared to cover the site's industrial and administrative areas first, with a plan under development for D Area. The entire site will eventually be assessed and plans will be prepared for implementation over the next 10 years. Watershed plans will allow managers to select the most critical projects

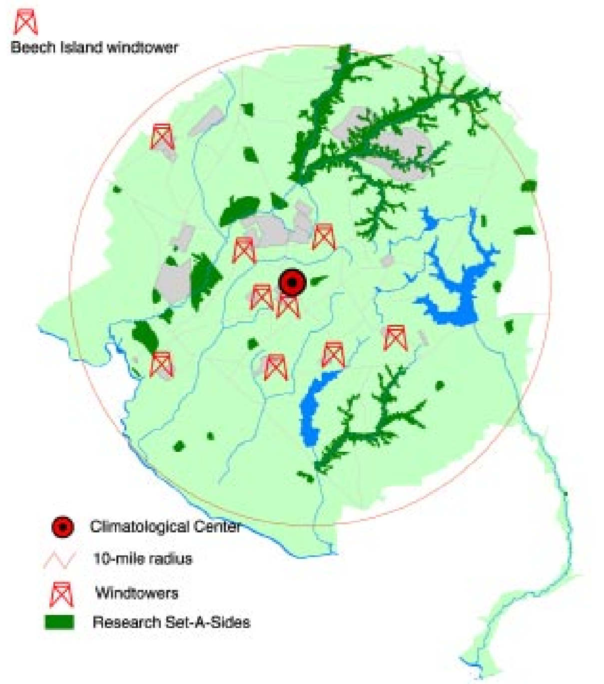


Figure 6.5
SRS meteorological towers monitor air quality, and research set-asides serve as valuable environmental research and monitoring laboratories.

to complete and to address primary erosion causes, rather than deal with erosion results.

Air Quality

Existing Conditions. The site's meteorological monitoring program provides current, accurate meteorological data for emergency response applications. The data are archived in large databases for application in site environmental and safety regulatory documents (e.g. Safety Analysis Reports and Environmental Impact Statements) and for air quality calculations required under the Clean Air Act. The site has a network of eight meteorological towers located in forested areas near the industrial facilities with the highest potential for releases of contaminants to the environment (see Figure 6.5). A fully equipped climatology station is located near Central Shops in N Area. SRS also uses a Beech Island TV tower 19 miles from the center of the site, instrumented at seven levels up to 1,000 feet.

Current Management. Under existing regulations, SRS is not required to conduct site monitoring for ambient air quality but is required to show compliance with various air quality standards. Air dispersion studies are conducted for new emission sources. Modeling indicates SRS air emission sources are in compliance with applicable state and federal regulations. South Carolina and Georgia continue to monitor ambient air quality near SRS as part of the network associated with the Clean Air Act.

The USFS-SR maintains a prescribed burning program to reduce fuel loads and reduce the probability of catastrophic wildfire and to restore the historical pre-European ecosystem. The USFS-SR fire organization is staffed to launch a strong initial attack for smoke management purposes and to minimize any subsequent disruption to industrial operations. Smoke emissions are a constant consideration. The best available technology to control smoke emissions is used in prescribed burning operations. These technologies include accelerated mop-up, rapid ignition techniques, and burning when moisture conditions limit total smoke production. Present air quality regulations limit prescribed burning to about 50 days per year. Burning is not done during stagnant weather, during dry conditions, or when weather conditions indicate drifting smoke may severely affect sensitive facilities, highways, airports, or populated areas.

Constraints. The State of South Carolina has some of the most stringent air quality burning regulations in the nation; consequently, the opportunity for prescribed burning is often limited. In some years, depending on weather and ambient air quality, the total number of acres allowed to be burned may fall to less than half the annual objective. To ensure compliance with SCDHEC air quality regulations and standards, SRS conducts air dispersion modeling for certain criteria and toxic air pollutants. Modeling indicates SRS air emission sources are in compliance with applicable state and federal regulations.

Future Actions. Studies are ongoing to determine methods of smoke dispersion that can be used to minimize the impacts of prescribed burning activities. The results of such studies, conducted in cooperation with the U.S. Forest Service Southern Research Station, will assist SRS, private landowners, and other land management agencies in ensuring compliance with tighter air quality regulations while maintaining the volume of burned acres needed to restore Southeastern ecosystems

Recreation

Existing Conditions. Other than the Crackerneck Management Area, the site does not have areas formally designated for recreational use. On other areas of the site, controlled deer hunting and fishing are allowed and wellness exercise/walking trails are offered on a limited basis within specified areas. Additional recreation activities include the use of specific areas of the site by Boy Scout and Girl Scout organizations.

Current Management. The USFS-SR manages the site's recreational opportunities, in cooperation with the South Carolina Department of Natural Resources (SCDNR). Recreational and wildlife management activities in this area are directed by SCDNR in cooperation with USFS-SR and other site partners. The Crackerneck Wildlife Management Area and Ecological Reserve is a South Carolina Department of Natural Resources Wildlife Management Area that emphasizes hunting of game species aided by the use of linear strips and food plots. These plots are planted in partnership with Quail Unlimited, a non-profit organization dedicated to increasing the number of quail through habitat improvement. Skinface Pond is managed for recreational fishing opportunities, primarily through control of aquatic weeds by herbicides and grass-eating sterile triploid carp. Additional details on the site's hunting and fishing opportunities are provided in the Wildlife section of this plan element.

Constraints. All State of South Carolina rules and regulations pertaining to fishing and hunting apply to SRS, and all hunting and fishing participants must have a valid South Carolina game license. Hunting and fishing participants must check in and out of the Crackerneck Wildlife Management Area and Ecological Reserve. Game taken within this reserve must be checked for biological data, and game taken in other site areas must be checked for radiological contaminants. Access to certain recreational areas is restricted during the hunting season for safety reasons. Although some trespass may occur in areas bordering the Savannah River, the public has been hunting the Crackerneck Wildlife Management Area and Ecological Reserve for over 30 years.

Future Actions. Recent improvements to Skinface Pond included deepening of the shoreline, removing aquatic vegetation, stocking of the pond with game fish, dam repairs, and installation of a bottom water drawdown system. These improvements should increase fishing opportunities.

Other future recreational opportunities may include additional walking trails for employees that may be constructed in B and F Areas.

Several large tracts of SRS may be suitable for low impact, controlled, outdoor public activities such as hunting, hiking, bird watching, camping, and bicycling. An outdoor recreation plan could provide increased public recreation in unique habitats easily accessible to a large part of the population of the Southeast. Some opportunities could lend themselves to economic development through nature-based tourism, which could be coordinated with the state of South Carolina's Heritage Corridor Project. To meet the nation's growing demand for outdoor recreation, some have endorsed the strategy of reinvesting revenues from nonrenewable resources to create a system that puts money to work at the local, state, and federal level to increase recreation at federal sites. There is little debate about the ability of SRS to accommodate increased recreational activities. However, it is imperative to maintain a balance between limited recreational activities and mission-related site land uses, safety and security, and emergency response issues.

Education

Existing Conditions. During the 1999-2000 school year, 61,000 area students benefited from SRS educational activities. There are two major SRS organizations that support natural resource education at SRS. SREL Outreach program was established to disseminate SREL's ecological research to the public. Today, the program continues to make the public aware of the rich and diverse ecosystem that makes up SRS and surrounding area. The USFS-SR's efforts include the Savannah River Environmental Sciences Field Station and the Natural Resources Science, Mathematics, and Engineering Education Programs. Both USFS-SR programs work with local schools and universities within several states to increase science and math skills through the use of the site's natural resource attributes. Additional programs target minority students to enhance interest in natural resource careers (see Figure 6.6).

Ecotalks, sponsored by SREL, bring nature into the classroom by conveying information on ecological subjects to school, civic and professional groups. The presentations use live plants and animals, visual aids, and videos. Topics include animal adaptations, biodiversity and ecology of the southeastern United States, endangered species, habitat destruction, and natural resource conservation.

The SREL "Ecologist for a Day" program brings elementary, middle, and high school classes to the SREL Conference Center for a day-long program of hands-on environmental education activities. The students participate in field projects, such as nature hikes, biological sampling, and species identification. The goal of the program is to enhance environmental awareness and encourage students to consider careers in science. In addition to educating the students, the program

Figure 6.6
Thousands of students benefit from educational outreach programs.

helps teachers learn how to create outdoor classrooms on or near their campuses.

The SREL Ecoshadows program provides an opportunity for area high school students to spend a day with an SREL researcher. Students receive a realistic view of ecology as a potential career by helping employees carry out their day-to-day work activities. SREL Outreach also participates in the South Carolina Governor's School Summer Research program, matching some of South Carolina's best math and science students with SREL researchers.

The SREL Outreach Program has various other activities to reach a broad audience. One such activity presents exhibits and displays at many local and regional events to promote awareness of the SRS ecosystem to large numbers of people from many diverse backgrounds. The exhibits use live animals and plants to demonstrate the biodiversity of local ecosystems. Saturday morning workshops provide hands-on, interactive learning experiences to teach people about their environment. Open to the general public, these workshops are ideal for entire families.

Teacher workshops are offered to teachers in eight of South Carolina's counties. SREL educational materials, visual aids, and native species of live animals are used to teach educators about the ecology of South Carolina's Coastal Plain and to train them to create outdoor classrooms of their own. Because of the overwhelming demand for ecology-related materials, SREL has created a number of educational products designed to enhance science education for students across the United States. These products include a variety of fact sheets, two six-foot long posters on turtle and wetland ecology with guides for teachers, a fact card notebook, an outdoor classroom planning guide, and a 28-page booklet entitled *Snakes of Georgia and South Carolina*.

The Savannah River Environmental Sciences Field Station also conducts hands-on activities at SRS in which students at various grade levels apply mathematics, science, and engineering principles to solve natural resource and environmental problems. The program is designed to increase the students' understanding of natural resources and the environment, as well as improve science and mathematics skills. Teacher workshops and graduate education classes are also a part of this program. The program is a partnership among South Carolina State University, 25 other colleges and universities, and three federal agencies. Students and teachers improve science, math, and engineering skills through hands-on activities in a natural resource setting. Schools with large minority populations are especially recruited for participation in this program. The Internet Technologies Program supports three SRS classrooms equipped with computers, Internet connections, and oversized monitors/projection systems. Students share scientific data collected at SRS with researchers and students from throughout the world using the Global Learning and Observations to Benefit the Environment (GLOBE) program. This education program has been designated as a GLOBE franchise and offers teacher training and mentoring of trained teachers throughout the region. Students also are able to analyze ecosystems and land use history through activities using geographic information system (GIS) software. Data including vegetation, soils, water, toxic waste sites, endangered species, roads, buildings, 1950 aerial photos, satellite images and over 50 other map themes are available for students' use to solve environmental problems and questions.

USFS-SR provides hands-on, field-oriented experiences for historically black colleges and universities and other minority institution undergraduates. The program is a partnership among 25 colleges and universities, three federal agencies, several corporations and the United Negro College Fund Environmental Sciences Program. The program helps to ensure a competent and diverse work force, especially in the areas of environmental science, environmental restoration, and environmental literacy. Lessons and activities focus on the application of mathematical and scientific principles to solve problems in environmental science, natural science, agriculture, and engineering. The USFS-SR supports colleges and universities in their efforts to develop and expand curricula and degrees in the areas of environmental science, environmental engineering, and natural science. Undergraduate students visit SRS for both one-day classes and multi-week courses taught by university and SRS faculty and scientists.

Current Management. Education programs are managed through cooperative agreements and partnerships with colleges, universities, school districts, teachers, parents, and students.

Constraints. A low level of commitment can adversely impact the future support of present partners or new partners, and would decrease the site's opportunity to gain leverage for new programs.

Future Actions. The Environmental Sciences Field Station and the Natural Resources Science, Mathematics, and Engineering Education Programs are actively seeking outside funding sources through grants, foundations, and other federal agencies. Consequently, the state and local school districts or some consortium with varying partners may play a stronger role in funding the programs with the federal government providing the availability of the human and natural resources attributes of the National Environmental Research Park.

Research

Existing Conditions. In 1972, the entire site was designated by the Atomic Energy Commission as the nation's first NERP. This designation opened the site to scientists from other government agencies, universities, and private foundations for use as a protected outdoor laboratory where long-term projects could be established to answer questions about human impacts on the natural environment. Thirty specified areas, designated as Research Set-Aside Areas, have been reserved for research (Figure 6.5) These areas are comprised of 14,005 acres, seven percent of the site's total land area. Set-asides are located in each of the nine-vegetation communities characteristic of the SRS and act as control areas, providing a context for comparisons with other communities on the site that may be impacted by human activities (*DOE Research Set-Aside Areas of the Savannah River Site*, 1997. Davis and Janecek. SRO-NERP-25).

In addition to the NERP Program, SRS has numerous other major research programs. In addition to 12 universities, the SRTC, SREL, and USFS-SR also conduct research on SRS.

Current Management. SREL serves as the custodian for the Research Set-Asides and provides day-to-day administration of the SRS Set-Aside Program. Responsibilities include boundary maintenance and coordination of activities within and around the protected natural communities. SREL personnel conduct studies on the diversity, physiology, and genetics of deer, waterfowl, amphibians, reptiles, and microscopic invertebrates in SRS reservoirs and wetlands. Other research includes the effects of site operations on site sediments, the breeding biology of endangered wood storks, potential methods to contain or mitigate the effects of hazardous wastes in soils, and the effects on organisms of exposure to organic and heavy metal contaminants and radionuclides. Additional studies examine the ecology of SRS streams and wetlands recovering from industrial activities.

SRTC conducts research and monitoring activities in a variety of habitats on the SRS. Wetland restoration projects are underway near M Area and Pen Branch in collaboration with SREL and USFS-SR.

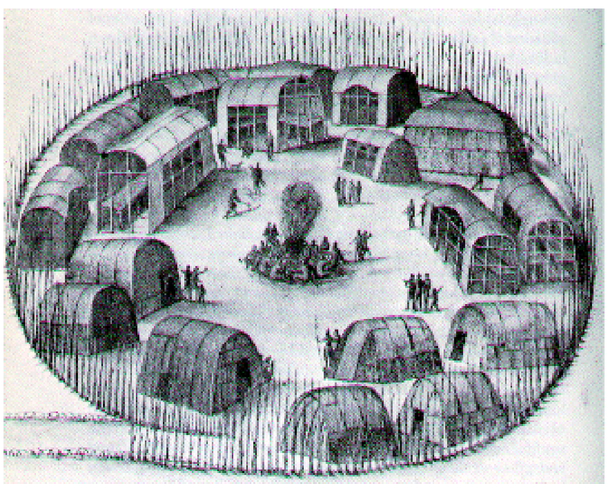
USFS-SR research is designed to support the SRS mission with emphasis on technology transfer and application to other land management organizations. More than 40 researchers from over 15 universities and institutions work in five major program areas involving over 100 studies. Five major areas of research are biodiversity, endangered species, wetland restoration and management, the Short Rotation Woody Crop Program, and forest operations. The Biodiversity Research Program is aimed at creating options for land management at SRS and similar environments that will allow for continuation of forest management and industrial activities while enhancing and sustaining biological diversity. The Endangered Species Program is designed to support the implementation of the long-term recovery plan for red-cockaded woodpeckers and smooth purple coneflowers on SRS. The Wetlands Restoration and Management Research Program is designed to support the site's mitigation action plan for K Reactor and for the Wetland Bank Program. For the latter program, USFS-SR is responsible for implementing the site preparation and planting phases, monitoring the site recovery phase, and establishing a baseline for the program's assessment process. The Short-Rotation Woody Crop Program supports the site's involvement in the national DOE effort to commercialize crops for biofuels and fiber and supports technology and expertise for phytoremediation of organic chemical contaminants, tritium, and other materials. Forest Operations Research Program provides research solutions to operational problems related to smoke regulation, control of pests and diseases, and inventory analysis and projection.

Constraints. If a change in land use is needed, Set-Aside Areas may be difficult to relocate or substitute since they act as an historical baseline from which to judge the extent of environmental change relative to surrounding land uses.

Future Actions. There are no immediate plans to increase the number of Research Set-Aside Areas or to significantly increase the acreage of any existing set-aside. However, because the original Cypress Grove Set-Aside Area was contaminated as a result of site operations related to T Area, SRS added two new areas as replacement set-asides for the original Cypress Grove area. The replacement areas are: (1) the Stave Island replacement site, located in the Savannah River swamp, east of Stave Island, and (2) the Georgia Power replacement site, located in the Savannah River swamp at the confluence of Fourmile Branch and the Savannah River. SREL has begun developing long-range management plans for each of the 30 existing Research Set-Aside Areas. For each set-aside, a core team composed of SRS personnel who are most knowledgeable about the set-aside's current and future research value, the health of the vegetation within and around the set-aside, and the implications of any management actions that may be proposed will be assembled. The core team will evaluate the current conditions in each set-aside and draft a management strategy detailing recommendations for how to best ensure the long term value and health of that area. Input from the Set-Aside Task Group also will be sought. Any actions stipulated in the management plans will be conducted jointly between SREL and USFS-SR, and management plans will be reviewed periodically and updated as necessary to reflect changing conditions.

Chapter 7

Cultural Resources Plan



Purpose

The purpose of the Cultural Resources Plan is to provide SRS planners and managers with the information they need to ensure cultural resources are appropriately considered in planning decisions, as required by applicable laws and regulations. In addition to assisting site decision-makers, the plan provides DOE Headquarters and external stakeholders with a basis for understanding the magnitude and diversity of the site's cultural resources, limitations and barriers to cultural resource planning, and strategies for effective decision-making involving the site's cultural resources.

Scope

This plan addresses, as applicable, the broad range of cultural resource components described below and lists applicable statutory requirements.

- *Collections, including material remains and associated records.* "Material remains" is defined as artifacts, objects, specimens and other physical evidence excavated or removed in connection with efforts to locate, evaluate, document, study, preserve or recover a prehistoric or historic resource. Classes of material remains that may be in a collection include: components of structures and features, such as houses, earthworks and mounds; artifacts of human manufacture, such as tools and pottery; natural objects used by humans, such as feathers; by-products and waste products; organic material; human remains; components of artistic or symbolic works; components of shipwrecks; environmental and chronometric specimens, such as pollen, seeds, and soil; and paleontological specimens found in direct physical relationship with a prehistoric or historic resource. (36 Code of Federal Regulations [CFR] Part 79.4(a))
- *Burial sites, associated funerary objects, unassociated funerary objects, sacred objects and objects of cultural patrimony.* (Native American Graves Protection and Repatriation Act, Sec. 2)
- *Historic properties or historic resources.* "Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register, including artifacts, records, and material remains related to such a property or resource." (National Historic Preservation Act, Title III, Sec. 301(5))
- *Historic buildings.* "...structures created to shelter any form of human activity..." (36 CFR Part 60.3) that are at

least 50 years of age and meet certain criteria, and properties achieving significance within the past 50 years if they are of exceptional importance (Part 60.4), such as structures created and used to support the Manhattan Project, Cold War, and Science and Technology missions of DOE and its antecedent agencies."

- *Traditional cultural properties and resources.* "…properties of traditional religious and cultural importance to an Indian tribe…" including properties "…associated with cultural practices or beliefs of a living community that are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community." (National Historic Preservation Act, Sec. 101(d)(6)(A); National Register Bulletin 38)
- *American folklife, traditions and arts.* "…custom, belief, technical skill, language, literature, art, architecture, music, play, dance, drama, ritual, pageantry, handicraft… learned orally, by imitation or in performance…" (American Folklife Preservation Act, Sec. 3.)

Details on the Prehistoric Chronology in the Coastal Plain Portion of the Savannah River Valley can be found in Appendix G, and the Site Historical Background can be found in Appendix H.

Cultural Resources Management Policy

The National Historic Preservation Act requires federal agencies to assume responsibility for the preservation of historic properties, which are owned or controlled by the agency. The act also requires the agency to establish a preservation program for the identification, evaluation, and protection of historic properties and the nomination of eligible properties to the National Register of Historic Places. The Department of the Interior developed the *Secretary of the Interior's Standards and Guidelines for Federal Agency Historic Preservation Programs Pursuant to the National Historic Preservation Act* to assist federal agencies in carrying out policies, programs, and projects in a manner consistent with the requirements and purposes of Section 110 of the Act, related statutory authorities and existing regulations and guidance.

In 1990, concern for the public trust led DOE to establish a comprehensive cultural resource management program to better manage the cultural resources being identified across the DOE Complex, including SRS. DOE is actively committed to fulfilling its stewardship responsibility to manage cultural resources on government-owned land and other lands impacted by DOE programs, as evidenced by the Secretary of Energy's 1991 decision to adopt the Department of Interior's National Archeological Strategy. Supplemental policies focus on areas where significant progress has not been made, or where it is necessary to emphasize DOE land management responsibilities.

DOE's cultural resources policy is also intended to incorporate the DOE American Indian Policy and other applicable federal statutes. Therefore, in accordance with this policy, all SRS cultural resources planning, research and compliance activities, whether conducted by DOE personnel, contractors, or researchers, must conform to current standards of scholarship and will be administered and conducted by fully qualified personnel in accordance with the requirements set forth in 36 CFR Part 61, Procedures for Approved State and Local Government Historic Preservation Programs and the Secretary of the Interior's standards and guidelines.

Concurrent with federal cultural initiatives, SRS finalized an Archaeological Resource Management Plan containing the Programmatic Memorandum of Agreement among DOE, the South Carolina State Historic Preservation Officer, and the Advisory Council on Historic Preservation. The agreement allows SRS to proceed with routine operational plans involving landscape alteration without a case-by-case review process, satisfying DOE's responsibilities under Section 106 of the National Historic Preservation Act. The agreement streamlines the formal compliance review process, while ensuring that the site's specific management and operational needs are met. Most importantly, the agreement provides a stronger basis for comprehensive planning, allowing more effective management of the site's cultural resources, and integration with other programs and plans.

Cultural Resources Planning Goals and Objectives

The broad goal of SRS cultural resources management is to demonstrate continued excellence through compliance-based research and public outreach. To accomplish this goal, both short- and long-term objectives have been identified. The following short-term objectives are designed to satisfy immediate concerns, meet existing regulatory compliance requirements, and enhance cultural resources planning:

- Continue to integrate archaeological site location data into a Geographic Information System (GIS). With GIS, location data can be generated to make precise estimates of the probability of the occurrence of particular site types and management of known archaeological sites can be enhanced;

- Emphasize the role of SRS archaeological sites as environmental resources and as a research database, both of which are integral constituents of the site's designation as a National Environment Research Park;
- Integrate facilities and processes from the Cold War era into site cultural resource management planning;
- Provide protection for remnant cemeteries;
- Refine prehistoric and historic predictive models to enable improved site use planning and decision-making;
- Conduct additional testing of archaeological sites to evaluate cultural resources currently deemed potentially eligible for nomination to the National Register of Historic Places; and
- Bring the site into full curation compliance. SRS is currently out of regulatory compliance with 36 CFR 79, Curation of Federally Owned and Administered Archaeological Collections, primarily due to insufficient collection space.

The following long-term objectives were established to ensure proper management of SRS cultural and historic resources and continued compliance with cultural resource laws and regulations:

- Fulfill compliance commitments;
- Conduct prehistoric and historic archaeological research;
- Care for the SRS archaeological research collections; and
- Share research results with the public.

Cultural Resources Planning Assumptions

In preparing this plan, several assumptions were made, as follows:

- SRS will remain federally owned property.
- The U. S. Forest Service-Savannah River will continue to plan the management of SRS timber resources in a manner consistent with past practices.
- The Site Use System will continue to serve as an effective management tool.
- Funding for cultural resource management will increase to enable SRS to achieve the goals and objectives set forth in this plan.

Existing Conditions

In 1973, SRS began a phased approach to archaeological compliance involving reconnaissance surveys, general intensive watershed surveys, specific intensive surveys, data recovery, and coordination with major land users. Information from these activities is used to define archaeologically sensitive areas, facilitating effective land-use planning. The South Carolina Institute of Archaeology and Anthropology/Savannah River Archaeological Research Program supports SRS in this regard. Figure 7.1 shows samples from the early to mid-18th century lead-glazed earthenware, part of the recovery during a mitigation project in the Steel Creek area.

In the archaeological record of Native American prehistory, evidence of human activity is dominated by fragments of stone tools and ceramic vessels abandoned at sites. Changes in the form and decoration of tools and ceramics allow archaeologists to determine and understand Native American cultural time periods. Information about distribution of tools within and between archaeological sites, as well as the stone tools and ceramic artifacts themselves, provide a valuable source of information about Native American prehistory. Appendices G and H contain additional information about the site's historical background.

Over 1,300 archaeological sites have been identified within the site's boundaries. Most of the site's archaeological resources are prehistoric sites. At present, it is not feasible to pinpoint the location of all SRS prehistoric sites. However, researchers have found that similarities between the content of these sites and their locations relative to certain environmental features allow generalizations to be made about site locations. Researchers currently recognize three distinct types of prehistoric sites, distinguished primarily by the density and diversity of material remains:

Type 1 sites are long-term multi-component sites that served primarily as base camps. These sites are restricted to terraces and floodplains of large streams.

Type 2 sites are short-term multi-component and single component sites that served primarily as base camps from the Late Archaic period. Type 2 sites are found in the vicinity of Type 1 sites and are situated along both large and small streams.

Type 3 sites are small, chronologically unidentified sites serving primarily as small, short-term, food processing areas. These sites have a nonspecific, seemingly random distribution.

Figure 7.1.
18th Century lead glazed pottery shards

Site types have location patterns that are partly exclusive, but largely overlapping. In this sense, Type 1 and 2 sites are subsets of Type 3 locations. Type 1 and 2 site locations are characterized by environmental conditions conducive to human habitation. Variations in the resource potential of locations, in the size and complexity of regional populations, and in the organization of human settlement are among the many factors accounting for location patterning among sites. These issues are critical for assessing the research significance of sites. In addition, the location patterns evident among site types are useful for future SRS site use planning. The patterns and site types were used to develop the archaeological sensitivity zones and other planning tools described later in this section.

Differences in site types impact the management and preservation of SRS archaeological resources in at least two ways. First, research significance, hence eligibility for nomination to the National Register of Historic Places, generally increases with the number of components at a site. This is because the length of occupation, assemblage diversity, and artifact density of sites increases with the number of components. It follows that large, dense, and diverse multi-component sites will contain materials and contexts suited to a wider range of research topics than will lesser sites.

A second, largely independent consideration to SRS decision-makers is the cost of mitigating the adverse effects of impacting archaeological resources. All else being equal, the cost of excavating a site will generally increase with the number of components present. Site size and depth are important aspects of this assertion, meaning that multi-component sites tend to be larger and deeper than other sites. Although the research potential of archaeological sites is sometimes difficult to define and is subject to change, for the purpose of effective site use planning, the relative costs of mitigating impact to sites can be related to content and site location.

Archaeological Sensitivity Zones

Archaeological Sensitivity Zones are predictive boundaries for prehistoric archaeological sites. Four levels of archaeological sensitivity are used to facilitate site use planning (see Figure 7.2).

Sensitivity Zone I encompasses all areas in which Type 1 sites are located, as well as all projected locations of similar sites. Sensitivity Zone I is defined as areas containing all but a few of the known sites with four or more prehistoric components in the statistical sub-sample, and projected to contain sites of similar composition, as well as lesser sites. This area is considered to be the zone of highest archaeological site

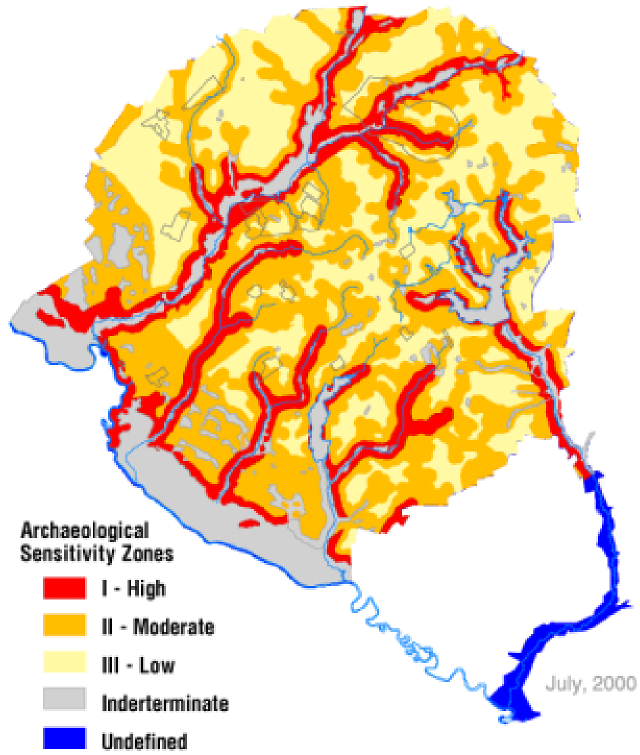


Figure 7.2
Map of SRS archaeological sensitivity zones

density. Land use activities in this zone have a high probability of encountering archaeological sites and a high probability of encountering large sites with dense and diverse artifact assemblages. Because of the combination of rich content and generally good preservation potential, many sites in the zone have substantial research potential and are considered eligible for nomination to the National Register of Historic Places. The monetary costs of mitigating potential impact to sites in this zone will generally be high.

Sensitivity Zone II encompasses all areas in which Type 2 sites are located, as well as all projected locations of similar sites. Sensitivity Zone II is defined as areas containing sites with zero to three diagnostic components in the statistical subsample and projected to contain sites of similar composition. The area is also considered to be this zone of moderate archaeological site density. Land use activities in the zone have a moderate probability of encountering archaeological sites but a low probability of encountering large sites with more than three prehistoric components. Sites characterized by a combination of rich content and good preservation will be considered eligible for nomination to the National Register of Historic Places. Because little is known about sites in this zone, small sites with limited content but with good preservation are also considered to have research potential. The monetary costs of mitigating potential impact to sites in this zone will generally be moderate.

Sensitivity Zone III includes all SRS areas not contained within Sensitivity Zones I and II, excluding restricted access areas, inundated bottomlands, and swamps. Sensitivity Zone III is defined as areas containing sites lacking diagnostic prehistoric components in the statistical sub-sample and projected to contain sites of similar composition. This zone is considered to be the zone of low archaeological site density. Land use activities in this zone have a low probability of encountering archaeological sites and virtually no chance of encountering large sites with more than three prehistoric components. Geologic deposition in the zone is generally limited, so the potential for site preservation under these conditions is low. Many sites in the zone will be surficial, lacking any artifacts. Exceptions to the meager content and poor preservation of sites in the zone have been observed, so there is some potential for encountering sites that would be considered eligible for nomination to the National Register of Historic Places. The costs of mitigating potential impact to sites in this zone, in terms of time and money, will generally be low.

Indeterminate Sensitivity Areas include swamps of the Savannah River floodplain and tributary floodplains in which no archaeological survey has been conducted.

Site Use System Grid Maps of Archaeological Sensitivity

Site Use System grid maps of archaeological sensitivity should be used as planning resources, and are not intended to substitute for or short-cut the normal SRS Site Use System application process or compliance activities pertaining to federal protection of cultural resources. Used in the early stages of land use planning, this set of maps enables an initial assessment of possible archaeological resources. However, no definite statements concerning actual archaeological resources or their significance should be made without actual archaeological survey and testing, and coordination with and concurrence from the South Carolina State Historic Preservation Officer.

Cultural Resources Planning Constraints

SRS is obligated to comply with state and federal laws and regulations governing cultural resource management. Numerous regulatory drivers for SRS archaeological activities exist, including the National Environmental Policy Act, the National Historic Preservation Act, the Archaeological Resources Protection Act, and the South Carolina State Historic Preservation Officer's *Guidelines and Standards for Archaeological Investigations*. To meet these requirements, SRS developed the *Archaeological Resource Management Plan*, which describes plans to continue surveys to identify and nominate properties and archaeological sites to the National Register of Historic Places.

Adequate space for collections is also a constraint. SRS is currently out of regulatory compliance, in part because space constraints prevent adequate public access to its collections. Currently, the new regulatory requirements concerning Cold War era resources, such as documentation, records, models, and other artifacts, present the greatest uncertainty in the site's ability to plan for collection space needs.

Future Plans

SRS is currently out of compliance with cultural resource regulations, in part, because space constraints prevent adequate public access to its collections. New regulatory requirements concerning Cold War-era resources including documentation, records, models, and other artifacts present the greatest uncertainty in the site's ability to plan for collection space needs. One solution to the current problem, which would also address additional problems that could result from proposed changes to the National Historic Preservation Act, would be for the site to construct a facility to house the collection, with sufficient display space for public viewing. This would serve several archaeological regulatory purposes and could be used to provide additional benefit for the site and the surrounding community in support of projects such as the South Carolina Heritage Corridor. Site reconfiguration provides the opportunity to include a permanent home for the collections with public access in the development of the visitors' center in the B Area administrative complex.

Chapter 8

Long Term Stewardship Plan

Purpose and Scope

During the last decade, the Department of Energy (DOE) has made significant progress in its environmental cleanup program, resulting in substantially lower risks and lower annual costs for maintaining safe conditions. Complete restoration to levels acceptable for unrestricted use cannot be accomplished at many DOE sites. This is due, in large part, to the nature of the contamination and the lack of proven cleanup and treatment technologies. Some hazards remaining at DOE sites will require attention for many centuries. Land use will need to be restricted for portions of some sites, as will the future use of contaminated groundwater.

Consequently, long-term stewardship will be needed at these sites to ensure that the selected remedies will remain protective for future generations. Long-term stewardship includes all activities, such as environmental monitoring, site maintenance, application, and enforcement of institutional controls and information management required to protect human health and the environment from hazards remaining at DOE sites after cleanup is complete.

This chapter discusses the long-term stewardship for the site. For this discussion, the site is divided into six areas based on watershed boundaries. SRS stewardship activities will be a part of its ongoing missions. If complete cleanup is not possible, contaminated sites will be managed by other protective means such as isolation, monitoring, and land use restrictions. Over time, advances in science and technology could drive changes in ultimate end-states and long-term stewardship activities. This stewardship process will cover facilities, waste sites, and other contaminated areas such as release sites and groundwater.

National Perspective On Long Term Stewardship

DOE is required to conduct stewardship activities under existing regulatory requirements and DOE Orders. Many DOE organizations have been conducting stewardship activities for several years as part of their ongoing missions. Scientists and engineers have long understood that much of the wastes, radionuclides, and metals managed by DOE cannot be broken down into non-hazardous materials. These materials must be managed by treatment, isolation, and monitoring.

Site-level stewardship activities include two general categories:

- **Active controls.** These include performing certain activities to control risk on a relatively frequent or continuous basis, such as operating, maintaining, and monitoring engineered controls, including caps, other physical barriers, and groundwater pump-and-treat systems. This could also include practical tasks such as repairing fences, preventing erosion, and collecting environmental samples to monitor the natural movement of contaminants.

- **Passive controls.** These generally entail less intensive tasks required to convey information about site hazards and/or limiting access through physical or legal means. Passive controls could include ensuring the continued effectiveness of applicable management, including physical systems (e.g., fences and other barriers), governmental controls (e.g., ordinances and building permits), and proprietary controls (e.g., deeds and easements). In addition, information management systems will be necessary to store, preserve, and integrate information about a wide range of issues including the physical and chemical characteristics of each hazard, how it was created, whether it has changed over time, and the measures that have historically been used to contain each hazard.

A key element of the national long-term stewardship program will likely be the use of institutional controls, including governmental and proprietary controls, to ensure that land use restrictions are maintained. Institutional controls include deed restrictions, zoning restrictions, permit programs, well-drilling restrictions, and other restrictions that are traditionally established by local governments. Proprietary controls include deed restrictions, easements, and restrictive covenants that are based on state property laws.

In addition, there are a variety of tasks that will likely be needed for an effective long-term stewardship program. These include the following:

- Supporting and evaluating new technologies, as they develop, that may be useful in reducing long-term stewardship costs, improving performance, or performing a permanent remedy that eliminates the need for long-term stewardship, as well as improving the understanding of health and environmental impacts of residual contaminants;
- Emergency response;
- Compliance oversight;
- Natural and cultural resource management;
- Budget preparation and other administrative support; and
- Site redevelopment and community liaison and planning.

SRS Perspectives on Long Term Stewardship

As of 1998, of the approximately 2,000 buildings at SRS, 128 were identified surplus. An additional 120 facilities may be declared surplus within the next five years. In addition to the facilities, there are 515 waste units identified, of which 221 have been classified as either remediated or as requiring no further action. Approximately 8,300 acres of groundwater plumes containing 14 billion gallons of contaminated groundwater have also been identified, and over four billion gallons have already been treated.

The process of identifying all the detailed requirements for long term stewardship activities anticipated for the site is still underway and will not be completed for at least a year. This plan provides the general framework for the long-term stewardship process. Environmental remediation activities currently are scheduled for completion by 2038. The site is divided into six units, based on watershed boundaries, for managing site remediation activities (see Figure 8.1). A summary of the stewardship issues for each of the six watersheds and their associated areas follows.

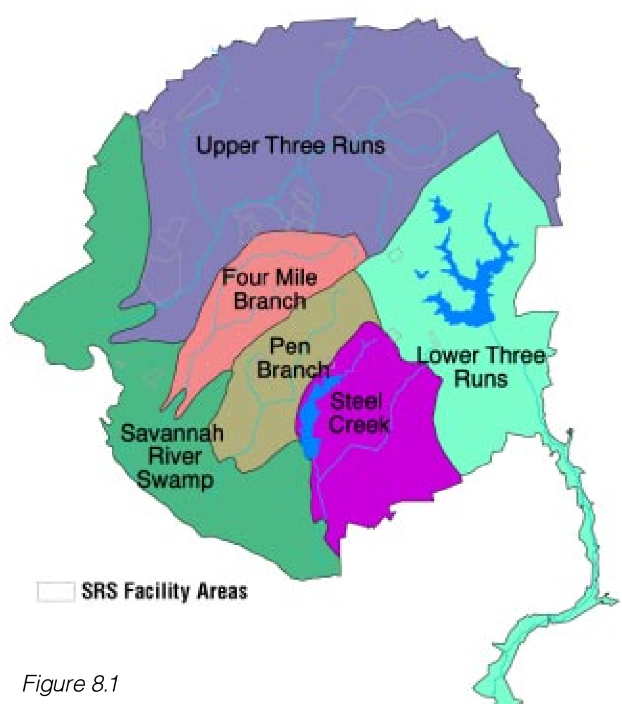


Figure 8.1
SRS watershed map

Flood Plain Swamp Watershed

This watershed encompasses the D, T, A, B, and West M Areas, all located in the Site Industrial Support Zone. Both M Area and West M Area border on the General Support Use Zone. M Area and portions of D Area and West M Area were used for the disposal of debris, oil, and chemicals. T Area, formerly called TNX, was used to conduct pilot tests and for disposal of debris, oil, and chemicals. The area is contaminated with metals, volatile organic compounds (VOCs), and radionuclides.

Soil: Contaminants of concern in the flood plain swamp area include metals, radionuclides, and VOCs. Preliminary evaluation of release sites in these areas has not been completed, and specific soil remediation strategies and technologies have not been identified. It is anticipated that the remedy for buried waste, structures, and soil contamination in Flood Plain Swamp will focus on in-place treatment or immobilization, rather than excavation and disposal. Cleanup levels will be determined with the regulators and with public concurrence during the remedial process and will be based on applicable or relevant and appropriate requirements (ARARs) and risk-based concentration limits. Soil contamination, buried waste, and buried structures, such as pipelines, remaining in place will be contained through natural or synthetic capping.

Water: Contaminants of concern in groundwater include chlorinated VOCs, metals, and radionuclides such as tritium, cesium, uranium, and strontium. The groundwater strategy is a combination of ex-situ and in-situ treatments with target cleanup levels equal to the maximum concentration limits (MCLs). The duration of this treatment will be determined by the rate of remediation.

Engineered Units: All Cold War legacy low-level radioactive wastes from these areas are anticipated to be disposed in onsite vaults located in other areas of the site. Waste units closed in place in this area will contain residual metals, VOCs, and radionuclides. There is also a waste oil facility in the D Area, for which there are no current remediation plans.

Facilities: Some facilities are contaminated with radionuclides and heavy metals. A final endstate for major surplus facilities in this watershed has not been determined, although no plans to reuse the facilities have been made. Facilities are likely to remain in a radiologically contaminated state. At a minimum, the M-Area fuel fabrication facilities will require restricted access and institutional controls. Deactivated major surplus facilities in D and M Areas will be monitored through 2070 or until final deactivation and decommissioning (D&D) and final disposition of the surplus facilities. In the interim, deactivated facilities will be maintained in accordance with DOE Order 430.1A, Life Cycle Asset Management. Access to deactivated facilities will be controlled, and environmental monitoring will continue. M-Area facilities will undergo limited stabilization and deactivation because they are located close to the site boundary.

Fourmile Branch Watershed

This watershed encompasses E, S, Z, C, N, F, and H Areas and the Burial Ground Complex, all of which are located in the Site Industrial Zone. E Area and the Burial Ground Complex have been used as disposal sites for hazardous and radioactive wastes. The portions of this watershed located in the Site Industrial Zone have been identified as areas that could be developed for future waste management or industrial use. Some specific missions have been identified in the *Paths to Closure* and other SRS documents, including production of mixed oxide fuel (MOX) fuel and production and purification of tritium. Periodic monitoring and institutional controls will be implemented and deed restrictions will be required in the event that the property is transferred to other owners.

Soil: Contaminants of concern in Fourmile Branch Watershed include heavy metals, radionuclides, and VOCs. Preliminary evaluations of release sites in these areas have not been completed, and specific remediation strategies and technologies for remediation of these release sites have not been identified. It is anticipated that the remedy for buried waste and soil contamination in the Fourmile Branch Watershed will focus on in-place treatment or immobilization rather than excavation and disposal. Specific remediation technologies will be determined during the remedial process for each of the sites with concurrence from the regulators and the public. The final endstate for the Old Radioactive Waste Burial Ground at the Burial Ground Complex assumes the area will be capped. Cleanup levels will be determined during the remedial process and will be based on ARARs and risk-based concentration limits.

Water: Contaminants of concern in groundwater in the Fourmile Branch Watershed include tritium and other radionuclides, metals, VOCs, and nitrates. The remediation strategy includes a pump and treat and reinjection system with reverse osmosis, pre-filtration, and secondary wastewater treatment. The duration of pumping and reinjection is dependent upon hydrogeology and decay rates. It is anticipated that groundwater use will be restricted indefinitely. Groundwater monitoring will take place, although the duration and frequency is currently undetermined.

Engineered Units: Fifty-one high level waste (HLW) tanks, two saltstone disposal vaults, and 22 solvent tanks will remain in this area. The final endstate for the HLW tanks is scheduled for 2025. To achieve the final endstate, all waste heels will be removed from the tanks, piping will be capped and sealed, and the tanks will be washed, filled with grout, and left in place. The Saltstone disposal vaults will be covered with native soil, and a cap will be installed consisting of layers of clay, gravel, geotextile fabric, and other materials. For the 22 old solvent tanks in this area, the liquid and sludge will be removed from these tanks, where feasible, and dispositioned according to agreements with the regulators. It is expected that the tanks will be filled with grout, capped, and left in place. It is anticipated that the units closed in this area will require institutional controls and long-term surveillance and maintenance in perpetuity. Environmental monitoring will be required; however, the duration of this monitoring is undetermined at this time and depends on facility operations.

Facilities: Facilities in this watershed are contaminated with radionuclides, heavy metals, VOCs, and asbestos. Several of the facilities are being considered for fissile materials disposition and future nuclear missions. Deactivation of the 247-F Naval Fuels Facility was completed in 1997, and the facility is currently undergoing long-term surveillance and maintenance, pending a decision on final decontamination and decommissioning for final disposition. All processing equipment at the Defense Waste Processing Facility (DWPF) will be deactivated, the sand filter will be isolated and capped, and the DWPF waste treatment plant will be closed after vitrification of all waste is complete. The former nuclear processing facilities, such as F and H Canyons, 235-F Building, HB-Line, and C-Reactor Building, are anticipated to be deactivated between 2007 and 2015. After that, they will be maintained in a long-term surveillance and maintenance condition while awaiting a decision on D&D. F- and H-Canyon facilities will be dispositioned in accordance with the Phased Canyon Strategy signed by the Secretary of Energy on July 17, 1997, and DOE Order 430.1, Life Cycle Asset Management. All of the facilities are likely to remain in a contaminated state. During deactivation, and while awaiting a decision concerning final D&D, facilities in these areas will undergo surveillance and maintenance and monitoring activities. Interim surveillance and maintenance activities include surveillance of facility conditions; monitoring and controlling contamination; providing a safe method for entry into the facilities; and ensuring the structural integrity of the facilities, per the guidelines of DOE Order 430.1A, Life Cycle Asset Management. All of the former nuclear processing facilities will require restricted access and institutional controls. These deactivated facilities will be subject to long-term surveillance and maintenance through 2070 or until a decision is made concerning final D&D and final disposition of the facilities.

Lower Three Runs Watershed

This watershed encompasses the R-, L-, P-, and K-Reactor Areas and Par Pond. The reactor areas are located in the Site Industrial Zone, and Par Pond is located in the Site Industrial Support Zone. Release sites at the reactor areas were used for the disposal of radioactive and chemical wastes, and Par Pond received sludge from the Central Shops Sludge Lagoon in N Area. Environmental Restoration activities in these areas, including long-term surveillance and maintenance activities, are scheduled to continue through 2038. The reactor areas are scheduled for deactivation by 2013.

Par Pond is a 2,640-acre, manmade pond, which has unacceptable levels of cesium and mercury in the pond bed. Ironically, the stability, size, and high nutrient content has made Par Pond a significant, unique, and highly studied ecological resource for fish and wildlife populations in the Southeast until it was partially drained in 1991 due to a structural problem discovered in the earthen dam. The drawdown by two-thirds of its volume for safety reasons exposed 1,340 acres of radioactively contaminated sediments and caused the loss of 10 square miles of wetland vegetation. This led to its declaration by the Environmental Protection Agency as a Comprehensive Environmental Restoration Conservation and Liability Act (CERCLA) site subject to remediation. However, in doing so, it has raised concerns for the populations of fish, alligators, and endangered species and the potential for off-site migration of contaminated wildlife from contact with the exposed sediments. Because of the paradox of this ecologically valuable, yet contaminated ecosystem, the lake's future ecological and operational management is uncertain.

Soil: Contaminants of concern in the Lower Three Runs Watershed include radionuclides (e.g., strontium, cesium, cobalt, and tritium), metals (including arsenic, chromium, and lead), and VOCs. The P- and R-Areas Burning/Rubble Pits were closed in 1981. The remediation strategy for contaminated soils and buried waste anticipates that contaminated soils, wastes, and structures may be treated or immobilized onsite, left in place, and subject to long-term surveillance and maintenance. Cleanup levels will be determined during the remedial process for each of the sites and will be based on ARARs and risk-based concentration limits.

Water: Groundwater in these areas is contaminated with VOCs, heavy metals, cesium, uranium, and strontium. The duration of remediation will be determined by the rate of remediation. Contamination in Par Pond, Savannah River Swamp, and L Lake cannot be remediated without causing ecological damage. Restrictions on surface and groundwater use are anticipated to be required indefinitely. Monitoring activities and their duration will be determined when the remedial process is determined and with the concurrence of the regulators and the public.

Engineered Units: There are no landfills, vaults, or tank farms in this area. In-place waste units will be closed. Long-term surveillance and maintenance activities will be defined as the remedial process is selected.

Facilities: All of the reactors are potentially contaminated with polychlorinated biphenyl (PCBs), asbestos, and long-lived radionuclides. It is expected that long-lived radionuclides are present in these facilities; however, until characterization activities are completed, the nature and extent of the contamination is indefinite. Deactivation of the reactors in the K, L, P, and R Areas will be completed by 2012. The Receiving Basin for Offsite Fuels (RBOF) is located near the reactors. This facility will be remediated to meet the guidelines of DOE Order 430.1A, Life Cycle Asset Management.

SRS has not prepared a definitive plan for D&D of the production reactors or RBOF. The current plan is for deactivation of these facilities, rather than complete D&D. Neither the technologies nor the final approach to D&D of any of the major nuclear facilities is known at this time. Cleanup levels will be determined as deactivation plans are prepared. Each of the reactors will require restricted access or institutional controls as determined by the deactivation plan. The reactors and the RBOF will be monitored and subject to long-term surveillance and maintenance through 2070 or until D&D and final disposition. All long-term surveillance and maintenance activities and their frequencies will be established by required safety documentation prepared at the completion of deactivation.

Pen Branch Watershed

This area encompasses N, L, K, and G Areas. The N, L, and K Areas are located in the Site Industrial Zone. G Area is located in both the Site Industrial and Site Industrial Support Zones. Release sites in these areas were used for disposal of chemicals, metals, pesticides, organic chemicals, and contaminated wastewater.

Soil: Soils are contaminated with metals, VOCs, and radionuclides. The anticipated soil remediation strategy for SRS is that contaminated soil and buried waste will be treated or stabilized in place. Contamination remaining in place will be contained through natural or synthetic capping. Institutional controls and inspections will be implemented and deed restrictions will be required in the event that the property is transferred to other owners.

Water: The groundwater in this watershed is contaminated with tritium and other radionuclides, VOCs, metals, and sulfate. The groundwater treatment strategy for this watershed with the exception of tritium contamination, is a combination of in-situ and ex-situ treatment. Tritium contamination in these areas will likely be remediated through natural attenuation. Contaminated water will be remediated to MCLs. Restriction of groundwater use in these areas is anticipated to be required indefinitely.

Engineered Units: Waste units will be closed in-place. Closure of the units in this watershed will be designed on a unit-specific basis. Long-term surveillance and maintenance activities will be determined as remedial activities take place.

Facilities: The reactors in K and L Areas will be deactivated as described in the Lower Three Runs Watershed section. The reactors will be monitored through 2070 or until D&D and final disposition.

Steel Creek Watershed

This area encompasses portions of the L and P Areas, which are located in the Site Industrial Zone. The L-Area Seepage Basin accepted small quantities of oils and organic chemicals of unknown use and origin. Undocumented amounts of radioactivity were released to the seepage basin through infrequent repair work. The L-Area Seepage Basin was also used for disposal of the L-Reactor's Disassembly Basin purge water. The burning/rubble pit in P Area was used for the disposal of organic chemicals of unknown use and origin, waste oils, and other wastes.

Soil: Contaminants of concern in this area include radionuclides, metals, and VOCs. The anticipated soil remediation strategy for the SRS is that contaminated soil and buried waste will be treated or stabilized in place. Contamination remaining in place will be contained through natural or synthetic capping. Institutional controls and inspections will be implemented and deed restrictions will be required in the event that the property is transferred to other owners.

Water: Groundwater in this watershed is contaminated with tritium and other radionuclides, VOCs, heavy metals, and sulfates. The groundwater treatment strategy for this watershed is a combination of ex-situ and in-situ treatment. Tritium contamination in this watershed will likely be remediated by natural attenuation. Restrictions on the use of groundwater in this watershed are expected to be required indefinitely. The duration of remedial actions will be determined once remediation is taking place. Long-term surveillance and maintenance activities are expected, but the frequency and duration are currently unknown.

Engineered Units: Existing in-place waste units will be closed. The closure strategy for the units in this watershed has not yet been determined. Long-term surveillance and maintenance is expected, but the frequency and duration are not known at this time.

Facilities: The reactors in L and P Areas will be deactivated as described in the Lower Three Runs Watershed section. The reactors will be monitored quarterly through 2070 or until D&D and final disposition.

Upper Three Runs Watershed

This area encompasses the A, B, and M Areas, and parts of E, F, and H Areas. The A, M, and B Areas are located in the Site Industrial Support Zone and the E, F, and H Areas are located in the Site Industrial Zone. The A and M Areas are adjacent to the General Support Use Zone. Site operations in these areas resulted in the disposal of waste in seepage and settling basins, unlined pits, waste piles, burial grounds, and underground process lines and storage tanks. F and H Areas were used for plutonium separation, and H Area also processed tritium and uranium.

Soil: Contaminants of concern in Upper Three Runs areas include trichloroethylene, perchloroethylene, arsenic, cadmium, chromium, lithium, mercury, PCBs, aluminum, radionuclides, and lead. The remediation strategies for contaminated soils in this watershed will focus on excavation/removal of highly contaminated soils and barrier/containment type technologies that prevent exposure of contamination and minimize and contain the spread of contamination. The number of units or acres to be capped in this watershed has not been determined due to the fact that the area is still under investigation, and the extent of the contamination is still being defined. Cleanup levels will be incorporated into Resource Conservation and Recovery Act (RCRA) and/or CERCLA documents and will be based on ARARs and risk-based criteria. Soil monitoring, waste unit restrictions, institutional controls, and inspections will be implemented. Deed restrictions will be required in the event that the property is transferred to other owners.

Water: Contaminants of concern in this watershed include VOCs, tritium, and metals. Dense non-aqueous phase liquids (DNAPLs) are also present and pose a significant challenge for remediation. DNAPLs are concentrated areas of organic solvent contamination in the vadose zone or in low places in the groundwater aquifer. Technology development efforts have been focused on identifying better ways to find and remediate regions of DNAPL contamination. The groundwater remediation strategy for this watershed includes air stripping, in-situ chemical oxidation, underground steam stripping, and monitored natural attenuation. The duration and frequency of treatment is not yet determined.

Engineered Units: Remediation of the tank farms and Saltstone facility in the H and F Areas are covered in the Fourmile Branch Watershed section. There are several hazardous waste disposal sites, a closed sanitary waste landfill, and radioactive burial grounds in the B Area. E Area has several facilities that were used or are currently used as disposal sites for hazardous and radioactive wastes. Wastes associated with these active and closed waste management facilities will remain onsite after stabilization and capping. The sanitary and non-radioactive waste landfill has been capped. The hazardous waste disposal units will either be closed with RCRA caps or other unit-specific engineered designs. No remedial decisions have been made for the Burial Grounds.

Facilities: The remediation strategy and anticipated long-term stewardship requirement for contaminated facilities in this watershed are similar to those discussed in the Fourmile Branch Watershed section.

Appendices

Appendix A
SRS and the Federal Budget Process

Summary of the Federal Budget Process

Funding for SRS activities is provided through a complex and lengthy process, the federal budget process. A budget is a plan for managing funds, setting levels of funding, accomplishing a scope of work on a given schedule, and measured by performance metrics. The process begins approximately two years prior to the start of the fiscal year in which the funding will be needed. A fiscal year, for federal budget purposes, is October through September. For example, the fiscal year 2001 is October 1, 2000, through September 30, 2001. With a lead time of two years, there are many uncertainties facing federal agencies including future economic conditions, political decisions, and congressional actions. Below is a very simplified list of the steps necessary for developing the U.S federal budget.

1. Each federal agency develops a budget.

   Each federal agency within the Executive Branch of the U.S. Government prepares a budget, which is submitted to the Office of Management and Budget (OMB), a part of the Executive Branch. OMB coordinates the agencies' requests with direction from the President to form the President's Budget, due to Congress eight months before the start of the fiscal year in which the funding will be needed. This President's Budget is only a request, which will be debated and possibly changed by Congress over a period of seven to eight months.

2. The House of Representatives and Senate budget committees and subcommittees revise the President's budget.

   After review of the budget by several Congressional committees, each committee modifies and then approves their respective portion of the President's Budget, eventually creating a consolidated bill, approved by both the House and Senate. The discrepancies between these two consolidated bills are resolved through a compromise process, leading to a final budget approved by both the House and Senate.

3. The President considers the budget approved by Congress.

   The final version of the budget, approved by both the Senate and House, is then delivered to the President for approval or veto. Once approved by the President, implementation of the budget can begin.

Authorizations and Appropriations

Before a federal agency can spend funds on a program or activity, Congress must pass both an authorization act and an appropriations act. An authorization act is legislation that establishes the purpose and guidelines for a given program and usually sets the upper limit on the amount of new funds that can be appropriated. The authorization does not provide the actual dollars for a program or enable an agency to spend funds in the future. An appropriations act is legislation that enables an agency or department to make spending commitments and to spend money. An appropriation is the key determinant of how much will be spent on a program.

Authorizations. An authorization is legislation that has a dual purpose: (1) it is the means by which Congress establishes policy and exercises control of federal agencies, and (2) it provides the authority for Congress to appropriate funds. Accordingly, an authorization act is legislation that establishes, continues, or modifies an agency or program and authorizes the enactment of appropriations for that agency or program. In general, an authorizations act establishes the terms and conditions under which each agency operates.

Authorizations Committees in both the House of Representatives (House) and Senate are responsible for reviewing the President's Budget. These committees and their subcommittees hold hearings on the specific parts of the budget within their legislative jurisdiction. They are likely to hear from the cabinet officials whose programs they must review, groups that benefit from those programs, and other members of Congress. Once these reviews are complete, the committees pass authorizations bills. These bills represent the compromise between the House and Senate as to the level of effort for the government agencies and programs. Congress uses this legislation to tell agencies what level of activities will be approved. Typically, authorization bills are approved prior to the passage of the appropriations bills and serve as the basis for the Appropriations Committees to begin reviewing the budget.

Authorizations do not permit agencies to incur obligations or spend money, rather they establish the financial boundaries within which appropriations can be made. Actual funding is only made available through the appropriations process.

Appropriations. In the federal government, Congress must pass an appropriation before funds can be made available for obligation and expenditure. An appropriations act is a law passed by Congress, which provides federal agencies with the legal authority to incur obligations, and which provides the Treasury Department with the authority to make payments for designated purposes.

The power of an appropriation derives from the *United States Constitution*, which prohibits the withdrawal of money from the Treasury unless authorized in the form of an appropriation enacted by Congress. Congressional appropriations act as a limitation on the Executive Branch. An agency may not spend more than the amount appropriated to it, and it may use available funds only for the purposes and according to the conditions provided by Congress.

Typically, the review of an appropriation bill begins in the House. Before an appropriations bill is acted on by the full House Appropriations Committee, the relevant House appropriations subcommittee first considers it. These subcommittees hold extensive hearings on the appropriations request. Agencies prepare and submit justifications, providing detailed information to support the President's budget requests. Agency witnesses appear before House subcommittees to explain budget estimates and to answer questions.

Savannah River Site Budget Process

The annual Department of Energy Headquarters Office (DOE-HQ) budget call establishes the actual budget requirements, data formats, and submission schedules that governs the Savannah River Site (SRS) budget submission. Department of Energy Savannah River Operations Office (DOE-SR) Budget Formulation Process is the formal mechanism to develop DOE-SR and Management and Operating (M&O) Contractors cost estimates and planned work scope. The DOE-SR Field Budget Request is utilized in the development of the DOE HQ and OMB budget submissions that support the President's Budget to Congress (DOE-SR CFO *Budget Formulation Manual*, July 19, 2000).

During budget formulation, resource requirements are prepared and detailed analysis and reviews are performed to ensure that budgetary assumptions and other forms of guidance are being properly communicated. This involves the issuance of formal guidance and instructions to site contractors for the development of the outyear budget request.

The following timetable serves as a general outline of the SRS budget development process.

October: Within DOE-HQ, the Office of Budget issues the Budget Call to the managers and chief financial officers of the DOE field offices, including SRS. These calls contain detailed programmatic and financial assumptions, budget requirements and instructions, and budget submission schedules.

November: Based on the guidance in the DOE-HQ Budget Call, DOE-SR issues a budget call to site contractors, requesting estimates for the budget year and the four outyears beyond the budget submission year. DOE-SR issues an initial outyear budget call to the contractors requesting a statement of the current year budget as authorized by Congress and allotted by DOE, a re-statement of the budget for the next fiscal year as modified from the original submission, the proposed budget for the fiscal year two years in advance, and the forecast for the outyears beyond the budget submission years. The call contains:

- Preliminary funding and program guidance
- Data formats and instructions
- Budget assumptions and requirements
- Schedules for use in the development of the outyear and cross-cut budgets

December: Site contractors prepare and issue internal budget call packages to operating and supporting divisions, requesting all information required for budget development. Included in the call are the target levels of funding and staffing plans for the responsible divisions, as well as budget assumptions, program guidance, and required formats and schedules.

January-February: Site Program Managers and Financial Controllers develop strategic plans and budgets including long-term goals, priorities, resource requirements, and strategies for the budget year and the four years following the budget year.

For activities funded from the Environmental Management Program, program-specific priority decisions are based on the SRS Integrated Environmental Management Integrated Priority List (IPL). The IPL process was developed using a risk-based prioritization model, which has evolved into a management planning tool that considers extensive stakeholder input and is focused on reducing risk and improving safety within and outside the site boundaries while meeting enforceable compliance agreements. The IPL is the primary tool for assessing the impacts of funding shortfalls and consequently developing actions to mitigate the impacts.

February: Divisions submit budget requests for review and consolidation into integrated budget requests. Contractor budgets are presented to senior staff for review. During these reviews, Program Managers explain and justify their budget requests, at which time the initial budget requests are modified and approved by DOE-SR senior management.

March: Each contractor consolidates its final program budget into a fully integrated budget submission and prepares any required summary tables or budget narratives. Contractor budgets are submitted to DOE-SR in late March or early April.

April-May: After contractor budgets are submitted to DOE-SR, the field office is responsible for validating budget requests to ensure reasonableness, consistency with program guidance, and appropriate budget estimates. DOE-SR consolidates all primary and supplemental budget justification material into a comprehensive budget request for SRS and transmits it to DOE-HQ. DOE-SR gives final approval on program content and funding and submits the DOE-SR Field Budget Request to the cognizant DOE-HQ's Program Office.

May: DOE-HQ Program Office staff review and analyze the DOE-SR Field Budget Request prior to submitting the department-wide request to DOE-HQ Chief Financial Officer (CFO). HQ DOE CFO staff review and analyze the department-wide budget, propose adjustments, make presentations to the Secretary of Energy and submit department-wide budget to OMB.

Stakeholders are given an overview of the Federal budget process and why and how their input may impact future activities. In discussing budget estimates with stakeholders, DOE-SR clearly indicates that all target budget amounts are preliminary, and that funding requests are subject to congressional approval.

DOE-SR Budget Submissions

DOE-SR's mission encompasses several major departmental programs, thereby requiring multiple, diverse budget submissions. Each DOE program is funded separately by Congress to accomplish a specific work scope. Because of this, SRS cannot use money allocated from one program to fund activities in another program.

The following is a brief explanation of DOE-SR budget submissions.

"Unicall" Field Budget Submission: This submission is required by the DOE-HQ CFO. The Unicall concept enhances the efficiency and effectiveness of the field budget process by coordinating and centralizing communications between DOE-SR and DOE-HQ Program Offices regarding the budget. Most DOE-HQ organizations use the Unicall to communicate their specific data requirements relevant to the field office budget submission. The Unicall is coordinated and issued by the DOE-HQ CFO and contains a common set of due dates. DOE-SR issues initial calls to its M&O Contractor and other SRS organizations, as appropriate, based on the financial guidance provided by the Unicall.

Defense Program's Weapons Activities Stockpile Management Budget: The Weapons Activities budget submission for DOE-SR weapons activities is included in the budget request by the DOE Albuquerque Field Office (DOE-AL), as part of its responsibility for the Stockpile Support component of the Department's Weapons Activities. Unique aspects of the nature and organization of these activities require a budget formulation process separate and slightly different from the field budget submission process managed by the DOE-HQ CFO. As a result, DOE-SR annually formulates and submits to DOE-AL a Weapons Activities budget reflecting DOE-SR's role in the Weapons Activities Program. DOE-AL consolidates the DOE-SR submission with the other Weapons Activities field budgets for a consolidated submission to DOE-HQ. The SRS role in Weapons Activities relates to the Weapons Stockpile Support component of that program. These activities include production competency and the maintenance, evaluation, retirement, dismantlement, and disposal of nuclear weapons in accordance with the quality, quantity, and schedule requirements approved by the President in the Nuclear Weapons Stockpile Plan.

Integrated Safeguards and Security Budget: The Safeguards and Security Budget Guidance provides specific guidance and instructions for preparation of the annual budget request and related outyear planning estimates for the Safeguards and Security Programs at DOE-SR. This guidance includes instructions in the development of primary submission materials, supplementary justification materials, performance measures, project data sheets, and field work proposals. The budget structure for the Safeguards and Security (S&S) Budget is by subprogram (formerly S&S Category) and Program Element (formerly S&S Subcategory). These subprograms are Physical Protection Protective Forces, Physical Security Protection Systems, Transportation, Information Security, Cyber Security, Personnel Security, Security Investigations, Material Control and Accountability, Technology Development, Program Management and Program Direction.

Environmental Management (EM) Paths to Closure (PtC): The PtC integrates all EM tasks into discrete projects in an optimized sequence to maximize cleanup across the DOE Complex by 2006. The SRS PtC is composed of individual cost, scope, and schedule project baselines with yearly performance targets, each called a Project Baseline Summary (PBS). DOE-HQ EM issues budget formulation guidance each year that is consistent with the PtC vision. This guidance includes OMB funding targets, national assumptions, budget narrative and priority list requirements, and direction concerning the development of program-specific performance measures. SRS prepares the requested budget information, as required in the Field Budget Unicall. As part of this process, SRS uses the IPL to optimize budget priorities.

Savannah River Budget Plan: The SRBP is a resource that provides extensive supporting documentation for DOE-SR's out-year budget requests. Both tasked based plans and organizational based plans are developed. The plans provide detailed work scope descriptions, planned accomplishments, milestones, performance measures and staffing and funding requirements for each site task and organization. This information is provided for a 7-year window. The SRBP provides an estimate of site staffing and costs with respect to organization, scope of work, skill mix, funding source (e.g., Budget and Reporting Code), Budget Authority, Budget Outlay and Work Breakdown Structure. The work scope descriptions describe work for each fiscal year and explain changes in scope from year to year. Staffing and funding information is broken down between direct and indirect and provide visibility for division and department overhead and capital equipment and general plant project requirements. Funding information is also broken down by element of expense (e.g., labor, materials, subcontracts, and power). In addition, numerous financial schedules/exhibits are provided, which provide additional supporting detail.

Work for Others: The Savannah River Technology Center (SRTC), besides supporting SRS and DOE missions and objectives, also provides support to other government agencies, universities, and private companies. The site collects money from these other entities, which is used to fund the SRTC activities performed. Budget submissions for Work for Others varies based on the entity requesting the activity.

Funding Categories

DOE's budget for most programs is divided into two funding categories: Operating Expenses and Construction. In fiscal year 1996, funds supporting General Plant Projects (GPP), Capital Equipment (CE) and most Accelerator Improvement Plant Projects (AIP) were merged and budgeted with operating funds. This change was made to allow for greater flexibility for the Department's laboratories and facilities in allocating resources for operations and infrastructure activities, and at the same time retain the capability for adequate program management by DOE-HQ program offices.

Operating Expenses: These expenses are normally used to budget for operational activities and include such expenses such as labor, travel, training, materials, maintenance and replacement of equivalent worn parts and items, which are not intended to be capitalized. Capital assets or equipment are assets included in financial records having an acquisition value of $25,000 or more per unit or system and has a useful life of more than two years. Operating expenses are also used to fund construction projects that have an expected life of less than two years and experimental facilities since these projects will not be capitalized on the books. Another exception is the lease purchase of telecommunications equipment that is considered to be the provision of the utility services and is funded annually using operating expenses. When operating expenses are used to budget for construction projects, a project data sheet is required for each project in excess of the limitation on General Plant Projects, currently at $5 million.

In most cases, equipment can be installed with little or no significant installation cost or construction activities required. However, in some cases, the equipment requires significant construction activities to function such as the provision of foundations, utilities, and structural modifications and additions to a building. As a general rule, construction funds are used when these construction activities constitute more than 20 percent of the costs of the equipment, or when construction activities exceed the GPP limitation.

Capital Equipment: These assets are recorded in financial records when they have an acquisition value of $25,000 or more and a service life of two or more years. Examples include heavy equipment, special and scientific equipment, and automated data processing equipment and systems when components' total value equals $25,000. The Committee on Energy and Water Appropriations has merged capital equipment and general plant projects with operating funding. However, this equipment continues to be reflected in financial and accounting reports and budget requests as capital equipment. In most cases, equipment can be installed with little or no significant installation costs or construction activities required. However, in some cases, the equipment requires significant construction activities for installation of the equipment. When construction activities constitute more than 20 percent of the costs of the equipment or when construction activities exceed the GPP limitation of $5 million, then the costs are considered construction funds.

General Plant Projects: These activities are generally miscellaneous minor new construction activities where the total estimated costs do not exceed the Congressionally authorized amount of $5 million. These projects are necessary to adapt facilities to new or improved production techniques, to effect economies of operations, and to reduce or eliminate health, fire, and security problems. They provide for the design and/or construction; additions and improvements to land, buildings, and utility systems and may include construction of small new buildings, replacements or additions to roads, and general area improvements. GPPs are now merged and budgeted with operating funds.

Line Item Construction Projects: These are separately identified project activities that are submitted for funding and are specifically reviewed and approved by Congress. A Line Item Construction Project supports a program mission with a defined start and end point, undertaken to create a product, facility, or system with interdependent activities to meet a common objective or mission. Line Item Construction Projects include planning and execution of construction, renovation, modification, environmental restoration or decommissioning efforts, and large capital equipment or technology development activities. A project data sheet is required to explain and justify to Congress the need for each Line Item Construction Project and includes the description, justification, and cost data. A project data sheet is submitted for each new Line Item Construction Project that is estimated to cost $5 million or more, and again each year that money is requested.

Final SRS Budget Submission

The final SRS budget submission includes Weapons Activities, Environmental Management, and other minor program budgets, broken into operating expense and construction projects. The site's budget is added to the entire DOE Complex budget and submitted to the Office of Management and Budget. OMB includes the DOE budget with other federal agencies' budgets to form the President's budget, which is sent to Congress for review. Congress passes authorizations and appropriations acts, providing funding for DOE and other federal agencies. DOE distributes its budget among the various programs, as directed by the authorizations and appropriations bills. The SRS budget is then funded by the various programs to accomplish the work that was proposed two years earlier.

Appendix B
Information Sources For Transportation Of Radioactive Materials

U.S. Department of Energy

U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831
(423) 576-1188
Website: http://www.osti.gov/ostipg.html

For more information on DOE's transportation programs, contact:
National Transportation Program
U.S. Department of Energy
Albuquerque Operations Office
P.O. Box 5400, MS SC-5
Albuquerque, NM 87185-5400
(505) 845-6134
Website: http://www.ntp.doe.gov/

Center for Environmental Management Information
P.O. Box 23769
Washington, DC 20026-3769
1-800-736-3282
(202) 863-5084
Website: //www.em.doe.gov/

Transportation Resource Exchange Center
ATR Institute
University of New Mexico
1001 University Blvd., SE
Albuquerque, NM 87106-4342
1-800-287-TREX (8739)
E-mail: trex@unm.edu
Website: http://www.unm.edu/~trex

For information on Transuranic Waste Transportation to WIPP, contact:
U.S. Department of Energy
National Transuranic Waste Program
Carlsbad Area Office
P.O. Box 3090
Carlsbad, NM 88221-3090
1-800-336-WIPP (9477)
Website: http://www.wipp.carlsbad.nm.us/

For information on DOE's transportation program for spent fuel and high-level radioactive waste to a geologic repository or an interim storage facility, contact:
U.S. Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Project
1-800-225-6972
Website: http://www.ymp.gov/

Other Government Agencies And Facilities

National Technical Information Service
Technology Administration
U.S. Department of Commerce
Springfield, VA 22161
(703) 605-6000
Website: http://www.ntis.gov/

U.S. Environmental Protection Agency
Information Resources Center
401 M Street, SW
Washington, DC 20460
(202) 260-5922
Website: http://www.epa.gov/

U.S. Nuclear Regulatory Commission
Office of Nuclear Materials Safety and Safeguards
Washington, DC 20555
(301) 415-7800
Website: http://www.nrc.gov/

U.S. Department of Transportation
Research and Special Programs Administration
Hazardous Materials Information Center
400 Seventh Street, SW
Washington, DC 20590
(202) 366-4488
Website: http://www.dot.gov/

Federal Emergency Management Agency
Public Affairs
500 C Street, SW
Washington, DC 20472
(202) 646-4600
Website: http://www.fema.gov/

Nongovernment Organizations

American Nuclear Society
555 North Kensington Avenue
La Grange Park, IL 60526
(708) 352-6611
Website: http://www.ans.org/

American Trucking Associations
Information Center
2200 Mill Road
Alexandria, VA 22314-4677
(703) 939-1880
Website: http://www.truckline.com

Association of American Railroads
50 F Street, NW
Washington, DC 20001-1564
(2020) 639-2100
Website: http://www.aar.org/

Chemical Manufacturers Association
1300 Wilson Boulevard
Arlington, VA 22209
(703) 741-5000
Website: http://www.cmahq.com

International Atomic Energy Agency
c/o Bernan Associates
4611-F Assembly Drive
Lanham, MD 20706-4391
1-800-274-4447
Website: http://www.Bernan.com

Nuclear Energy Institute
1776 I Street NW
Suite 400
Washington, DC 20006-3708
(202) 739-8000
Website: http://www.nei.org/

Appendix C
SRS Sensitive, Threatened, and Endangered Plant Species

Common Name	Scientific Name	Habitat
Federally Protected Plant Species:		
Smooth Purple Coneflower	*Echinacea laevigata*	open meadow/woodland
Sensitive or Potentially Sensitive Plant Species:		
Flax-leaf False-Foxglove	*Agalinis linifolia*	open wet savanna
Striped Garlic	*Allium cuthbertii*	dry pine, oak-pine
Sandhills milkvetch	*Astragalus michauxii*	xeric pine, sandhill
Milkvetch	*Astragalus villosus*	dry pine, oak-pine
*Blue False-Indigo	*Baptisia australis*	dry pine savanna
Lance-leaf False-Indigo	*Baptisia lanceolata*	dry pine woods
*Chapman's Sedge	*Carex chapmanii*	hardwood slope & bluff
*Collin's Sedge	*Carex collinsii*	wet bottomland forest
Cypress-knee Sedge	*Carex decomposita*	open flooded wetland
*Long Sedge	*Carex folliculata*	wet depression & margin
*Eastern Few-Fruit Sedge	*Carex oligocarpa*	wet, open depression
Nutmeg Hickory	*Carya myristiciformis*	rich forest & bottom
Rose Coreopsis	*Coreopsis rosea*	open wet depression
*Southeastern Tickseed	*Coreopsis helianthoide*	open pine savanna
Elliott's Croton	*Croton elliottii*	open wet depression
*Buckwheat Tree	*Cliftonia monophylla*	wet depression & swamp
*Carolina Larkspur	*Delphinium carolinianum*	wet open pine savannah
Dwarf Burhead	*Echinodorus parvulus*	open wet depression
*Joe-pye Weed	*Eupatorium fistulosum*	open meadow
*Biennial Gauna	*Gauna biennis*	open streambanks
*Two-wing Silverbell	*Halesia diptera*	small stream slope/bottom
*Small-flower Silverbell	*Halesia parviflora*	small stream bottom
*Sneezeweed	*Helenium pinnatifidum*	open meadow
*Large Whorled Pogonia	*Isotria verticillata*	bottomland forest
Bog Spicebush	*Lindera subcoriacea*	small stream bottom
Boykin's Lobelia	*Lobelia boykinii*	open wet depression
Spatulate Seedbox	*Ludwigia spathulata*	open wetland
Carolina Bird-in-Nest	*Macbridea caroliniana*	forest stream side/bottom
*Moonseed	*Menispermum canadense*	bottomland forest
*Piedmont Water-millfoil	*Myriophyllum laxum*	ponded water
Nestronia	*Nestronia umbellula*	upland forest

Common Name	Scientific Name	Habitat
Georgia Beargrass	*Nolina georgiana*	dry pine & oak-pine
American Nailwort	*Paronychia americana*	open upland
Green-fringed Orchid	*Platanthera lacera*	moist slope & bottom
*Bluff White Oak	*Quercus austrina*	mesic terrace & slope
Durand's Oak	*Quercus durandii*	ancient river terrace
Awned Meadow Beauty	*Rhexia aristosa*	open wet depression
*Drowned Hornedrush	*Rhynchospora inundata*	open wetland
*Tracy Beakrush	*Rhynchospora tracyii*	open wetland
Piedmont Azalea	*Rhododendron flammeum*	upland slope
*Stalkless Yellow Cress	*Rorippa sesssiliflora*	open wetland
Slender Arrowhead	*Sagittaria isoetiformis*	open wetland & savanna
*Sweet Pitcher Plant	*Sarracenia rubra*	seeps, wet depression
Canby's Bulrush	*Scirpus etuberculatus*	open wetland
*Gum Bumelia	*Siderodendron lanuginosum*	upland forest
*Pickering Morning glory	*Stylisma pickeringii*	dry pineland & sandhill
*Carolina Tassel-rue	*Trautvetteria caroliniensis*	moist slope & bottom
*Trepocarpus	*Trepocarpus aethusae*	bottomland & swamp
*Carolina Trillium	*Trillium pussilum*	alluvial bottom
Florida Bladderwort	*Utricularia floridana*	flooded open wetland
Piedmont Bladderwort	*Utricularia olivacea*	flooded open wetland
*Eel-Grass	*Vallisneria americana*	streams
Potentially occurring Federally Protected and Sensitive Plant Species:		
Small-flowered Buckeye	*Aesculus parviflora*	rich, mesic bottom/slope
Scale-leaf Gerardia	*Agalinis aphylla*	wet pine savanna
Soft Groovebur	*Agrimonia pubescens*	open alluvial wetland
Savannah Milkweed	*Asclepias pedicellata*	pine savanna
Georgia Aster	*Aster georgianus*	open meadow & woodland
Yellowwood	*Cladastris kentuckea*	rich upland & bottom
Georgia Plume	*Elliottia racemosa*	sandy upland & slope
Pine Barrens Gentian	*Gentiana autumnalis*	moist pine savanna
Shortleaf Sneezeweed	*Helenium brevifolium*	open wetland & bay
Georgia Frostweed	*Helianthemum georgianum*	open meadow & savanna
Schweinitz's Sunflower	*Helianthus shcweinitzii*	open meadow
Rocky shoals spider lily	*Hymenocallis coronaria*	river shoals
Creeping St. John's-wort	*Hypericum adpressum*	wet depression
Sarvis Holly	*Ilex amelanchier*	stream/river bottom/savanna
White-wicky	*Kalmia cuneata*	bay & wetland margin
Pond Berry	*Lindera melissifolia*	deep swamp

Common Name	Scientific Name	Habitat
Pond Spice	*Litsea aestivalis*	deep swamp margin
Rusty Lyonia	*Lyonia ferruginea*	open woodland
Rough-leaved Loosestrife	*Lysimachia asperulaefolia*	wet depression
Canby's Dropwort	*Oxypolis canbyi*	open wet depression
Eulophia	*Pteroglossaspis ecristata*	open pineland & meadow
Harperella	*Ptilimnium nodosum*	wet depression & savanna
Oglethorpe Oak	*Quercus oglethorpensis*	flat, ancient floodplain
Baldwin's Nutrush	*Scleria baldwinii*	cypress savanna
Chaffseed	*Schwabea americana*	pine savanna
Prairie Goldenrod	*Solidago rigida*	open meadow
Giant Spiral Ladies-tress	*Spiranthes longilabris*	cypress savanna
Corkwood	*Stillingia aquatica*	open wetland & margin
Reclined Meadow-rue	*Thalictrum subrotundum*	moist forest
Faded Trillium	*Trillium discolor*	rich mesic slope/bottom
Relict Trillium	*Trillium reliquum*	rich mesic slope & bluff
Piedmont Strawberry	*Waldsteinia lobata*	mixed upland&slope

* New species recently added by the State of South Carolina

Appendix D
Land Use Models

This appendix describes the result of a series of workshops held in 1994 and 1995, under the sponsorship of the SRS Land Use Technical Committee (LUTC). Fifty-five internal stakeholders from many organizations and programmatic areas were asked to develop scenarios on what SRS could look like in the future. These experts spent many hours in small and plenary groups, researching, discussing, reviewing, and writing. The final product was a report to site management and other stakeholders on the future of SRS.

The purpose of the report was to provide technical guidance to site decision-makers from "internal stakeholders" regarding the selection of a primary future use of SRS land and facilities. When the primary future use is decided by the DOE with input from stakeholders, remediation decisions can be made based on realistic future uses; cleanup goals can be addressed; and future project siting and economic development goals will be enhanced. This report was compiled by the SRS Land Use Technical Committee, which is comprised of 23 senior technical experts from all the major site organizations representing all major program areas. The LUTC was chartered to supply in-depth land use technical analysis to site management with regard to project siting, resolution of land use conflicts and land use planning—as well as with Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA) compliance. For example, if a contaminated area will be used for homes in the future, its clean-up goals may be very different than if it were to be paved for an industrial park.

The SRS Land Use Technical Committee provided this report to the Site Manager and has served as the basis for subsequent future use scenarios. While the major goal of this report was to provide recommendations for future SRS land use, land-use recommendations will also help DOE decide suitable activities which are compatible with and support the primary use. Both the opportunities and limitations of the land and facilities at SRS have been considered in arriving at the recommended primary future use and ancillary activities (e.g., the National Environmental Research Park program, education, etc.). While the Land Use Technical Committee recommended that all land on the site remain under federal ownership, some of the land could be possibly used by the public or private sector in a lease arrangement with the federal government. Because many site areas are suitable for multiple uses, the LUTC did not propose specific areas for specific uses. Specific uses and activities for site areas will be decided via established site policy and internal regulatory processes for site use. Finally, the report was used in the context of other future use efforts, most notably the *Site Future Use Project Report* and the future use recommendations prepared by the SRS Citizens Advisory Board (CAB). DOE Headquarters had charged each site to prepare a future use report that depicts stakeholder preferences for future use, given each site's unique characteristics.

Four basic future use models were evaluated: the Consolidated Core Future Use Model, the Residential Future Use Model, the Disaggregate Future Use Model, and the Integral Site Future Use Model. The Integral Site Future Use Model was chosen as the model that best reflected the future of SRS. Each of these models is discussed briefly below.

Consolidated Core Future Use Model

In this scenario, the site's boundaries would shrink to the minimum size necessary to isolate contaminated waste from the rest of the site, while protecting the public and the environment. The remnants of the site would be housed in the restricted core area until technologies are developed to make any hazardous constituents safe. Starting with facilities closest to the site perimeter, buildings would be decontaminated, decommissioned and demolished, and land would be restored and transferred to the General Services Administration, which would transfer it to other federal agencies, the state or sell it to the general public.

This model assumes no future missions for the site, and assumes the site would shrink in size as areas are remediated and returned to general public use. Lands turned over to the general public could presumably be used for any purpose, although restrictions on land use would be developed by DOE to ensure that the site is not further contaminated and public access to the remaining long-term stewardship sites is controlled. Future land uses would be addressed in two categories: former SRS lands returned to the public and lands retained as part of the SRS.

Advantages of this model include a reduction in DOE's land management responsibilities, increased use of SRS land by the general public and reduced operational costs after consolidation of site operations to a central core area.

The disadvantages of this model are significant, however. It is unlikely that technology or funding would be available to clean up many areas to levels adequate for unrestricted public access. Remaining waste management facilities, such as the DWPF, are likely to require significant protective buffer zones. This requirement would also pertain to the numerous water bodies with stream and lakebed contamination. This would minimize the amount of land that could be returned to surrounding communities. Liability for future health effects resulting from exposure to SRS lands would continue to reside with DOE, requiring any lands returned to the public be cleaned to residential standards, a considerable burden for the U.S. taxpayer. The current value of SRS land based on in-lieu-of-tax payments currently made by DOE to South Carolina counties is probably higher than the value of cleaned acreage, which would most probably return to farmland. This would be an additional potential adverse impact on local economies.

Residential Future Use Model

The Residential Future Use Model assumes no continuing federal mission for the site, and the site would be cleaned up to federal and state standards for residential use. Restoration would include all surface water, groundwater, and soils. The land would be transferred to the General Services Administration for eventual transfer to the public. The residential scenario assumes that the entire site be returned to the public for use as single- or multi-family dwellings. Associated with residential development would be shopping areas, small businesses, community areas, and schools. Other possible uses of lands classified as residential include farming, hunting, and recreation. These uses could be accommodated within site boundaries, possibly utilizing zoning for different uses.

Upon analysis, it was determined that return of SRS to residential use is not realistic. It would force DOE to clean the site to levels that, in many cases, may not be reasonably or technologically possible and would result in enormous time and cost requirements. Although transfer of SRS to public control would ultimately free DOE from land management responsibilities in this region, DOE would remain responsible indefinitely for any adverse public health or environmental effects as a result of previous site operations. Closure of SRS would result in significant loss of employment in the region, which would have detrimental impacts on the regional economy that could not be supplanted by existing industries. Additionally, return of SRS lands to public occupation would seriously threaten the extraordinary biological diversity of the site.

In public affirmation against this planning scenario the SRS Citizens Advisory Board has formally stated that the Residential Future Use Model should not be used.

Disaggregate Future Use Model

The Disaggregate Future Use Model assumes that lands not within the site core or along contaminated stream corridors would be available for transfer to public uses. The assumed goal would be to reduce DOE holdings to as much as half the site's current size. Conditions for transfer would need to address whether or not the areas are free of contamination and how sensitive site features would be protected. This model would maintain a central site core to support SRS missions and would retain known areas of major contamination. Radiating from the core would be "tentacles" of land that would be maintained by DOE with restrictions on future use. The tentacles would generally follow site streams known to be contaminated. Site lands outside the core area and tentacles would potentially be available for transfer to the General Services Administration, other federal agencies, or the state. Ultimately, some or all of the lands could become available to the public resulting in a wide range of future uses.

The basic advantage of this model is that it allows for the centralization, concentration, and confinement of the site's mission-related activities to a core area. It would also retain land areas that could be potentially required during the reconfiguration and consolidation of the DOE Nuclear Weapons Complex. Implementation of this model would result in decreased security patrol of the Savannah River swamp, would allow extensive public use of natural resources, and would reduce the cost of infrastructure maintenance.

This model also presents many challenges. Property would need to be carefully characterized prior to transfer to ensure waste sites are not accessible by the public. Issues of public health and safety could become costly and time consuming. Because of the configuration and number of the many tentacles related to this model, site security could be more troublesome and buffers to the public would be reduced, greatly diminishing if not potentially eliminating continued and/or future missions due to the loss of safety zones around operations. Site boundary dose calculations would need revision, and monitoring stations would require relocation. Expansion or realignment of site missions may become more difficult due to encroachment of public uses on the site boundary.

Another challenge resulting in increased time and resources is the amount of characterization required to convey federal land. Prior to transfer, detailed research would be undertaken to ascertain the presence of threatened and endangered species. This also holds true for archeological resource surveys. Several federal laws explicitly state that federal land must be thoroughly investigated for prehistoric and historic artifacts.

As a final important impact, a significant portion of the SRS would no longer be designated as a National Environmental Research Park. SRS is the nation's first, largest, and most active National Environmental Research Park. Additionally, the biodiversity of the site could decrease, and important research areas between site property would likely be degraded by public access. Research study sites and equipment would be negatively impacted.

Integral Site Future Use Model

Under this model, site boundaries would remain intact and land use would not change significantly. However, the industrial footprint would shrink — consolidating to the center of the site in a "reconfigured" land use. This scenario would allow for the accommodation of new missions, as well as the option of expanding the site core should the Cold War restart, terrorist activities increase, or other external causes of significant re-industrialization occur. The amount of environmental cleanup would depend on the intended future use, but potential new missions that complement existing site uses would be less likely to alter the existing land use and are also less likely to require extensive cleanup. Land uses that require extensive unrestricted public access would not be compatible with this scenario.

This model includes the following assumptions:

- Political support for SRS activities will continue.
- Technical expertise will be retained.
- Site infrastructure will be maintained. Environmental, forestry, wildlife, and archeological activities will continue concurrent with the pursuit of the site's national security mission.
- Technology development and transfer will expand.
- DOE funding will support limited "transition" activities and risk assessment will be critical to prioritizing facilities for restoration. Dispositioning of process-contaminated facilities will be financially limited to those of highest risk.
- Surplus facilities will systematically transition from production to minimum maintenance, and eventually be decontaminated and dismantled or identified for alternative missions.

The advantages of this model are significant. Flexibility for planned and future missions would be retained. With the site remaining a large, contiguous area, significant opportunities for forest resource utilization would continue. On a national level, the site is maintained as a facility and land "bank" for future missions should the need arise. With the closing of most of the other United States weapons facilities, the county would have no large, secure facility or land mass for defense production. Opportunities for continued research and development and retention of Research Set-Aside Areas designated under the National Environmental Research Park program would also continue. Because use would continue to be restricted and access controlled, the model allows for maximum preservation of historic, prehistoric and archeological resources, enabling continued cultural research. This model does not require site lands be cleaned to extremely protective conditions, and maximum buffer (safety) zones are maintained between existing and future SRS operations and the public. It would minimize potential liability from public ownership of land.

The model also results in three significant environmental advantages as described below.

- The vast expanse of habitat would support biodiversity and species enhancement projects as well as research and monitoring activities.
- The large abundance of wetlands would increase the opportunities for research in the areas of wildlife habitat, aquatic biology, and hydrophilic vegetation.
- Research Set-Aside Areas would be retained, promoting habitat development, biodiversity, protection of endangered species, and environmental research, monitoring, and investigation.

With few exceptions, the existing site infrastructure complements the Integral Site Future Use Model, with infrastructure related to heavy industrial or nuclear land uses concentrated in the center of the site. The major disadvantage of this model is the significant initial investment of rebuilding facilities and consolidating infrastructure near the center of the site. Although the site project trend has been to move operations and support away from the site boundaries, a substantial amount of facilities, infrastructure and employees are located outside of this proposed central zone.

Stakeholders cite a disadvantage not usually considered by site management because it is outside future use operations scenarios. Specifically, some stakeholders state that if the site continues operations then there would be no opportunity for former land owners to re-settle SRS. This issue was been moderated during the planning process. Previous residents realize that much of their former homeland is not useful for their purposes. Also, since over fifty years have passed, federal ownership into the future is generally accepted. A more reasonable alternative associated with a scenario that is acceptable to many stakeholders is to consider portions of the site, which would be available to limited public use.

The scenarios listed here have been presented to internal and external stakeholders for comment in formal and informal meetings, via the Internet. In this iterative process over the last four years, site planners with the oversight of site management, have developed the “Integral Site Future Use Model” as the preferred planning scenario outlined in Chapter 3.

Appendix E
Risk Ranking of Inactive Facilities

At some point in the life of a facility, the missions for which it was constructed will be completed. This can occur when the mission objectives have been achieved, or when a replacement facility has been put into operation. About one to three years before this milestone occurs, the facility custodian is obligated by site policies and procedures to take steps to prepare for the end of operations. This lead-time is necessary because of the federal budget cycle. (*Facility Disposition Manual 1C,* Revision 0, September 30, 1999.*)*

The operating division who has ownership of the facility, with concurrence of DOE-SR, decides whether the facility will fall into one of two categories when it becomes inactive: (1) retain for reuse, or (2) to be declared excess for disposition. In the first case, the site looks for program funding for conversion of the facility. In the second case, plans are made to transition the facility from operations to disposition.

SRS is required by the provisions of the DOE Order O430.1A, *Life Cycle Asset Management*, to maintain an inventory of assets at the site. As part of that requirement, the site maintains a database, called the Site Inactive Facilities List. This database is used by SRS to plan for the disposition of facilities and to prioritize disposition activities.

First, the facility custodian completes a Facility Review Checklist to understand the remaining hazards so that decisions can be made and priorities set based on relative risks. Below is list of the types of information required for completion of the checklist.

- Is the building occupied or routinely entered?
- Are the walls, roofs, and stairwells structurally sound?
- Do the entries or doors pose any hazards? Are they controlled in any way? Are they accessible? Is there an entry plan?
- Are utilities functional? (electricity, heating and air conditioning, ventilation, steam, etc.)
- Is the fire system operational? (sprinklers, fire alarms, extinguishers, etc.)
- Are communications available? (intercoms, telephones, etc.)
- Is there any waste accumulation or disposal?
- Are there any hazards? (tripping, falling, slipping, chance of being struck, drowning, suffocation, confined spaces, electrocution, noise, etc.)
- Are there any biological hazards, including wildlife?
- Are there any radiological hazards, hazardous materials, or chemicals?
- Are there any potential radiological releases or chemical spills to the environment? (air, ground, surface water, groundwater)
- Are there any residual process materials in tanks or piping?

Information about the hazards in the various idle facilities is used to determine how funds will be applied to correct the problems. To do this, it is necessary to evaluate the identified hazards at each of the identified inactive facilities and to distinguish the high-risk hazards from others. Some risks may be unacceptably high and must be dealt with in a timely manner. Other lower risks can then be dealt with as resources permit.

The method for ranking risk at inactive facilities is described in FDD-ENG-99-0060, *Prioritization Method for Risk Reducing Actions at Inactive SRS Facilities (U)* (J. C. Musall to R. V. Carlson, June 7, 1999). The series of steps for this risk ranking are described briefly below.

SRS assembles a multidisciplinary team of experienced people to perform risk ranking. This is done on an annual basis, in time to support annual budget requests and Annual Operating Plan preparation.

For each hazard, these experts make an estimate of the possible consequences from that hazard and the likelihood that those consequences will occur. Computer software uses this information to calculate the risk score for each hazard condition.

The computer software then sorts the inactive facilities by risk score and provides a list. Any hazard with a score higher than 15 represents a significant risk and requires aggressive corrective action. A score between 15 and 1 represents a moderate risk and will be corrected as resources permit. Scores below 1 represent acceptable risks.

The table below represents the risk ranking as of May 2000. This list is provided to show the relative ranking at that point in time. This list changes frequently as inactive facilities are added, and this particular list may not reflect the current risk ranking.

Area	Building	Description	Facility Use Category	Risk Ranking Order
H	221-H	Old HB-Line	Industrial	1
F	284-F	Power House	Industrial	2
A	773-A, Section F	Separations Equipment Development	Industrial	3
F	211-4F	Sampling House	Support	4
F	235-F	Actinide Billet Line	Industrial	5
F	235-F	PEFF	Industrial	6
F	235-F	PuFF	Industrial	7
T	677-T	Advanced Contractor Test Facility	Research and Development	8
T	677-T	Mixer-Settler Test Facility	Research and Development	9
A	777-10A	PDP (3 levels)/SPRX Room	Industrial	10
H	285-3H	Cooling Tower #2	Industrial	11
K	185-1K	Chlorinator House	Industrial	12
C	105-000C	Reactor Building	Industrial	13
T	677-T	Geometrically Favorable Dissolver	Research and Development	14
C	717-000C	Contaminated Maintenance Facility	Industrial	15
M	321-M	Fuel Fabrication Facility	Industrial	16
F	254-2F	Diesel Generator Facility	Industrial	17
L	190-L	Cooling Water Pumphouse	Industrial	18
F	607-001F	Sewage Treatment Plant/Digester	Industrial	19
R	105-000R	Reactor Building	Industrial	20
C	108-001C	Emergency Diesel Room	Industrial	21
M	320-M	Alloy Fabrication Facility	Industrial	22
M	313-M	Slug Fabrication Facility	Industrial	23
A	779-A	Manipulator Repair Shop (Formerly Naval Fuels Building)	Industrial	24
K	186-1K	Sodium Hypochlorite Tank Storage	Industrial	25
D	412-004D	Mask Maintenance Building	Industrial Support	26
A	773-A	Section F, Alpha D&D Cell	Industrial	27
A	773-A	Section F, Californium Processing Facility, Cells 1, 2, 3	Industrial	28
A	773-A	Section F, Medical Source Facility	Industrial	29
A	773-A	Section F, F003 Gloveboxes	Industrial	30
H	230-H	Beta Gamma Incinerator	Industrial	31
P	190-P	Cooling Water Pumphouse	Industrial	32
R	108-001R	Emergency Diesel Room	Industrial	33
P	105-000P	Reactor Building	Industrial	34
F	235-F	Old Met Lab	Research and Development	35
F	242-F	1F HLW Evaporator	Industrial	36

Area	Building	Description	Facility Use Category	Risk Ranking Order
R	108-002R	Emergency Diesel Room	Industrial	37
F	242-3F	CTS Pit (IF Evaporator)	Industrial	38
C	108-002C	Emergency Diesel Room	Industrial	39
C	105-007C	Change Building	Industrial	40
C	191-000C	Booster Pump Building	Industrial	41
T	692-T	ECR/ICR Building	Support	42
T	692-T	PHEF Control Room	Research and Development	42
T	711-T	Mechanical Services Building	Support	43
T	711-T	E&I Shop	Support	43
G	904-108G	Trebler Sampler Pit No. 3	Industrial	44
T	682-T	PHEF Plant	Research and Development	45
C	108-004C	Exhaust 903 Fan Emergency Diesels	Industrial	46
M	320-M	Chemical Laboratory	Research Facilities/ Technology Demonstration	47
T	684-T	Flammable Storage Building	Research and Development	48
T	694-2T	Carpenter Shop	Support	49
F	247-F	NF Manufacturing Building	Industrial	50
G	681-001G	Up-Stream Pump House for 100 Areas	Industrial	51
L	110-L	Helium Storage Tanks	Supply/Storage	52
P	108-001P	Emergency Diesel Room	Industrial	53
P	108-002P	Emergency Diesel Room	Industrial	54
T	679-8T	Pump House	Support	55
H	234-3H	Hold Volume Enclosure	Industrial	56
N	716-1N	New Steam Cleaning	Industrial	57
P	614-002P	Effluent Monitoring Building	Industrial	58
H	242-003H	Old CTS H Area	Industrial	59
C	701-001C	Area Gatehouse and Patrol HQ	Support	60
C	190-000C	Cooling Water Pump House	Industrial	61
A	779-10A	Lunch Room/Change Room Trailer	Industrial	62
L	186-001L	Sodium Hypochlorite Addition	Industrial	63
G	628-003G	Propane Gas Tank	Industrial	64
M	701-1M	Main Gatehouse	Support	65
D	772-D	Control Laboratory and Supervisor's Office	Industrial Support	66
M	341-8M	Vendor Treatment Facility	Industrial	67
C	105-006C	Change Building	Industrial	68
K	701-1K	Area Gatehouse and Patrol HQ	Support	69
H	242-H	1H HLW Evaporator	Industrial	70

Area	Building	Description	Facility Use Category	Risk Ranking Order
K	185-K	Cooling Tower (Power House)	Industrial	71
D	717-D	Shops, Stores and Change House	Support	72
C	608-000C	Change Facility	Industrial	73
M	313-4M	Stack for 313-M	Industrial	74
H	242-018H	CTS H Area	Industrial	75
B	607-4B	SUD/Sanitary Waste Water Facility	Industrial	76
N	690-000N	Process Heat Exchanger Repair	Industrial	77
F	247-7F	EC Process Tower	Industrial	78
P	704-P	Area Administration and Services Building	Support	79
P	183-2P	Filter and Softener Plant	Industrial	80
K	185-3K	Cooling Tower	Industrial	81
M	322-M	Metallurgical Laboratory	Industrial	82
P	191-000P	Booster Pump House	Industrial	83
D	403-D	Soil Bioremediation Facility	Industrial	84
K	190-K	Cooling Water Pump House	Industrial	85
D	412-D	Control Room	Industrial	86
M	313-M	Chemical Transfer Facility	Industrial	87
D	421-D	Finishing Building	Industrial	88
L	191-L	Booster Pump Building	Industrial	89
M	340-M	Lab Waste Treatment Facility	Industrial	90
D	420-D	Concentrator Building	Industrial	91
D	421-2D	Moderator Handling and Storage	Industrial	92
D	711-D	T&T Office and Storage Building	Support	93
P	152-7P	Generator Room	Industrial	94
D	480-2D	Maintenance Material Storage	Industrial Support	95
L	723-3L	Change Building	Industrial	96
H	241-916H	Oxalic Acid Addition Facility	Industrial	97
F	247-42F	Outside Storage Building	Industrial	98
C	701-006C	Guard House	Support	99
F	247-41F	Outside Storage Building	Industrial	100
P	186-001P	Sodium Hypochlorite Facility	Industrial	101
L	701-1L	Area Gatehouse and Patrol HQ	Support	102
M	710-M	Lithium Storage Building	Industrial	103
F	247-12F	Outside Cold Feed Storage	Industrial	104
D	421-5D	Loading Cock	Industrial Support	105
P	608-000P	Change Facility	Industrial	106
D	420-2D	Moderator Handling and Storage	Industrial	107

Area	Building	Description	Facility Use Category	Risk Ranking Order
P	717-009P	Pipe Fabrication Shop	Industrial	108
T	670-T	Pilot Plant Robotics Building	Research and Development	109
F	607-29F	Naval Fuel Pump Station for Wastewater Treatment	Industrial	110
K	614-2K	Effluent Monitoring Building	Industrial	111
K	191-K	Standby Pumphouse	Industrial	112
F	247-4F	Ground Cooling Tower	Industrial	113
R	190-000R	Cooling Water Pump House	Industrial	114
F	247- 10F	Process Waste Building	Industrial	115
L	614-2L	Effluent Monitoring Building	Industrial	116
P	105-13P	Heavy Water Storage Building	Industrial	117
P	110-000P	Helium Storage Tanks	Industrial	118
F	247-1F	Diesel Generator	Industrial	119
L	709-1L	Fire Truck Shed	Support/Emergency Response	120
F	643-021E	Emergency Diesel Generator	Industrial Support	121
H	254-6H	Diesel Emergency Generator for 230-H	Industrial	122
N	619-1N	Fuel Oil Storage Tank	Industrial	123
R	122-R	Heavy Water Storage Building	Industrial	124
P	701-1P	Area Gatehouse and Patrol HQ	Support	125
A	607-001A	Sewage Treatment Plant	Industrial	126
F	247-8F	Compressed Gas Storage	Industrial	127
B	770-000U	Test Reactor Building (HWCTR)	Industrial	128
D	717-1D	Storage Building	Support	129
D	501-D	Emergency Diesel	Industrial Support	130
P	701-2P	Gatehouse at Bldg. 105	Support	131
D	420-3D	Tritium Effluent Water Monitoring Building	Industrial	132
D	421-4D	Drum Storage	Industrial	133
K	110-K	Helium Storage Tank	Industrial	134
A	701-013A	Guardhouse at Employment Road	Support	135
D	421-6D	Heavy Water Equipment Storage	Industrial Support	136
D	711-1D	Storage Building	Industrial Support	137
F	247-11F	Outside Process Control Room	Industrial	138
K	108-4K	Emergency Diesel Generator and Fuel Oil Storage	Industrial	139

Area	Building	Description	Facility Use Category	Risk Ranking Order
M	701-4M	Entry Control Bldg. for 321-M	Industrial	140
G	904-108G	Change House for Contaminated Equipment Workshop	Industrial	141
D	800-000D	Soils Bioremediation Facility	Industrial	142
H	254-43H	Secondary Transformer for 230-H	Industrial	143

Appendix F
Level of Service for SRS Roads

The "Level Of Service" (LOS) concept is used nationally and by the State of South Carolina to describe how well a road is supporting traffic demands. LOS designations range from A, the best, to F, the worst. LOS ranges A to E describe traffic in a flowing condition while LOS F describes a condition of failure. Most roads are designed to operate at LOS C during peak conditions. The LOS of a road is determined by its peak hour traffic count with units of vehicles per hour. LOS ranges differ from road to road based on surrounding conditions: lane width, shoulder width, no passing zones, etc. For SRS Road 2, the upper limits for LOS C, D, and E are 500, 800, and 1600 vph respectively. Counts above 1600 vehicles per hour represent LOS F.

Table F-1. Typical Level of Service Ranges

LOS	AADT Description	Driver's Perception	Two Lane Roadway: Max. Service Volume[a]		Four Lane Roadway: Max. Service Volume[b]	
			AADT Per Day	Hour	Est AADT	Hour
A	Free Flow	Not affected by other drivers. Driver determines operating speed.	700	105	48,000	2,000
B	Stable Flow (Upper Speed Limit)	Other vehicles are noticed, but do not affect the driver's selection of speed.	1,800	270	67,200	2,800
C	Stable Flow	Other vehicles become significant. Flow remains stable, but the driver's speed is reduced.	3,500	525	86,400	3,600
D	Approaching Unstable Flow	Other vehicles become more significant. Flow approaches instability. Driver's speed is significantly reduced. Lane changes and turns become difficult.	5,300	795	105,600	4,400
E	Unstable Flow	Other vehicles become obstacles. Speed, lane changes, and turns are dictated by what the other traffic "allows". Stop and Go conditions.	9,900	1,485	120,000	5,000
F	Forced Flow	The road is incapable of carrying the present volume. Stop and Go areas increase; turns and lane changes are not possible.	Variable	Variable	Variable	Variable

[a] Two-lane volume based on: rolling terrain, 40% no passing zones, 60/40 directional split, 82% passenger cars, 70 mph design speed.

[b] Four-lane volume based on rolling terrain, 80% passenger cars, 70-mph design speed.

Appendix G
Prehistoric Chronology in the Coastal Plain Portion of the Savannah River Valley

Date Range	Archaeological Periods	Archaeological Phases	Associated Hafted Bifaces	Associated Ceramic Categories
A. D. 1450				
		Irene	Small Triangular	Irene filfot stamped, incised and burnished ceramics
A. D. 1300	Mississippian			
		Savannah II	Small Triangular	Savannah complicated stamped, plain and burnished ceramics
A. D. 1100				
	Late Woodland	Savannah I	Poorly defined Small-med. triangular and stemmed forms	Fine cordmarked, fine check stamped, angular simple stamped, & fabric impressed
A.D. 500				
		Deptford II	Medium to small isoceles triangular	Deptford linear check, cordmarked, zoned punctate & simple stamped
A. D. 1	Middle Woodland			
		Deptford I	Yadkin	Deptford linear check/simple stamped linear check, check stamped & simple stamped
600 B. C.				
	Early Woodland	Refuge	Medium stemmed & notched forms (Thelma-like)	Refuge simple stamped, dentate stamped, and punctate
1000 B. C.		Thom's Creek	Thom's Creek	
		Stallings III	Savannah River	Decorated Fiber tempered
	Late Archaic	Stallings II	Savannah River	Plain Fiber tempered
		Stallings I	Savannah River	(Steatite vessels)
3000 B. C.				
	Middle Archaic	*?* *?* *Morrow Mountain*	*MALA* *Briar Creek* *Morrow Mountain*	
6000 B. C.				
	Early Archaic	*Kirk/Palmer* *Taylor* *Hardaway*	*Kirk Corner Notched* *Palmer Corner Notched* *Taylor Side Notched* *Hardaway Side Notched*	
8000 B. C.				
	Paleoindian	*Dalton*	*Dalton* *Fluted and unfluted lanceolate types*	
10500 B. C.				

Appendix H
Site Historical Background

Paleoindian Period (11,500-9900 B.P. [9550-7950 B.C.])

The earliest well-documented colonists of North America are peoples referred to as "Paleoindians." Recognized archaeologically by fluted Clovis points, the earliest Paleoindians are generally believed to have entered the continent from the Bering Straits by at least 12,000 B.P. Although prior episodes of colonization may have taken place, by the time Clovis-using peoples appeared on the continent, no pre-Clovis populations existed in North America.

Clovis occupation of the Southeast is believed to span a period from 11,500 to 11,000 B.P. During the subsequent 500 years, smaller fluted points and unfluted lanceolates, such as the Simpson and Suwannee types, replaced Clovis points in the Southeast. The last phase of Paleoindian occupation is identified by the pan-southeastern Dalton horizon, dating to the interval between 10,500 and 9,900 B.P.

Recent interpretations of specific Paleoindian adaptations have revolved around two major issues, the degree of subsistence specialization and the nature of settlement organization. Based on faunal information from Paleoindian sites west of the Mississippi River, Clovis subsistence in the eastern United States was long assumed to be focused on the hunting of extinct large mammals or megafauna. However, several lines of evidence have been recently amassed to support the argument that Paleoindian subsistence in the East was in large measure generalized, drawing widely from small game and plant foods.

The traditional view of Paleoindian settlement, one that persists in some current models of Paleoindian colonization, proposes a highly mobile strategy affiliated with the exploitation of megafauna. Alternatively, the reinterpretation of subsistence data and other evidence has been used to argue for more limited mobility. For instance, it has been proposed that Paleoindian colonists quickly homed in on key locations in the East and used these as "staging areas" for subsequent population expansion. In this model, the Savannah River region represents an area of secondary colonization, which, once occupied, became homeland to a relatively stable subregional population.

Specific evidence for Paleoindian settlement and subsistence in the Savannah River region is in short supply. Exploitation of megafauna in South Carolina has been documented, but the relative dependence on such resources is unknown. Researchers generally agree that by the late Paleoindian subperiod (Dalton phase), subsistence choices included a variety of plant and animal foods. In fact, the appearance of the Dalton point is thought by some southeastern specialists to signify a major change of adaptation from the hunting of megafauna to smaller fauna, primarily deer. Persisting into Dalton times, however, was the Paleoindian reliance on sophisticated stone tool technology. Throughout the Paleoindian period, use of stone tools made from high quality chert suggests a settlement strategy of mobility and specialized resource scheduling. The prevalence of such technology in the Savannah River region, as well as the greater Southeast, indicates that technological solutions to resource procurement and processing were key adaptive strategies of Paleoindians. Changes in the forms of these tools, in the intersite composition of toolkits, and in the geographic range of raw materials, are the chief sources of data for interpreting Paleoindian lifeways. If anything can be agreed upon about the Paleoindian period, it is that it was a time of rapidly changing environmental conditions.

A particularly nagging problem with Paleoindian research in the Savannah River region is the lack of well-preserved sites. Like many portions of the Southeast, local knowledge is almost completely restricted to surface finds of lanceolate points. Efforts are now being made to model site formation using regional and local climate, hydrology, and sedimentology data. Researchers hope the application of these data to predictive models of site location will soon result in the discovery of preserved Paleoindian sites and an increased understanding of these early Southeastern inhabitants.

Early Archaic Period (9900-8000 B.P. [7950-6050 B.C.])

The Early Archaic period is typically regarded as a period of human adaptation to the warming climate of the post-Pleistocene epoch. Delineated from the Paleoindian period by the appearance of notched bifaces, the Early Archaic period in the Savannah River region is defined by the presence of Taylor side-notched points (circa 10,000-9500 B.P.), Palmer/Kirk corner-notched varieties (ca. 9500-8300 B.P.), and various bifurcate forms (ca. 8900-8000 B.P.). The abundance of these types and related variants throughout the Southeast suggests an extensive regional Native American population was in place by the tenth millennium. Morphological variation in point forms across the Southeast is further indicative of the initial development of subregional traditions (i.e., the development and stabilization of subregional populations).

Recent research emphasis on the Early Archaic period has centered on settlement organization. Based on results of excavations at two sites in the Haw River Valley of North Carolina, researchers propose that changes in technology between the Paleoindian and Early Archaic periods reflect changes in settlement organization in response to climatic warming. Because of increased effective temperature, they argue, resources would have become increasingly homogeneous over the course of the Early Archaic period. A settlement strategy emphasizing residential mobility is predicted and would be manifested in the increased use of expedient tools. Through comparisons of the use of stone tool raw materials across the region, it is suggested that extensive residential mobility along major river drainages took place.

In contrast to the above model, data from the Wallace Reservoir area of Piedmont Georgia argues for relatively sedentary settlement organization during the Early Archaic period. This model predicts a fairly large local population of several hundred people within the Oconee River Basin, as well as territorial boundaries and some exchanges of stone tool raw material. The temperate, ecologically-diverse environment of the early Holocene is argued to have supported a system in which base camps (locations of multi-seasonal, recurring occupation) were positioned in locations of greatest environmental resource diversity and density.

The most comprehensive model of Early Archaic settlement to date combines elements of previous models with considerations of interregional integration and population dynamics. Four "limiting factors" (seasonal and spatial structure of food resources, mating requirements, information exchange, and demographic structure) indicates a settlement system in which small bands engaged in a mixed forager-collector strategy of watershed-wide seasonal mobility. Distinct seasonal characteristics in resource procurement, technology, and settlement organization are predicted and supported with assemblage data from the Savannah River Valley. A method for inter-watershed integration of bands is also postulated to accommodate information flow, mate exchange, and trade in raw materials.

Continued debate over the relative worth of these various settlement models will be arbitrated through analyses of the rich Early Archaic assemblages of the Savannah River region. Currently, the major points of contention are size of local populations, range of annual mobility, degree of settlement permanence, and nature of regional integration. The goal for future research is to develop innovative methods and bridging arguments enabling researchers to evaluate data against the assumptions and implications of the competing models.

Middle Archaic Period (8000-5000 B.P. [6050-3050 B.C.])

The Middle Archaic period has traditionally been regarded as a period of human adaptation to the mid-Holocene warming trend. The effects of a thermal maximum in the Southeast are poorly documented, but in the Midwest, the eastward expansion of prairie at this time appears to have triggered dramatic changes in human settlement and subsistence. Whether or not direct environmental impacts were felt on the South Atlantic Slope, population responses elsewhere may account for the onset of patterns recognized as Middle Archaic in the Carolinas.

The transition from the Early to Middle Archaic period is signified by the replacement of notched points with stemmed points. Phases of the Middle Archaic period in the Carolinas include those represented by the Kirk Stemmed (8000-7800 B.P.), Stanly (7800-7500 B.P.), Morrow Mountain (7500-6000 B.P.), and Guilford (6000-5000 B.P.) types. Of these, only the Morrow Mountain and Guilford phases are well represented in the Savannah River region, although absolute dates for either phase are lacking.

The Morrow Mountain phase in the Savannah River region represents the first perceivable divergence in cultural patterns between the Piedmont and Coastal Plain. Recent work with Piedmont collections document a seemingly random distribution of sites, a lack of inter-assemblage functional variability, a reliance on local raw material (primarily quartz), and expedient technology. A strategy of small co-resident group size, frequent residential movements, generalized subsistence, low-investment technology, and social flexibility has been inferred from this evidence.

Coastal Plain occurrences of Morrow Mountain sites are meager compared to the Piedmont. What data there are on site assemblages and variability suggest a more complex pattern of settlement in the Coastal Plain. In addition, the Coastal Plain contains examples of lanceolate, stemmed and notched bifaces not found in the Piedmont. From stratigraphic evidence alone, Coastal Plain forms such as the Brier Creek lanceolate and the so-called MALA (Middle Archaic-Late Archaic) reflect phases that were probably contemporary with Guilford in the Piedmont. Contexts containing these forms, particularly the MALA, include evidence for large-scale tool production and intensive habitation.

There is some evidence to suggest that the divergence between Piedmont and Coastal Plain Middle Archaic period cultural manifestations or stone tool types relates to behavioral differences. Distinct provincial patterns may result from two related factors: reduced annual mobility range over the Early Archaic period and increased patchiness of Coastal Plain resources while Piedmont environments remained relatively homogeneous (allowing for the persistence of a foraging strategy).

Researchers are only beginning to understand the nature of Middle Archaic adaptations in the Coastal Plain. Part of the problem is poor chronological and stone tool type resolution, one that is shared with research in the Piedmont. Unfortunately, the period is perhaps the most poorly dated of any in the region. Despite the poor resolution, the Middle Archaic period in the Coastal Plain poses intriguing problems, ranging from local technological change, such as the increased practice of raw material (chert) heat alteration, to interregional connections between the Savannah River region and Mid-south areas with similar time period cultural patterns.

Late Archaic (5000-3000 B.P. [3050-1050 B.C.])

Touted as the culmination of "Primary Forest Efficiency", the Late Archaic period is often described as a time of increased settlement permanence, population growth, subsistence intensification, and technological innovation. The Late Archaic period has long interested researchers in the Southeast, making it perhaps the best-studied period of early Native American prehistory.

The appearance of a broad-bladed stemmed biface referred to as "Savannah River Stemmed" marks the beginning of the period. The period is also characterized by numerous other technological changes, particularly the development of fiber-tempered ceramic vessel technology. One sequence for the Savannah River valley includes three phases: Stallings I (pre-ceramic; 5000-4500 B.P.); Stallings II (plain fiber-tempered pottery; 4500-3700 B.P.); and Stallings III (decorated and plain fiber-tempered pottery; 3700-3100 B.P.). Although terminology is different, the Georgia coastal sequence is roughly similar, except for a lack of pre-ceramic sites. Sand-tempered Thom's Creek pottery in both coastal and interior portions of South Carolina may date as early as 4000 B.P. The Thom's Creek and Stallings pottery series share many formal and stylistic similarities and probably have appreciable chronological overlap.

Data available on settlement and subsistence in the Savannah River region suggest that distinct Piedmont and Coastal Plain strategies were in place during the fifth millennium. An emphasis on riverine habitats was evident in the Coastal Plain at this time, while seasonal movement between upland and bottomland locations was practiced in the Piedmont. The first use of freshwater shellfish in the region coincides with the adoption or development of fiber-tempered pottery in the Coastal Plain at about 4500 B.P. As the modern floodplain developed in an upriver, time-transgressive fashion, Coastal Plain shellfish productivity waned, leading to shifts in settlement, including increased use of upland streams. Shellfish procurement and pottery utilization did not occur above the Fall Line until after 3700 B.P. Regional population density, social and political complexity may have peaked at this time, as witnessed by the richness of pottery designs, elaborate non-subsistence material culture, exchange in soapstone, and other items, and formation of huge shellmiddens and coastal shell rings (both resulting from the consumption of large amounts shellfish).

The patterns and processes of regional integration during the Late Archaic period raise fascinating anthropological issues. The period's rich site and assemblage data suggest patterns of tribalization, territoriality, craft specialization, non-subsistence (surplus) production, long-distance exchange and mortuary ceremonialism. Relationships between interior and coastal groups are particularly intriguing because of their distinct technological histories. In the realm of cooking technology, for example, Piedmont and Fall Zone inhabitants specialized in the production and use of soapstone cooking tools, first heating stones, then bowls. Pottery was a late addition to the technology, and once adopted, was used in traditional ways. In contrast, coastal inhabitants are noted for the early use of pottery and development of innovations to improve the thermal efficiency of the tools. Though exchanged across the interior, soapstone was not regularly acquired by coastal occupants. The inability to acquire soapstone on the coast and the long lag in the adoption of pottery in the interior, point to social and political factors that affected the mundane economic decisions of Late Archaic peoples.

Researchers believe this evidence points to the burgeoning of social and political complexity in the Late Archaic period, as well as the economic outcomes of an increasingly divergent set of subregional adaptations. Although research has emphasized the emerging sedentariness of Late Archaic populations (particularly the role of shellfish subsistence), the period encompasses a vast array of local economies and social formations and explication of the organization and integration of such diverse cultural entities is of primary research importance.

Early Woodland (3000-2450 B.P. [1050-500 B.C.])

Cultural manifestations referred to as “Woodland” in the eastern United states have traditionally been delineated from preceding Archaic manifestations by the appearance of pottery, mound building, and horticulture. These criteria are untenable for the Savannah River region, where pottery was very early and mound building and horticulture appeared much later than in other portions of the Eastern Woodlands. In fact, current divisions between the Late Archaic and Early Woodland periods in the Savannah region are purely typological, being most often given to the appearance of specific pottery surface treatments.

In the Coastal and Coastal Plain portions of the Savannah River region, the Early Woodland period is represented by Refuge pottery, dating roughly from 3000-2450 B.P. Refuge surface treatments include dentate stamped, simple stamped, and plain. Early Woodland manifestations in the Piedmont have been defined as the Kellogg and Post-Kellogg phases and are recognized primarily by the presence of fabric impressed pottery. Dates for Kellogg are generally later than those for Refuge, the former extending into the second millennium before present. The chronological and cultural relationships between the Refuge and Kellogg phases in the Savannah River valley remain one of the most perplexing problems in local Woodland period archaeology.

Little is known about the composition and variability of Early Woodland assemblages in the area. Stone tool technology is highly variable from the Coast to the Piedmont, as local adjustments to raw material availability appear to have engendered situational solutions to tool design and function. Small stemmed bifaces ranging widely in size and form are typical of Coastal Plain assemblages, while indented-based triangular points characterize Piedmont assemblages. Other artifact classes of the Piedmont include soapstone tubular pipes, boatstones, bar gorgets, biconcave mortars, and disk-shaped grinding stones, although these have not been documented in excavated contexts of the Savannah valley. Coastal assemblages have few stone tool artifacts, containing instead some shell, bone, and antler tools.

An expansion of the Late Archaic subsistence base to include small, locally available plant and animal resources is evident in the records of Early Woodland period diets. Shellfish procurement continued at select locations on and near the coast, but this aspect of subsistence was not as conspicuous as in the prior period. Refuge settlement in the coastal zone consisted of small, non-midden sites in areas of well-drained soil, coupled with large middens in riverine and estuarine contexts. Sea level fluctuations during this time have been documented as a major factor in site relocation. In the interior Coastal Plain, Refuge settlement components are present throughout the upland sandhills at sites with relatively low diversity and density. Kellogg settlement in the Piedmont has been described as riverine village-based with small, limited-activity procurement sites in adjacent upland settings. Compared to the Coastal Plain, Piedmont villages are generally smaller, suggesting smaller co-resident groups and/or shorter occupation spans.

The overall character of Early Woodland prehistory in the Savannah River region is marked by pottery surface treatment. Presumably, the distinctions observed in this class of artifact represent a continuance of the social and political or cultural differences of the preceding Late Archaic period. Unlike the Late Archaic period, however, there is little evidence for large-scale social integration during the Early Woodland. Large shell middens and rings indicative of social gathering were abandoned by 3000 B.P. Regional site distributions suggest a pattern of dispersed settlement, relatively small co-resident group size and little interprovincial interaction. The dynamic nature of local environments, particularly regarding sea level fluctuation and ensuing riverine development, had great influence on Early Woodland settlement and subsistence, and research in these areas has been fruitful. However, researchers have not yet described Early Woodland organization in social and political terms, or accounted for the processes unfolding in the fourth millennium which resulted in what appears to have been a dissolution of Late Archaic regional integration.

Middle Woodland (2450-1450 B.P. [500 B.C.-A.D. 500])

The Middle Woodland period in the Coastal and Coastal plain portions of the Savannah region is represented by the widespread Deptford phase. Deptford is a geographically expansive phase of the South Atlantic Slope, extending from North Carolina to Florida. Check, linear check, and simple stamping are typical Deptford ceramic surface treatments. The phase occupies a span of approximately 1,000 years, from 2450 to 1450 B.P. The latter half of this span, the Cartersville phase of the Piedmont, is also represented by check, linear check, and simple stamped pottery. Typological distinctions between Deptford and Cartersville are subtle, suggesting a high level of regional continuity or integration during the period.

Deptford has been interpreted as a coastal-estuarine adaptation with interior occupations limited to short-term hunting and collecting. Large-scale survey and excavation projects in the interior Coastal Plain have overturned this geocentric view to show that Deptford settlement included intensive non-coastal occupations. Equally intensive village-based settlement is documented at Cartersville sites in the Piedmont.

Seasonal or permanent base camps in prime resource locations characterize Middle Woodland settlement patterns throughout the Savannah region. Inhabitants exploited a wide range of wild food resources from these bases and also procured food through short-term extractive forays. Evidence for the cultivation of native or tropical plants has not been observed in the region. Settlement and subsistence organization appears to have been locally consolidated, consisting at times of relatively large aggregations of people, large-scale storage, and perhaps limited economic specialization.

Throughout the Eastern Woodlands, the Middle Woodland period cannot be fully understood without reference to the Hopewell Interaction Sphere centered in the upper Mississippi and Ohio valleys. Far-flung material exchange, mound building and elaborate burial practices characterize Hopewell manifestations in many parts of the Eastern Woodlands. Curiously, the Savannah River region contains no evidence of direct Hopewellian influence, although locations as close as western Georgia do include Hopewell exchange goods. The local absence of burial mounds and status differences in graves suggest significant differences between the Savannah River populations and those 200 or so kilometers to the west.

Despite the lack of obvious Hopewellian influence in the Savannah region, a higher order of sociopolitical complexity over the Early Woodland is evident in the material culture and settlement organization of Middle Woodland sites. Broad similarities in ceramic design across the region suggest a level of inter-provincial integration missing during the Early Woodland. Exchange between coastal and interior groups is indicated by the presence of marine shell and fossils in the Upper Coastal Plain. Elaborate ceramic and stone tool artifacts at the G.S. Lewis-West site are possible evidence for status differences, economic specialization, and non-subsistence production. The development of social and political models for the Middle Woodland period will depend on further comparisons of coastal and interior assemblages and on analyses of the production and distribution of non-subsistence items, as well as domestic economic production, including storage capabilities.

Late Woodland (1450-800 B.P. [A.D. 500-1150])

The Late Woodland period is difficult to delineate from Middle Woodland or from the subsequent Mississippian period. Cord-marked pottery is added to the Deptford repertoire in the last half of the phase. Heavy cord-marked pottery with small pebble temper marks the Wilmington phase on the coast, and this phase is typically cited as the onset of the Late Woodland period. Sand-tempered, cord-marked pottery of the interior Coastal Plain in the Wilmington type is also included, and many view the coastal and interior wares as temporal equivalents. Thus, cord marking alone is a poor discriminator of the Middle and Late Woodland periods, and the typological break is best defined by the decline in stamped Deptford wares at about 1500 B.P.

Complicated stamped pottery of the Napier and Swift Creek phases are Late Woodland identifying types of the Piedmont portion of the Savannah watershed. Compared to the Coastal Plain, Late Woodland site counts in the Piedmont are low. The lack of sites has been attributed to typological ambiguity, including a possible continuance of simple stamped pottery well into the second millennium.

Observations about Late Woodland site distributions in the middle Coastal Plain constitute one of the few bodies of settlement data for the region. The pattern of dispersed upland settlement described suggests either the local beginnings of slash and burn agriculture or intensification of upland resource procurement. Sites in the coastal zone are likewise numerous, small, and dispersed and suggest a decrease in settlement integration over the Middle Woodland period. In contrast, Piedmont sites are few and are dispersed along tributaries with little if any inter-riverine occupation. Ironically, the increased use of cultivated crops has been suggested to explain Piedmont floodplain settlement, although recent work in the Russell Reservoir shows that squash and corn played a minor role in Late Woodland diet.

A detailed account of Late Woodland organization in the Savannah River region is essential to the understanding of emergent Mississippian polities. Such an account has begun to take shape. For instance, the apparent continuity in pottery design from Swift Creek to Mississippian times suggests indigenous development. Also, platform mounds are superimposed over Late Woodland earth lodges at Beaverdam Creek in the Russell Reservoir area. This evidence, combined with mortuary data, may indicate that a chiefly elite population from a western Mississippian political system was imposed upon the local Late Woodland population. The agricultural basis for the rise of Mississippian social and political structures has not been documented locally, so it perhaps accompanied the imposition of political authority in the region. The Woodland to Mississippian transition is marked by a shift from small, widely dispersed sites to fewer, larger villages in or near floodplains. By the time this settlement change was made (after 800 B.P./ 1150 B.C.), corn agriculture was clearly being practiced locally.

Mississippian (800-500 B.P.[A.D. 1150-1450])

Mississippian typology and chronology in the Savannah River region is detailed and thorough, having benefited from decades of careful stratigraphic excavation and ceramic design analyses. Temporal control on the order of 100 to 150 years has been achieved for most assemblages. The chronology shows that Mississippian societies were well established in the Savannah basin by approximately 800 B.P.

Mississippian period occupation of the Savannah River basin is the history of the emergence, growth and eventual dissolution of discrete chiefly societies. Major mound centers in the Savannah River basin include Irene near the coast; Lawton, Silver Bluff, and Hollywood in the interior Coastal Plain; Rembert, and Beaverdam in the central Piedmont; and Chauga, Tugalo, and Estatoe in the upper Piedmont. A settlement hierarchy consisting of mound centers, villages, and hamlets is typical of site distributions across the region. Within individual communities, burial and subsistence data suggest fairly egalitarian relationships, but at mound centers, elites received special mortuary treatment and apparently ate better than commoners.

Shifting power and political alliances between mound centers is evident in the patterns of mound construction and site abandonment. The appearance of fortifications at the village site of Rucker's Bottom, in the Russell Reservoir, after A.D. 1300 suggests that competition between polities was a critical component of the rapidly changing political landscape.

The lower Savannah River Valley was abandoned sometime after A.D. 1450. At the time of European contact, about A.D. 1540, three complex chiefdoms were observed in the South Atlantic area: the province of Coosa, centered in northwest Georgia; the province of Ocute, in central Georgia; and the province of Cofitachequi, centered in north-central South Carolina. Dissolution of the Savannah polities and ensuing abandonment of the area was one result of the increasing power of the rival chiefdoms of Ocute and Cofitachequi. Patterns and processes of the geopolitical evolution of the region are subjects of on-going research, so a more thorough understanding of the demise of Mississippian societies in the Savannah basin is forthcoming.

Protohistoric-Historic (500 B.P.-Present [A.D. 1450-present])

Mississippian polities at the head of the Savannah basin survived the geopolitical changes of the fifteenth century and persisted into the historic era. When explorer Hernando de Soto crossed the middle Savannah River Valley in 1540, Native America settlements were not observed, and informants elsewhere described the region as a "buffer zone." The area apparently remained unoccupied until just prior to the English settlement of Charles Town in 1670. Native American occupants at that time were referred to as the Westo. Over the next several decades, various Native American groups including the Shawnee, Apalachee, Apalachicola, Chickasaw, Yamacraw, and Yuchi occupied settlements along the river for varying lengths of time. Very little is known about these groups because they came and went in such rapid succession. Ethnohistorical and historical references of these groups have recently been pieced together to arrive at a preliminary chronology and map of settlement. Systematic exploration for archaeological traces of these settlements is now beginning, but to date, practically no information of an archaeological nature is available. Knowledge of the protohistoric and historic Native Americans in the Savannah River region should expand in the coming years as increasing attention is paid to the impact of European contact and Native American strategies of accommodation and resistance.

The earliest European settlement of the area appears to have taken place following the establishment of Fort Moore, across the Savannah River from Augusta. The major economic activities through the 18th and early 19th centuries were probably cattle ranching, lumbering, and mixed subsistence farming. Much of the early demand for cattle in the area was driven by the export market, while at least some of the agricultural produce may have been sold to Low Country planters for slave rations. However, documentary comments regarding the difficulty of obtaining provisions indicates that subsistence agriculture was the economic mainstay of the area. Cotton agriculture was a relative latecomer to the economic landscape, and may not have become significant until the 1830s.

Throughout the century preceding the American Civil War, a small-scale, locally oriented milling industry serviced area farmers who harvested timber and ground their corn and other grain crops. This industry was further characterized by a relative lack of technological innovation and low levels of capitalization and probably operated on a part-time basis based on local demand. These characteristics may have been due to the marginal nature of the soils in the study area, which made farming a risky enterprise. In the face of fluctuating demand, it would have made little sense for area millers to over-invest in state-of-the-art technology when building their establishments. At the same time, increasing access to rail transport and improved road systems gave rise to small towns at important crossroads and railheads and allowed cotton growers to move commodities to market centers like Atlanta, Georgia, and Charleston, South Carolina much more efficiently than had been the case under a riverine transport system.

The late-19th and early 20th centuries were a time of radical economic change in some respects, and status quo in others. Perhaps the most significant change was the growing intensity in land use, as farmers plowed areas that had probably not been utilized earlier. This took place simultaneously with changes in land ownership patterns, as tenancy became established and superseded previous freeholder/slave tenure systems. In the 1930s, these patterns began to shift again, as federal crop programs encouraged further diversification. During the century following the American Civil War, some individual farmers were relatively successful. However, fluctuating prices, and later, the Depression, caused an outflow of population in the early 20th century. Timber became a more important industry, as marginal land finally became exhausted from over a century of intensive agriculture and was planted in pine.

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