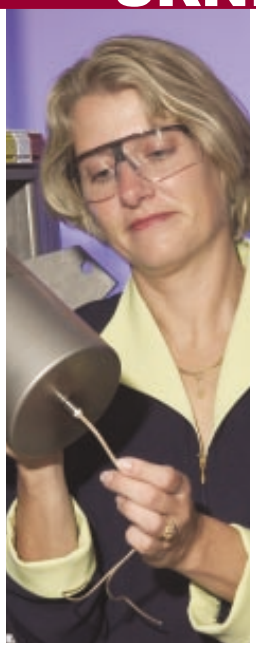
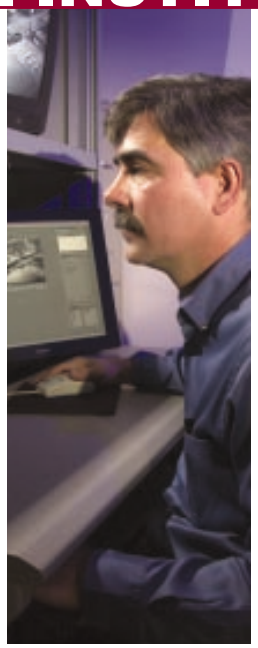
SRNL INSTITUTIONAL PLAN

November 2005

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SRNL™
SAVANNAH RIVER NATIONAL LABORATORY
We Put Science To Work

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SAVANNAH RIVER NATIONAL LABORATORY

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For the

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Message from the Director

Dr. G. Todd Wright
Director, Savannah River National Laboratory

The Savannah River National Laboratory (SRNL) has served the Nation with honor for the past 50 years and looks forward to continuing and strengthening its contributions to our national priorities. SRNL is the Nation's newest national laboratory, and I am proud to help chart its course into the future.

When the Secretary of Energy designated the Savannah River Technology Center (SRTC) as a national laboratory, it began a transition that will continue for the next few years. SRNL must transition from a significant role as SRTC, where we focused on developing and supporting the Savannah River Site (SRS), to the broader role of a national laboratory, addressing the priorities of the Nation. This Institutional Plan documents the current state of the laboratory and the future plans and needs essential for completing the transition to a broader national laboratory status.

To begin the laboratory's transition, I have established three key objectives:

- Lead key environmental science initiatives
- Provide critical support for the Nation's energy independence
- Provide essential technology support for homeland security initiatives and national nuclear defense

Our customers' goals are an integral part of these objectives, and I look forward to a broad collaborative relationship with the laboratory's current and future customers to achieve them.

SRNL has entered into an era that is testing its well-known ingenuity. As new challenges arise, SRNL must maintain its fundamental strength in generating, applying, and integrating technology. Strategies must also reflect sound management of our resources, whether they are the talent, knowledge, and creativeness of our staff, or the unique instruments and technologies in our laboratory.

Fulfilling our mission requires that SRNL continue to safely conduct and successfully apply the highest quality research and development (R&D) to challenges at SRS and within the Department of Energy (DOE) Complex. It also requires us to identify and pursue opportunities created by new technologies, challenges, and ever-changing world developments, within DOE and other government agencies, research institutions, universities, and industry.

To achieve our goals, we must ensure that we, as a highly qualified team, are willing to expand our potential while maintaining a clear focus on the core values of the laboratory. I look forward to a successful future as SRNL continues to put science to work.

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Section 1

Introduction

1.1 Plan Overview

The purpose of this document is to summarize all of the essential elements of the planning and operation of SRNL. Within the last 18 months, the laboratory was named a national laboratory and recognized as a national asset. Now is a time of transition and growth for SRNL—growth not in size, but in stature. SRNL is an applied science laboratory, and therefore its primary mission is to focus on efforts that support the key mission objectives of the DOE:

- Environmental Management
- Energy Security
- National Security

This plan will provide insight into the current programs and future challenges facing the laboratory and its customers. To ensure that the plan will be both readable and useful, major subjects will be addressed at as high a level as possible. The plan consists of eight major subject areas:

- Strategic Outlook
- Overview of Major Programs
- Longer-Ranged Research Programs
- Analysis of Business Activities
- Resources
- Technology Transfer
- Community Relations
- Safety, Security, and Quality

Finally, the plan is intended to capture the transitional elements as SRNL moves from its role as a technology center to national laboratory status.

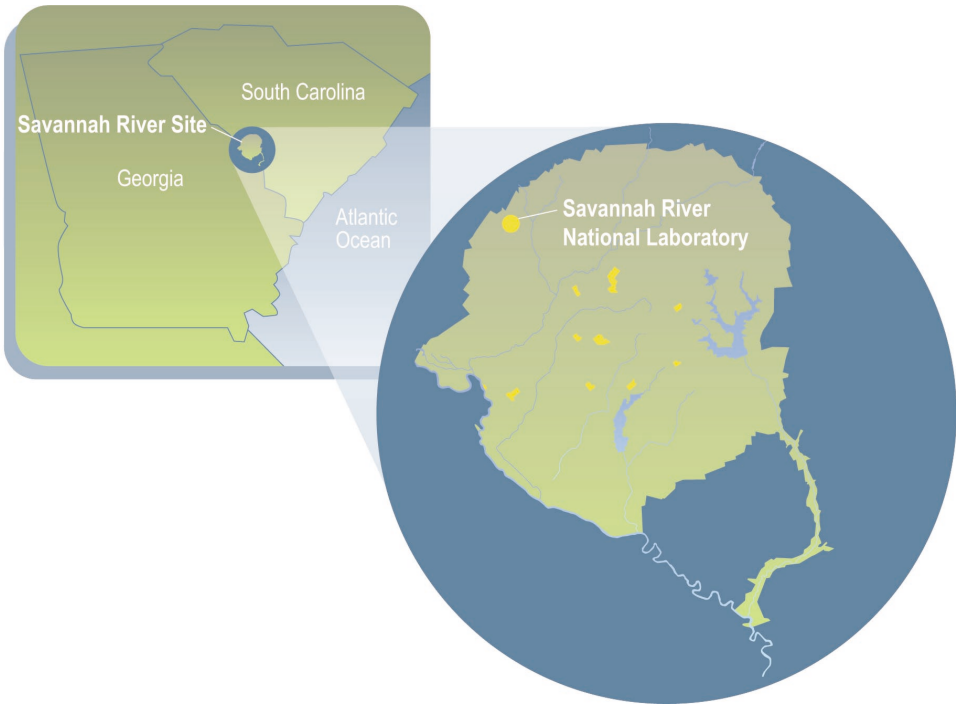
Secretary of Energy Spencer Abraham and South Carolina Governor Mark Sanford unveil the laboratory's new name after it was designated the twelfth national laboratory in the DOE Complex on May 7, 2004.

1.2 History of SRNL

SRNL, the Nation's premier applied science laboratory, was established at SRS in 1951 as the Savannah River Laboratory (SRL). SRL's key mission was to provide R&D support for the production of nuclear materials for national defense. SRL quickly developed a reputation as the world leader in nuclear materials production technologies by providing the R&D necessary to establish a number of facilities: a nuclear fuel and target manufacturing facility; a heavy water production facility; five production reactors; two chemical separations facilities; and a tritium production facility.

Throughout the Cold War, SRL expertise was called upon to support other national defense missions. After reactor designs and chemical processes for first-of-a-kind facilities and processes were completed, SRL turned its focus to process improvements, alternative processes, and expansion of production capabilities.

By 1960, reactor power had increased, new fuel designs had been developed, and separations capabilities had been expanded. As a result of the laboratory's versatility, SRL played a vital role in experimental programs that involved special irradiation and processing of transplutonium isotopes and uranium^{233}, and processing of offsite fuels. In the 1970s and 1980s, programs related to the environment, waste disposal, and reactor safety grew; these included onsite and offsite environmental monitoring, studies of alternative waste forms, and development of defense nuclear waste processing technologies. The laboratory continued to provide R&D support for the production reactors during this time through efforts to upgrade systems and determine reactor power limits. Support of national defense tritium missions also has remained a major focus of the laboratory's applied research.



Following the end of the Cold War, the laboratory's mission continued to evolve to meet the needs of the nation, the DOE, and SRS operations. Greater emphasis was placed on innovative and cost-effective methods of cleaning up the environment. Environmental protection and monitoring, which began in 1950, evolved and strengthened over the years.

SRNL has long-standing international scientific interactions. Over 25 years ago, SRNL led the implementation of international R&D efforts to field test proposed glass compositions for the long-term disposition and storage of high-level nuclear waste. Results of these efforts have been critical to participating countries' programs to successfully manage nuclear waste, an issue of great strategic importance to the energy security of the U.S.

More recently, we became a member and sponsor of the International Energy Agency's (IEA) solid-state hydrogen storage program, and a member of the DOE International Partnership for a Hydrogen Economy Program (IPHP).

In 1992, SRL was renamed the Savannah River Technology Center to recognize its focus on applied research and technology development. The laboratory has continued to provide R&D to support national defense through its technologies and capabilities in nonproliferation and tritium processing. It also applies new technologies to stabilize and dispose of nuclear materials, to clean up groundwater and soils polluted with industrial wastes, and to explore alternative energy uses.

In 2004, the laboratory was designated the Savannah River National Laboratory, the twelfth national laboratory in the DOE Complex. This designation acknowledges more than 50 years of continuous R&D excellence and SRNL's future key role in scientific research programs that address our Nation's most critical needs.

1.3 SRNL's Roles as Environmental Management (EM) Corporate Laboratory

1.3.1 SRNL's EM Mission

SRNL is the EM Corporate Laboratory. In this role, SRNL applies its considerable experience and technical expertise in environmental sciences and nuclear waste management to support EM in its mission:

- Accelerate risk reduction.
- Clean up the environmental legacy of the government's nuclear weapons program.
- Conduct nuclear energy research.

The EM program, one of the largest, most diverse, and technically complex environmental cleanup programs in the world, includes responsibility for the cleanup of 114 sites across the country. Specifically, this responsibility includes the following initiatives:

- Safely disposition large volumes of nuclear wastes. SRNL will contribute its world-class expertise and experience to support and pursue scientifically defensible bases for cost-effective, timely nuclear waste disposition.
- Safeguard materials that could be used in nuclear weapons. SRNL will continue its historic role as a key participant in ensuring sound scientific bases and engineering excellence in safeguarding nuclear weapons materials.
- Deactivate and decommission several thousand contaminated facilities no longer needed to support DOE's mission, and remediate extensive surface and groundwater contamination. SRNL will continue to provide the scientific research, engineering development, and field experience to support the EM efforts across the DOE Complex.

When announcing the national laboratory designation for SRNL, the Secretary of Energy stated that as one of the country's elite national laboratories, SRNL will continue its work with environmental cleanup and nuclear waste management, but now will have additional opportunities to explore a wider range of national research issues.

1.3.2 Corporate Laboratory Challenge

The DOE Strategic Plan outlines its overarching mission to advance the national, economic, and energy security of the United States; to promote scientific and technological innovation in support of that mission; and to ensure the environmental cleanup of the national Nuclear Weapons Complex. The plan includes four strategic goals aimed at the environment, defense, energy, and science.

The focus of the Environment Strategic Goal is "to protect the environment by providing a responsible resolution to the environmental legacy of the Cold War, and by providing for the permanent disposal of the Nation's high-level radioactive waste." The magnitude and complexity of this challenging cleanup-legacy management mission requires the optimal utilization of national laboratory and cleanup site resources. These resources must be fully leveraged through coordination and collaboration. SRNL, as the EM Corporate Laboratory and the only DOE laboratory for which EM has Cognizant Secretarial Officer responsibility, will meet this challenge by working with other National Laboratories and research institutions to develop and implement solutions that will best enable EM to fulfill its missions. SRNL will support EM to systematically identify and address pertinent site and national issues, strengthening the technical credibility of EM's decisions.

The other three DOE strategic goals, and the SRNL role in their execution, are described below:

- Defense Strategic Goal: To protect our national security by applying advanced science and nuclear technology to the Nation's defense.
- Energy Strategic Goal: To protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy.
- Science Strategic Goal: To protect our national and economic security by providing world-class scientific research capacity and advancing scientific knowledge.

SRNL, as the Nation's newest national laboratory, already contributes significantly to these strategic goals, with lead roles in the areas of science, environmental and nuclear waste cleanup, and energy. In accomplishing our mission, we partner with DOE, other federal laboratories and agencies, the academic community, and the private sector. Specific SRNL short-term and long-term initiatives that address these strategic goals are described throughout this Institutional Plan.

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Section 2

Laboratory Strategy

2.1 Mission and Vision

2.1.1 Mission

- To meet national and SRS science and technology needs.
- To build technical capabilities to meet future needs and future SRS missions.
- To provide the R&D vital to the Nation that can also stimulate the region's technology-based economy through partnerships with South Carolina and regional universities and collaborations with regional governments.

2.1.2 Vision

SRNL is the Nation's premier applied science laboratory in National Security, Energy Security, and Environmental Management by delivering world-class, innovative performance for the Department of Energy in National Defense and Homeland Security Technologies, Hydrogen Technology, and Accelerated Cleanup.

SRNL, through its collaborations with the regional universities, has created a virtual R&D center with significant intellectual and economic benefits to the region and the Nation.

2.2 Core Values

2.2.1 Customer Satisfaction

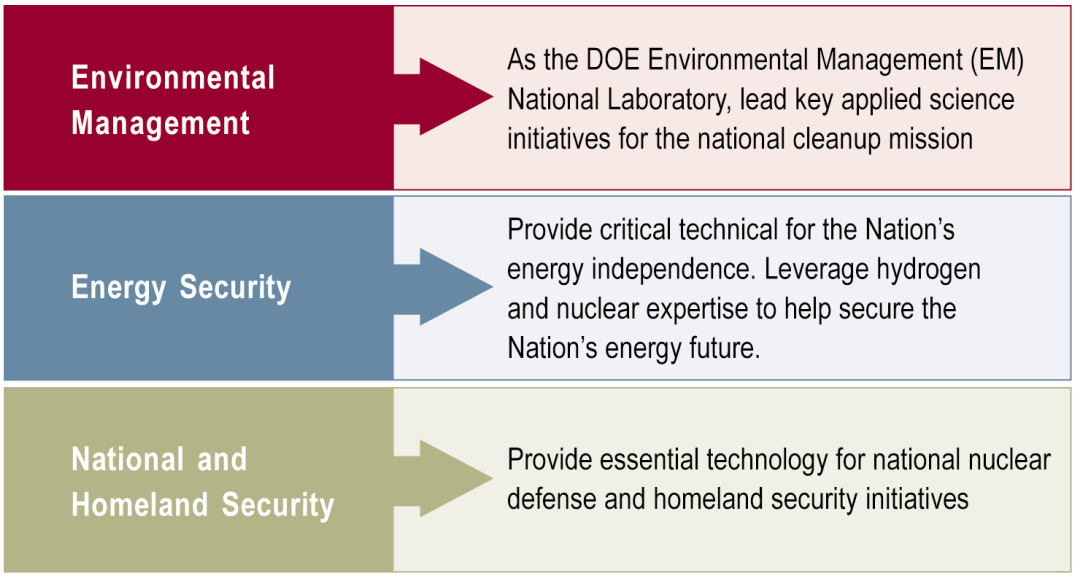
- We partner with our customers and continually strive to anticipate their requirements, meet their expectations, and enable their success.
- Our culture works to ensure that each SRNL employee understands and acts upon his or her role in satisfying the needs of each customer by providing products or services of superior value and quality.

2.2.2 People

- We value each individual's personal health and safety.
  - Our safety culture reinforces the belief that every injury is preventable and establishes a work environment of behavior-based safety.
- We highly regard each other as business associates and individuals.
  - We care about each other on a personal basis. We help one another reach success in both a business and a personal context. We promote growth and development opportunities for employees.
- We treat each other with respect, courtesy, and honesty at all times.
  - Our culture is based on belief in the inherent worth of each individual. To that end, we establish policies and systems as well as encourage behavior consistent with this core value.
- We appreciate and recognize each other's contributions.
  - Our culture fosters frequent, timely, and inclusive recognition of teams and individuals. We do this both formally and informally in ways that are valued by those being recognized.
- We value the innovative and creative abilities of our people and their sense of ownership and accountability.
  - We encourage and develop in each person the effective exercise of authority and responsibility. We build commitment to taking responsibility by treating mistakes as valuable learning opportunities.

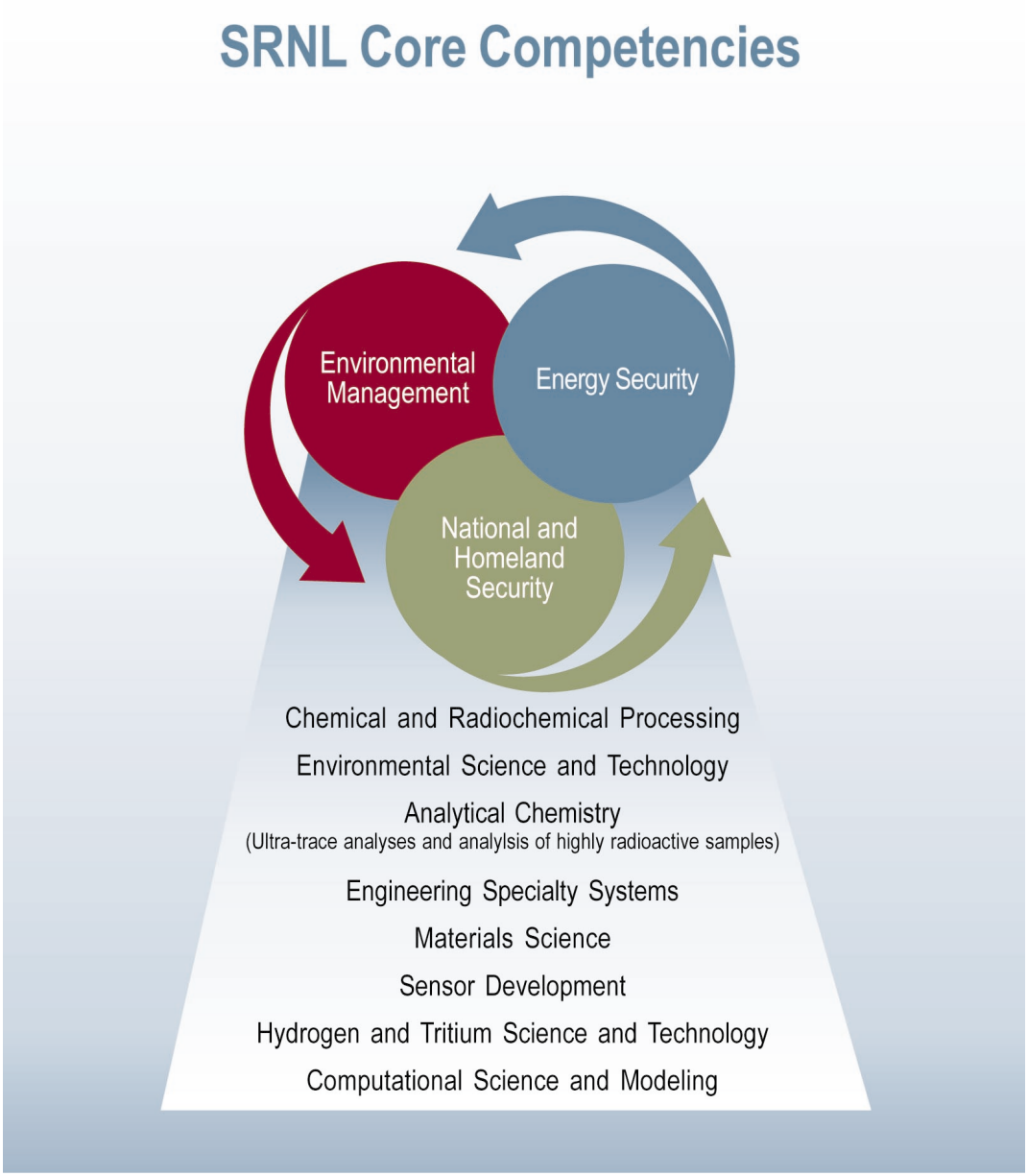
2.3 Core Competencies

The following sections list the core competencies and wide array of skills SRNL applies in each area of our business. Our expertise within these business lines enables us to support the site, EM, and the Nation.



SRNL's core competencies across our three strategic focus areas support initiatives that are vital to our nation's future and security.

Environmental and Process Technology	
HLW	• Waste processing and stabilization (in glass ceramics and grout) • Waste storage, packaging, and disposition
Low level waste (LLW) Transuranic (TRU) waste Hazardous waste and mixed waste	• Characterization, retrieval, separations, waste form qualification, and closures
Soil and water remediation	• Passive and natural remedial approaches • Remediation technologies • Strategies and technologies to meet National Pollutant Discharge Elimination System (NPDES) permits • Characterization, modeling area closures, and Decontamination and Decommissioning (D&D) support



Energy Security	
Hydrogen storage	• Hydride beds • Alanates • Nanoparticle development of various storage materials
Hydrogen generation	• Thermochemical generation of hydrogen research and demonstration
Nuclear energy	• Training and research reactor conceptualization • Materials research • Advanced fuel cycle studies • Dry storage of high burn up fuel demonstrations
Clean fossil energy	• Development of advanced stack-scrubbing technologies • CO_2 removal and control • SO_2 and NOX removal • Mercury removal
Fusion energy	• ITER Development Program
Climate change	• Weather modeling - micro climes
Biomass	• Land-fill methane utilization studies • Biomethane generation studies in coal mines • Forest residue power production studies

National and Homeland Security	
Tritium	• Extraction, isotopic separation, purification, storage, and loading of tritium • Reliability assessment • Effect of tritium on nuclear stockpile materials
Plutonium	• Separation, recycle, purification, storage, and handling
Nuclear materials management	• Plutonium and nuclear materials treatment • Package development • Transportation, storage, and surveillance • Spent fuel treatment and storage, particularly aluminum-clad fuels
Nuclear nonproliferation	• Disposition of legacy nuclear materials • Detect and deter proliferation of weapons of mass destruction • High-sensitivity analyses
Homeland Security	• Technical support to Immigration and Customs Enforcement, Border Protection, and law enforcement • Radiation • Nuclear training for Coast Guard and Federal Bureau of Investigation (FBI) • Nuclear forensics for FBI
Defense technologies	• Tools for combat support: remote inspection and repair; field deployable, real-time radiation monitoring; robotics; surveillance; and specialty equipment

2.3.1 Collaborations

SRNL enhances the value of its core competencies to its customers through strategic collaboration with select industry, university, and national laboratory partners. For example we are partnering with several automotive companies in pursuit of joint objectives for hydrogen storage for transportation. We are also supporting directed research in hydrogen storage materials for the DOE Center for Excellence for Hydrogen Storage, an effort led by Sandia National Laboratory. Under a formal collaboration agreement designed to capitalize on the strengths of each institution, SRNL and the Los Alamos National Laboratory have successfully met the Tritium Process Technology Development needs of DOE.

2.3.2 Goals and Objectives

Our overarching goal is to maximize the national impact of SRNL's capabilities and the laboratory's ability to act as a key enabler for technology utilization. We will accomplish this by implementing the following strategies to meet the stated objectives:

- Develop an enhanced capability to deliver technology solutions.
  - Maintain close communication with key customers and congressional leaders.
  - Develop key growth initiatives for the laboratory.
  - Form southeastern regional alliances with the universities and the regional economic development partnerships.
- Build on our core competencies to enhance our position as DOE's premier applied science laboratory.
  - Build on our unique role in tritium stockpile stewardship for national defense.
  - Build on our significant contributions in nonproliferation and international safeguards for national security.
  - Advance SRNL competence in nuclear materials management.
  - Apply our unique EM expertise to accelerate EM closure activities across the DOE Complex.

- Expand SRNL's contributions to new areas of national need.
  - Establish SRNL as a national R&D contributor in hydrogen technology.
  - Establish SRNL as the lead FBI nuclear forensic laboratory.
  - Assist the Department of Homeland Security (DHS) in customs enforcement and border protection.
  - Develop and build Department of Defense (DoD) businesses in niche markets.
  - Establish a viable nuclear training and research reactor center for the southeast at SRS.
- Enhance the stature and reputation of SRNL.
  - Continue to work with DOE to determine the appropriate enduring sponsor.
  - Provide increased opportunity for SRNL staff to be involved in the appropriate technical societies, advisory boards, peer groups, and panels at national and international levels.
  - Seek to hire nationally recognized technical staff to aid in strategic business growth.

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Section 3

Environmental Management

Accelerating the cleanup program is the major emphasis of the Environmental Management (EM) program. Along with acceleration, decreasing the overall risk and reducing the cost of the program are key objectives. As the EM Corporate Laboratory, SRNL's role is to lead and coordinate the effort to develop and apply new solutions to environmental problems across the DOE and to also apply our expertise to assist other Federal agencies. SRNL works with its partner laboratories on the Environmental Laboratory Consortium (ELC) to actively support finding solutions to DOE's most pressing environmental management problems. The major focus is on Hanford, Idaho, SRS, Oak Ridge and Fernald, Ohio, closure sites.

There is a continuing need to deploy new characterization and remediation technologies to accelerate completion and to reduce the cost of environmental remediation activities. Significant new emphasis is being placed on monitored and enhanced natural attenuation and more passive remedies for subsurface contaminant cleanup. Another major emphasis is the elimination or reduction of risk associated with facilities that have no further use currently or in the future. Challenges in characterization, hazard assessment, and remedial action exist and must be addressed.

SRNL is currently the lead organization for the EM Monitored Natural Attenuation/ Enhanced Attenuation (MNA/EA) program, which coordinates targeted research throughout the DOE Complex and universities. These and other studies have identified gaps in the basic understanding of mechanisms involved in contaminant transport. These knowledge gaps are addressed in the current and projected portfolio of the Office of Science. The coupling of hydrologic, geochemical, and biological processes present basic scientific issues that demand basic research in each of the identified disciplines, but equally importantly, a new paradigm to address the primary, secondary, and tertiary interactions among the processes. Rather that explaining such processes as linear actions driven by hydrologic processes, geologic *constructs* act dynamically on both the transport of water and constituents, resulting in non-linear dynamics that currently have poor predictability. These processes both affect, and are affected by, biological processes involving *geno-metabolic structures* that are activated or deactivated as a result of extant physical, chemical and biological conditions. Basic research on mechanisms associated with the individual processes, including activation/deactivation of genes, represents a core of the portfolio. Advances in the computational sciences is critical to understanding the inherent dynamism of such systems, which will lead to improved predictability for these, and other, complex systems.

There is also growing recognition of the need to develop more cost-effective, reliable technologies for long-term monitoring of waste, waste unit closures, and remediation systems. This long-term stewardship responsibility encompasses the need to monitor closure integrity and to provide corrective actions, if needed, to ensure public and environmental safety.

SRNL's support of the SRS cleanup efforts has helped the programs stay on or ahead of schedule for cleaning up groundwater contamination and legacy waste sites, closure of F Canyon, processing of legacy materials, vitrification of HLW, shipping of transuranic (TRU) waste to WIPP, and decommissioning buildings. However, cesium removal and disposition of HLW salt cake remains a major challenge.

To address the challenge of HLW salt cake disposition, the Salt Waste Processing Plant (SWPP) startup must be expedited. In addition, alternate approaches to treating some salt prior to SWPP startup must be implemented to make space available in the tank farm, which is a critical need. In the Defense Waste Processing Facility (DWPF), there is a need to further increase the waste loading in the glass and to increase the plant throughput in order to further reduce the cost of HLW vitrification and disposition.

The stabilization of legacy nuclear materials in H Area is challenged by the diversity and poor characterization of feed items from the de-inventory of the FB Line vault, as well as from other sources as requested by DOE. There is an ongoing need to develop flowsheets that can stabilize these diverse materials, with an emphasis on maximizing the effectiveness of a given flowsheet in stabilizing a broad range of materials.

Vitrification is one of SRNL's principal waste management technologies. This process chemically bonds hazardous, radioactive, or mixed waste in glass to convert byproducts of nuclear weapons production into a stable form for long-term storage and disposal. The largest application of SRNL's vitrification technology is the SRS Defense Waste Processing Facility, where over 6 million pounds of radioactive waste has been converted into glass.

3.1 High-Level Waste

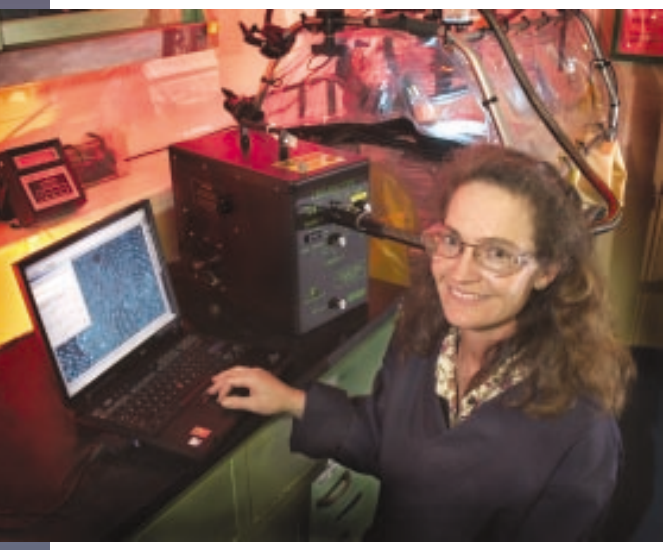
Description

SRNL has provided technical support for all parts of the HLW program at SRS since startup and has developed most of the processes now in use. With the HLW experience and expertise developed at SRS, SRNL has been providing major technical assistance in the development of the Waste Treatment Plant for the Hanford HLW. SRNL is also contributing to the Hanford tank closure effort and the treatment of sodium-bearing waste at the Idaho site.

The HLW program at SRS continues to remove sludge waste from the tanks, close the emptied tanks, and vitrify the sludge at DWPF. It also continues to receive, concentrate, and store waste from the canyons (generated from processing of legacy materials and closure activities) and from DWPF recycle. As of the end of October 2004, DWPF had produced 1732 canisters of glass. The salt fraction of the waste will be treated in the SWPF and the separated cesium and actinides sent to DWPF for vitrification. The decontaminated salt would then be sent to the Saltstone Facility for immobilization and on-site disposal. After an exhaustive evaluation and selection process, DOE selected Caustic Side Solvent Extraction as the process for the SWPF. The SWPF is now being designed and is scheduled to start operation in 2009. Alternate approaches to treating some salt prior to SWPF startup are being evaluated to decongest the tank farm where space has reached the critical stage.

Future Challenges

The major challenge at SRS will be to initiate processing of the salt fraction of the HLW. This is essential to make room in the tank farm and to allow DWPF to continue operation. The strategy is to accelerate the startup of the SWPF and, in the interim prior to startup, initiate some limited salt processing to provide space relief to the tank farm. SRNL will assist with these efforts.



SRNL's key scientists provide support for environmental management across the DOE Complex.

Another major emphasis is to continue to remove sludge waste to feed DWPF and to proceed with tank closures. Improving DWPF operation and reducing costs are also priorities. The SRNL focus will continue to be on higher waste loadings in the glass and increased melt rate in the melter. The need to provide grout formulations for the various waste streams going to Saltstone also will be addressed.

Another challenge will be continued safe operation of the tank farm and its evaporators. Space management and tank life management are key efforts that SRNL will support.

SRNL's unique expertise in HLW pretreatment and immobilization will continue to be used at other DOE sites such as Hanford and Idaho. New and alternate technologies such as steam reforming and cold crucible melters will be evaluated to optimize and enhance the treatment of DOE HLW streams.

Recent Achievements

Recent achievements in the HLW area include:

- Implemented several improvements to DWPF operations to increase the waste loadings and to improve the melt rate. These improvements included new frit formulations to allow higher waste loadings and increased melt rate, installing a glass pump to improve the melt rate, and installing a heated bellows liner to minimize glass pour pluggage. These have resulted in major cost savings to the HLW program.
- Provided the technical basis for the successful disposal of legacy americium and curium inventories from the canyon, thereby facilitating canyon closure.

- In support of the Office of Science Environmental Management Science Program (EMSP), SRNL conducted a workshop this year for principal investigators working on projects supporting HLW needs. A point of contact for the SRS HLW program was provided to respond to technical inquiries from universities, government facilities, and the private sector. To ensure that comprehensive and vital information was communicated, a liason with key personnel at Idaho and Hanford was established. A white paper describing science needs in support of HLW operations at DOE sites is being developed.
- Provided the technical basis for the disposal of neptunium inventories from the canyons. Higher levels of Np were allowed after determining a higher sulfate solubility in the DWPF glass and demonstrating that the higher nitrate content in this stream could be processed in the chemical process cell, thereby accelerating canyon closure.
- Supported the salt program with sampling, characterization, and dissolution of saltcake. Developed methods to dispose of the Tank 48H contents, which included destruction of the organics or aggregation of the waste followed by Saltstone immobilization and disposal.
- Identified an improved filter for the actinide removal process, which helped to double the baseline capacity.
- Developed an improved actinide sorbent and an improved rotary filter for salt treatment. A small column ion exchange process for possible in-tank deployment was also developed as an alternate, limited salt treatment process. Also provided support to the conceptual design for the Modular Caustic Side Solvent Extraction Unit.
- Provided extensive support to the Hanford Waste Treatment Plant. This included resolving a major problem with the ion exchange resin hydraulic performance, resolving pulse jet mixer design configuration issues, and successfully demonstrating the process in the Semi-Integrated Pilot Plant.
- Supported the Hanford tank closure effort by successfully demonstrating the performance of several grout formulations on a large scale.
- Evaluated steam reforming for potential treatment of a number of waste streams from Hanford, Idaho, and SRS. A bench scale steam reformer was developed for more rapid and less expensive process evaluation and development.

3.2 Environmental Remediation and Compliance

Description

There is a continuing need to deploy new characterization and remediation technologies to accelerate completion and reduce the cost of environmental remediation activities. New emphasis is being placed on MNA/EA as the final or ultimate remedy for subsurface contaminant cleanup. Exit strategies involving more passive cleanup technologies and more attainable cleanup goals are needed to provide for cost-effective transition from active treatment systems to MNA/EA. More realistic exposure scenarios and a more complete understanding of contaminant transport mechanisms will allow for more appropriate determination of aquatic and sediment compliance limits. Risk management and impact assessment of contamination on environmental media continue to be important areas of study, as will the development of credible, local exposure and toxicity response parameters for terrestrial, wetland, and aquatic habitats. Finally, there is a growing recognition of the need for more cost-effective and reliable technologies for long-term monitoring of waste unit closures and remediation systems.

SRNL provides key technical support to the resolution of SRS regulatory compliance issues through environmental characterization, modeling, and mitigation activities. Technical resources are provided for National Environmental Policy Act (NEPA) assessment, National Emissions Standards for Hazardous Air Pollutants (NESHAP) compliance modeling, and assessment activities related to compliance with new requirements related to NPDES and Stormwater Permits.

SRNL will continue to support the Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) programs through characterization and development of innovative remediation strategies.

Future Challenges

To accelerate aggressive cleanup of higher risk sites, limit action on lower risk sites, and establish/negotiate appropriate end states for all sites, several significant science and technology challenges will emerge.

For aggressive cleanup of higher risk sites to be successful, an accurate prediction of the residual mass of contamination, along with a greater understanding of key hydrogeologic parameters (such as, permeability), are important to the overall cost and effectiveness of remediation. Low-cost field screening techniques, supplemented with a limited number of certified results for verification, are needed to provide high resolution (vertically and laterally) on chemical and physical parameters.

This emphasis on data quantity, along with appropriate use of flow and transport models, provides the best opportunity to accurately define contaminant inventory and select the most effective remedial action. Effectively matching the appropriate source containment and/or remediation technology to the specific waste unit is critical to maximizing the success and minimizing the cost of the cleanup effort. Innovative applications and effective performance monitoring are needed for these more aggressive technologies (such as dynamic underground stripping (DUS), six-phase heating, and soil vapor extraction) to keep costs down and allow for rapid transition to less expensive, more passive technologies.

Science and technology challenges exist with lower risk sites where less aggressive or limited actions (for example, Microblowers, Baroballs, and MNA/EA) might be deployed. These challenges include understanding existing subsurface conditions, identifying approaches to enhance sustainable natural remediation, and developing cost effective long-term monitoring strategies. An understanding of existing subsurface conditions is essential for evaluating processes already occurring within a given media or at media transition zones (for example, groundwater to wetland), so that accurate process simulations can be performed and presented. Enhancements to existing natural remedies, such as biostimulation/bioaugmentation/immobilization, must be demonstrated to be sustainable if they are to be cost effective.

Finally, the appropriate integration of innovative and traditional monitoring techniques in field sensors and laboratory analysis is critical to the success of any long-term exit strategy.

A key challenge in meeting environmental compliance needs is determining the most appropriate aquatic and sediment compliance limits by mapping exposure pathways and transfer coefficients. We must identify and apply the most appropriate technologies for risk management and assess the impact of contamination in all environmental media. Planning for the closure of multiple units in a contiguous area requires advanced and integrated modeling approaches that incorporate both facility and environmental contaminations, realistic contaminant release and transport processes, and credible risk projections over extended time scales. The ability to evaluate how all of the factors interact will lead to enhanced risk reduction over a broader space and time scale. A suite of decision tools is needed to guide the environmental cleanup and closure end-state decisions through integrated risk and financial assessments.

Recent Achievements

Through the application of environmental core competencies in environmental assessment, biotechnology, environmental restoration, and statistics, SRNL responds to the key challenges of environmental remediation and compliance by:

- Integrating and applying science and technology to identify and meet environmental remediation and compliance needs.
- Identifying, developing, deploying, and optimizing technologies that accelerate cleanup and planning for long-term stewardship, while reducing risk and cost.
- Providing the scientific basis for the development of strategies and programs to achieve site compliance.

Recent achievements and accomplishments in the area of environmental remediation and compliance include:

- Scientific leadership in providing environmental technical assistance to the DOE Ohio Closure Sites and other DOE sites, for example, Oak Ridge (FY03–FY04).
- Scientific leadership on the national MNA/EA Alternative Technology Project for groundwater contaminated with chlorinated organics (FY03–FY06).
- Development and deployment of microblower technology for remediation of VOCs in soil gas (FY03–FY04).
- Characterization, remedy selection, and design support for delineation and remediation of volatile organic compounds (VOCs) at Pantex through the Accelerated Site Technology Deployment (ASTD) Program and direct funding (FY02–FY04).
- Technical support to industrial partners in developing strategies for assessing dense non-aqueous phase liquid (DNAPL) and VOC contamination at the Hanford 200 West site (FY03–FY04).
- Field deployment of a Sulfate Reduction Treatability Study utilizing soy bean oil and sodium lactate to treat an acidic/metals/sulfate groundwater plume resulting from a coal pile runoff basin (FY01–FY04).
- Adaptation of geotechnical methods and environmental wireline sampling techniques for the collection and analysis of salt samples from the SRS HLW tanks (FY03–FY04).
- Collaboration with Clarkson University on an Environmental Management Science Program (EMSP) project to study DNAPL surface chemistry and its relation to DNAPL migration and accumulation (FY00–FY04).
- Discovered and tested novel radiotolerant bacteria (Kineococcus radiotolerans) from HLW to biodegrade chemicals and immobilize radionuclides. Supported DOE Office of Science initiative to sequence the genome of radiation-resistant Kineococcus sp. discovered at SRS (FY00–FY04).

- Completed laboratory-scale feasibility testing for biostimulation and bioaugmentation technologies demonstrating applicability at C-Area and D-Area (FY03–FY04).
- Provided support to DOE Office of Science sponsored Natural and Accelerated Bioremediation Research (NABIR) program as a member of the Field Research Center Review Panel.
- Participated in the Long-Term Performance Monitoring of Metals and Radionuclides in the Subsurface: Strategies, Tools and Case Studies workshop sponsored by DOE-HQ to foster collaboration and expedite technology transfer and application (FY04).
- Instructed and led a workshop at the North American Environmental Field Conference and Exposition on Lessons Learned from Applying Direct-Push Sensors and Sample Collection Tools to Characterize Contaminated Sites at Federal Facilities (FY04).
- Hosted the Environmental Advisory Committee since 1984.
- Received the American Chemical Society's Industrial Innovation Award for contributions to the development, deployment, commercialization, and exploration of alternative applications of the PHOSter process (FY04).
- Selected to headline three upcoming special editions on environmental eeosciences at SRS for the American Association of Petroleum Geologists *Environmental Geosciences Journal* (FY04).
- Led the development and implementation of Wetland Treatment System technology for cost-effective treatment of industrial wastewater discharges and construction, the first such system in South Carolina (FY01–FY04).
- Developed and implemented a new toxicity testing protocol using an indigenous alternative test species that was accepted by both the South Carolina Department of Health and Environmental Control (SCDHEC) and the Enviornmental Protection Agency (EPA) as the first new species certified since the initial protocol was introduced. This resulted in the elimination of toxicity testing at all six outfalls, allowing for the termination of the Federal Facilities Compliance Agreement with the EPA (FY02 FY04).
- Revised EPA Soil Screening Values to incorporate results of current research on organismal toxic responses to soil contaminants (FY04).
- Organized a team and breakout session chairperson for the DOE/MSE Performance Monitoring Workshop (FY-05)
- Developed rapid bioassessment methodologies for the evaluation of receptor communities.

3.3 Areas Closures and D&D

Description

The major challenge facing the EM program at SRS is the removal of risk associated with facilities that have no future use. This program focuses not only on individual buildings, but also, the elimination of liabilities associated with certain production areas such as D-, M-, and T-Areas, and several reactor areas for which the entire function is no longer required. The facilities to be addressed range from administrative and security structures to industrial facilities containing both radioactive and non-radioactive hazards. The overall objective of the program is two-fold: to significantly reduce financial liabilities associated with inspection and maintenance of obsolete facilities, and to eliminate risk to workers, the public, and environment associated with those facilities. Following decontamination and decommissioning (D&D) of facilities and elimination of risks associated with the RCRA/CERCLA contaminants in the nearby environment, it is anticipated that these former production areas can be eliminated from the National Priorities List.

Future Challenges

The challenges associated with such an undertaking are substantial and diverse, representing numerous technical issues for which the broad capabilities of SRNL will be required. These challenges occur in three major areas: characterization, hazard assessment, and remedial action.

Characterization of facility hazards presents some unique technical and process issues. The age of most facilities results in issues associated with incomplete operational histories. Sometimes excessive characterization is required to accurately assess the hazards for both the D&D workers and the public as a result of any facility components that are not removed (for example, concrete slabs and underground structures). Characterization is a significant cost element, and efficient, defensible strategies must be developed using both innovative measurement methodologies for contaminant screening and measurement, and efficient sampling and verification strategies. The key to a successful characterization effort is accurately evaluating current hazards and developing appropriate mitigation measures to protect worker health and safety while accomplishing programmatic objectives. Characterization in radioactively contaminated facilities will necessitate the deployment of remote measurement capabilities using *in situ* measurement techniques.

Hazard assessment depends primarily on the adequacy of the contaminant characterization. New technologies are needed for improved characterization of structures that are currently slated for *in-situ* disposal. Enhanced evaluation methods will lead to a clearer understanding of the durability of the remaining structural elements and allow better sampling strategies. Evaluation of the current and potential risks is critical for determining appropriate D&D strategies for a particular facility. Proper determination of the potential current and future risk associated with *in situ* and potentially mobile contaminants in the facilities and surrounding environment is critical for the assessment of long-term risk and ultimately the probability of acceptance of area closure. Current understanding of the probability of contaminant release from the facility, and subsequent mobility through the environment to potential receptors, requires an understanding of contaminant availability, mobility, and toxicity at large spatial scales that can only be achieved through integrated modeling and assessment methodologies. Such an approach is required to determine the risk contribution of individual facilities in the context of overall risk associated with remaining facilities and activities in an area.

Remedial action of facilities and surrounding areas represents the third major challenge for the D&D and area closure initiative. While most facilities will be removed with minimal risk to workers, certain facilities, such as reactors and separations facilities, may represent sufficient hazards to D&D workers and minimal long-term risks to the public and environment to warrant stabilization as the most appropriate strategy. Significant challenges associated with remedial action include the safe disposal of materials from facilities that are demolished, and the long-term stabilization of facilities that are not. Techniques for long-term prediction of contaminant mobility, risk assessment, and contaminant immobilization are required for this phase of the program to ensure both public and environmental safety.

Recent Achievements

- Development of Technical Guidance Document for Characterization and Risk Assessment of D&D facilities, allowing consistent and transparent methodologies for facility D&D activities (FY04).
- Deployment of rapid screening methodologies for metals, organics, and radionuclides to expedite D&D hazard characterization (FY04).
- Development of statistically based sampling designs to ensure adequate and efficient characterization of residual contaminants (FY04).
- Development of site-specific Derived Concentration Guide Limits to facilitate real-time decision making during facility closure (FY04).
- Deployment of biohazard screening methodologies to ensure protection of D&D workers during decommissioning operations (FY04).
- Support for de-inventory of FB-Line to support deactivation of that facility, including development of flow sheets for processing of residues (FY04).
- Demonstration of efficacy of process for cleaning degraded F-Canyon solvent to allow for safe disposal (FY04).

3.4 Solid Waste

Description

SRNL has supported the site in the characterization, treatment, storage, remote handling, and disposal of solid waste (including low-level, hazardous, mixed, and TRU wastes). A major focus is the shipping of TRU waste to WIPP. As of June 2005, 16,754 drums have been shipped, which is significantly ahead of schedule.

SRNL conducts numerous performance assessments, composite analyses, special analyses, and unreviewed disposal question analyses to develop the most effective and economical methods of disposal of the various low level waste (LLW) generated waste streams and to maintain the LLW disposal authorization.

Future Challenges

Accelerating the shipment of TRU to WIPP will continue to be a high priority. Of particular concern is the challenge to prepare the drums containing high alpha levels (Pu^{238} waste) for shipment. Different approaches such as hydrogen getters, repackaging, and disposition of liquids are being evaluated. Another concern is the safe handling of TRU drums and boxes that may potentially contain flammable gasses in the headspace. Remotely handled TRU is another challenge that needs to be addressed.

With facility closures and D&D in full operation at SRS, many LLW streams are being generated. Developing the most technically sound and cost-effective method of disposal will be an ongoing challenge. Composite analyses will take on a more significant role as it becomes more important to assess the overall impact of these many closures and disposal sites. Collaboration with other sites and laboratories will continue to ensure that we are using the latest technical advances for treatment and disposal.

SRNL uses the results from performance assessment modeling to develop the technical basis for disposal of low-level radioactive waste in an engineered trench (shown), as well as other disposable units.

Recent Achievements

Recent achievements in the solid waste area include:

- Developed an automated intruder analysis application that mitigates the QA vulnerabilities encountered with former spreadsheet-based intruder calculations, which are time-intensive and potentially error-prone.
- Evaluated and recommended a disposal path for a depleted uranium shipping cask containing legacy radioactive sources.
- Performed multiple evaluations of new waste forms resulting in new disposal practices.
- Resolved a flammability issue with VOCs in TRU drums.
- Completed special analyses to reanalyze limits for all pathways and radionuclides for slit trenches, engineered trenches, and the intermediate level vault.
- Established interim disposal limits for previously unanalyzed isotopes for the components-in-grout trenches, low activity waste vaults, and naval reactor pads.
- Completed a special analysis to allow disposal of Tritium Extraction Facility absorber rods.
- Completed a large-scale, 60 day hydrogen getter test for TRU shipment to WIPP.
- Developed a solidification process for organic PUREX that is being implemented.

3.5 Management of Legacy Materials

Description

Over the past several years, SRNL has provided flowsheets for the stabilization, storage, and disposition of nontraditional legacy nuclear materials. The materials included solutions stored in the canyon tanks and in FB-Line and Building 233-F vaults. The vault items originated not only from SRS, but from across the DOE Complex, including the Rocky Flats Plant and Argonne National Laboratory West. Materials included plutonium and/or enriched uranium residues, highly enriched uranium solutions earmarked for blenddown, and solutions containing neptunium, americium, and curium. Also included were both irradiated and unirradiated fuels and targets unsuited for long-term disposal because of their deteriorated condition or unique challenges. To minimize the amount of processing needed to disposition solutions from dissolved materials, innovative approaches to poisoning dissolver solutions were developed so that those solutions could be sent to the HLW tanks and eventually to DWPF.

During the stabilization, storage, and disposal process, materials must be transported between facilities at a given site or from one DOE site to another. Over time, radiation from packaged nuclear materials breaks down moisture and organics (such as plastics and oils) to generate hydrogen and corrosive gases. To ensure safe transport, the understanding of the gas generation profile of different materials is necessary, as well as the development and certification of effective packaging and shipping devices.

Future Challenges

DOE continues to identify legacy nuclear materials that are unsuitable for storage or for processing in the Mixed Oxide Fuel Fabrication Facility. SRNL's proven ability to develop stabilization, storage, transportation, and disposition strategies for a broad spectrum of materials will be invaluable in assisting DOE with legacy nuclear materials management.

These materials not only present chemical challenges, but also materials and transportation challenges. The lack of pedigree and/or characterization adds to the difficulties that will be encountered in stabilizing, storing, transporting or disposing of these materials. SRNL's close working arrangements with the organizations responsible for flowsheet development, materials issues, analytical measurements, packaging, and waste treatment will enhance the success in identifying and resolving the complicated problems presented by these diverse legacy materials and provide SRS and DOE with the necessary technical bases for managing these materials.

Recent Achievements

Recent achievements in the management of legacy nuclear materials include:

F Canyon—Completed washing study of spent degraded solvent that allowed F Canyon to meet a major milestone by removing 61,000 gallons of "cleaned" solvent for eventual offsite disposition.

FB-Line—Developed a multi-use flowsheet to accommodate numerous FB-line plutonium/uranium-bearing residues for application in HB-Line or H Canyon dissolvers. As appropriate, residual materials from the developmental effort are being returned in oxide form for subsequent storage using the Department of Energy Standard for Plutonium Storage (DOE STD 3013). Approximately 680 grams of plutonium/uranium oxide that is appropriate for 3013 storage has been returned to FB-Line.

H Canyon: HEU Blenddown—Demonstrated that dissolution of lithium-aluminum (Li-Al) target tubes in a dissolver batch also containing uranium-aluminum fuel tubes would not impact the H Canyon safety basis nor affect product purity. Specifically, the impact of the dissolution of the Li-Al alloy target tubes on dissolution rate, off-gas generation rate and composition, and the effectiveness of the solvent extraction process to remove Li from the uranium product were investigated.

Verified that waste from processing unirradiated fuel met Saltstone Waste Acceptance Criteria. H-Area Completion planned to dispose of the high activity waste (HAW) stream from the processing of unirradiated fuel directly to Saltstone to conserve HLW tank farm space and to reduce the future production of HLW glass logs. The supernate from decanting the neutralized HAW stream was expected to meet the mercury and radionuclide levels required by the Saltstone waste acceptance criteria. SRNL demonstrated that the waste acceptance criteria would be met under the proposed processing conditions.

Performed computer simulation of mixing in the enriched uranium storage (EUS) tank that showed the need for a 24-hour mixing time to ensure appropriate accountability analysis. The EUS tank SRS contains dissolved uranyl nitrate hexahydrate and has a full capacity of 130,000 gallons. To determine uncertainties in the accountability samples from the EUS tank, an understanding of the mixing and circulation in the tank is necessary. Experimental methods for determining sufficient mixing times would be expensive and time-consuming, aside from the difficulties in obtaining random samples from the tank. Instead, a computation simulation and analysis was done to determine the mixing uniformity over time for the tank filled to 100 percent of capacity and for the tank filled at 23 percent capacity. Complete mixing for the 100 percent capacity case was predicted in 4 hours and in 36 minutes for the 23 percent capacity case. These results confirmed that the procedure being used was justified for the accountability samples since that procedure required a 24-hour mixing time.

H Canyon: Plutonium-Contaminated Scrap—Developed the flowsheet for the dissolution of plutonium-contaminated scrap. Subsequently, ancillary issues related to the dissolution of the nylon packaging materials, carbon steel, and magnesium oxide sand were studied. Plutonium-contaminated uranium metal scrap will be dissolved in H Canyon to support the de-inventory efforts of FB-Line vault.

HB-Line Phase I: Dissolution of Enriched Uranium Residues—Extended the use of gadolinium as a neutron poison for caustic precipitation of waste solutions from the Phase I dissolution of enriched uranium residues. Expected concentrations would have a maximum uranium:plutonium ratio of 4.3 and a 30 percent enrichment of U^{235}. Previous tests had a maximum uranium:plutonium ratio of 3. Results showed that a sufficient quantity of gadolinium precipitated in conjunction with the plutonium and uranium. In addition, a sufficient amount of water was associated with the precipitates to provide the needed neutron moderation for gadolinium to prevent a criticality in both simulant and actual waste test solutions. Use of gadolinium as a poison increased the amount of solution that could be transferred to HLW in a single batch and reduced the number of glass logs that would be produced in DWPF from those solutions, compared to using the traditional iron or manganese poisons.

Developed the flowsheet for the dissolution of highly enriched uranium residues received from the Idaho National Engineering and Environmental Laboratory. The flowsheet was developed to meet specific criteria requested by HB-Line Phase I. Those criteria included a final nitric acid concentration of 2 Molar and a final uranium concentration of 100-120 grams per liter. A dissolution temperature was recommended to minimize the amount of undissolved solids.

HB-Line Phase II: Neptunium Stabilization Project—Conducted significant investigation of anion exchange parameters needed to ensure successful recovery of neptunium for the HB-Line Phase II Neptunium Stabilization Project. Establishing neptunium processing competency among research staff to provide support to HB-Line for this mission. Of special importance were studies to maximize the partition of plutonium-238 from the neptunium-237 while minimizing the neptunium losses. Established the flowsheet for heel removal (neptunium oxalate) from precipitator tanks. Led effort to develop a spectroscopic method for the rapid analysis of neptunium in the process solutions. Also developed and implemented an on-line colorimetric method for process control of neptunium anion exchange.

Submitted successful 9973 Safety Analysis Report for Packaging (SARP) Revision to allow the neptunium oxide product from the HB-Line Phase II Neptunium Stabilization Project to be shipped to the offsite customer. Conducted ambient and elevated gas generation studies of neptunium oxide to provide the technical basis for this SARP. Also characterized the neptunium oxide with respect to moisture uptake and specific surface area.

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Section 4

Energy Security

4.1 Hydrogen Technology

Following the President's State of the Union Address in 2003, funding for hydrogen and fuel cell initiatives has steadily increased. Currently, hydrogen technology is the largest initiative in DOE's Energy Efficiency and Renewable Energy (EERE) Program. All of the major auto manufacturers have active fuel cell or hydrogen vehicle programs and most have prototype vehicles. Some are already leasing limited numbers of commercial hydrogen vehicles. However, critical challenges still need to be met. These include:

- Cost and durability of fuel cells
- Safety and efficiency of hydrogen storage systems
- Ability to economically produce large supplies of non-fossil-based hydrogen

SRNL has R&D programs that support all of these areas, especially the key areas of hydrogen storage and production.

Description

SRNL is recognized as a world-class leader in the area of solid-state hydrogen storage materials and system development. Current funding comes from DOE Hydrogen Programs as well as several industrial companies. Hydrogen production via nuclear energy systems, and more recently, biological energy systems, is also actively being pursued. Additional hydrogen activities include materials, sensor, and separation technology development.

SRNL conducts internationally recognized research on hydrogen storage materials.

SRNL is a national leader in developing metal hydride materials for hydrogen storage. Shown is a lanthanium nickel aluminum alloy.

Future Challenges

Greater world-wide interest in hydrogen has increased the number of R&D agencies pursuing hydrogen funding. SRNL needs to aggressively pursue ongoing hydrogen activities to maintain and grow its current leadership position. One way this can be done is to continue to pursue dual-use hydrogen/tritium technology in support of National Nuclear Security Administration (NNSA) initiatives as well as new hydrogen energy initiatives from DOE agencies (such as EE, FE, and SC), other government agencies (such as DoD, NASA, Department of Commerce, and Department of Transportation), and various auto and energy companies. SRNL has a long and successful history of partnering with other national laboratories and regional universities. These and other new strategic partnerships must be continued and further developed if SRNL is to be successful in the future.

Recent Achievements

SRNL has recently been involved in a variety of hydrogen energy initiatives including R&D, demonstrations, and infrastructure projects as described below:

- Began construction of a new hydrogen laboratory at the Savannah River Research Campus.
- Partnered with Sandia National Laboratory in a DOE Center of Excellence on Hydrogen Storage.
- Initiated new hydrogen storage Work for Others (WFO) task with a major automobile manufacturer.
- Initiated a new umbrella Cooperative Research and Development Agreement (CRADA) with another major automobile manufacturer.
- Partnered with several industrial companies and universities on a new $4.4M hydrogen R&D initiative to produce hydrogen from blue green algae.
- Asked to host a key International Energy Agency Working Group on solid state hydrogen storage.
- Implemented a strategic Nuclear Energy Research Initiative (NERI) Project ($1.35M) in the area of Nuclear H2 Production.
- Continuing in a CRADA with United Technology Center on new hydride material development.
- Partnered with the South Carolina Hydrogen Coalition (SCH2) to advance regional hydrogen initiatives.

4.2 Nuclear Energy

A primary goal of the National Energy Policy, to increase the domestic energy supply from a variety of sources, has led to a resurgence in the nuclear industry. Aggressive programs to advance nuclear reactor and spent fuel treatment technologies focus on reducing costs, enhancing proliferation resistance, and minimizing waste. The Nuclear Power 2010 Program, which is aimed at having a new nuclear plant built in the U.S. by 2010, is another key part of this iniative.

The policy also outlines an increasing role for hydrogen as the primary energy carrier in a future U.S. energy system, as outlined in the President's January, 2000, State of the Union speech. The goal of the DOE FreedomCAR initiative is to develop a transportation system that uses hydrogen as the primary fuel for cars and trucks, thus significantly reducing the Nation's dependence on imported oil. The DOE Nuclear Hydrogen Initiative is working to address the key issues necessary to pave the way for a joint DOE/industry nuclear-hydrogen demonstration plant.

Description

SRNL is poised to participate in the nuclear renaissance that is expected to develop over the first half of the 21st century as a result of these initiatives. SRNL has facilitated the formation of the Southeast Universities Nuclear Reactors Institute for Science and Education (SUNRISE) Consortium to pursue the establishment of a regional university research, training, and education reactor user facility that will be located in an Energy Park established at SRS. This facility will facilitate the rejuvenation of nuclear power by constructing advanced nuclear power reactors (so-called Generation III+ designs) through a Congressional mandated DOE/industry sharing program (initially the NP-2010 Program). The ongoing NERI study will provide a conceptual design for a gas-cooled reactor (Generation IV) that will provide high-temperature heat to a hydrogen production plant.

The SUNRISE Consortium will facilitate the reemergence of nuclear power by supporting a reactor research, education, and training facility.

Future Challenges

Currently, DOE plans to establish the Idaho National Laboratory (INL) as its center of advanced nuclear energy technology development. In order for SRNL to contribute significantly to these programs, opportunities for collaboration must be developed between SRNL and INL and other national laboratories such as Los Alamos National Laboratory (LANL) and Oak Ridge National Laboratory (ORNL). Close associations with key nuclear industrial concerns and universities also will be very beneficial, particularly within the two state region surrounding SRS (GA and SC), which has a large number of nuclear power plants and associated industrial concerns.

Recent Achievements

SRNL has recently been involved in a variety of initiatives to support the major DOE nuclear energy programs:

- The SUNRISE Consortium was formalized. The concept, along with a request for funding to complete the technical assessment and concept proposal, were presented to former DOE-NE Director, William Magwood, and key staff members.
- Phase A of the NERI Project, "Centralized Hydrogen Production for Nuclear Power: Infrastructure Analysis and Test-Case Design Study" was completed on schedule and an Interim Project Report was issued.
- SRNL was a member of the DOE-NE team that developed the Nuclear Hydrogen R&D Plan and was responsible for the Plant Interfaces and the Balance of Plant facilities.
- SRNL was named as the lead for development of the Hybrid Sulfur (HyS) Process, a leading contender for large-scale nuclear hydrogen production.
- SRNL created a draft development plan for the HyS Process and received initial funding to begin development of a single-cell electrolyzer design.
- SRNL performed the first successful demonstration of the uranium extraction (UREX) process for extraction of uranium from SNF in 2002 under the Advanced Fuel Cycle Initiative (AFCI). Currently, SRNL is tasked to propose methods for more efficient separation of spent fuel from its cladding.
- SRNL participated in the Materials Advisory Board for the Next Generation Nuclear Plant (NGNP) Materials Program and on the Materials Committee for the Generation IV Program.

Section 5

National Security—Overall Program Description

Helping to protect the security of the United States and its allies is one of the most important missions at SRS and SRNL. National security is an enduring mission that will last as long as there are viable threats to the security of the country. The elements under national security are very diverse in technology and customer base, as well as in the business practices necessary to manage them.

Defense Programs (DP) is a large, long-term National Nuclear Security Administration (NNSA) program that utilizes SRNL to provide the technology necessary to extract the tritium and fill the reservoirs that are essential components of most modern nuclear weapons. While the stockpile reduction has slowed the build rate of these components, the technology required to extract, store, handle, and test the tritium will continue at near the current level as long as other countries have nuclear weapon capabilities. Handling and accounting for legacy nuclear materials such as plutonium is also part of DP's scope. In addition, if national needs dictate, SRS is a prime candidate for the location of a Modern Pit Facility.

Since the collapse of the Soviet Union and the demise of an old enemy, terrorists have emerged as the new enemy, and along with them comes a whole set of new challenges. SRNL provides technology to the government to protect against nuclear, chemical, explosive, and biological agents. This work is performed under many small, short-term contracts that demand a great deal of attention to proper charging practices, delivery schedules, and customer relations. Although the entire program is an enduring mission, each individual contract generally extends no more than 1 year and is subject to renewal or cancellation depending on the satisfaction of the customer. The customers include NNSA, DHS, FBI, National Institute of Justice (NIJ), DoD, and several covert agencies. The need to protect the country against terrorists and rogue nations has received considerable publicity since September 11, 2001. Funding in this area is expected to grow. However, the competition, including other national laboratories, is very strong. With careful customer relations, this is seen as a growth area. Since the contracts are small, it is a significant challenge to maintain the infrastructure, technology, and equipment necessary to perform this work.

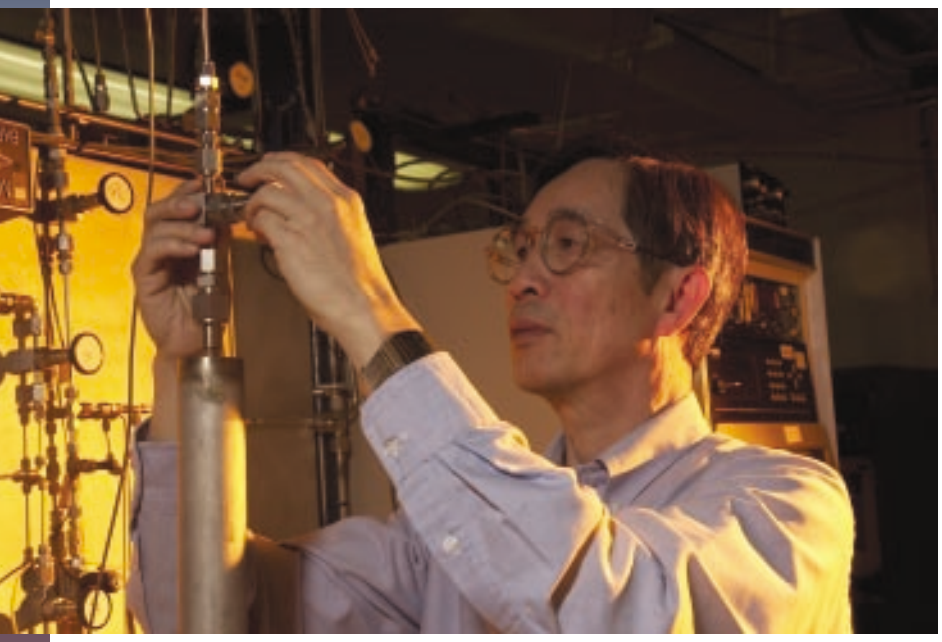
An SRNL engineer adjusts the "Riley-cam" camera on famed rescue dog, Riley, for a search mission after the World Trade Center terror attack.

5.1 Defense Programs

5.1.1 Hydrogen Processing

Description

The Hydrogen Processing Group (HPG) provides direct support to Tritium Operations and Engineering in the Defense Programs Division (DPD). HPG personnel design, develop, and test new systems and components for handling gases present in the tritium process. New technology is developed and implemented in the plant to purify, separate, strip, and store hydrogen isotopes. The fundamental understanding of these tritium gas-handling technologies is developed and retained by HPG personnel.



SRNL has the largest contingent of hydrogen experts in the country, with more than 80 scientists and engineers dedicated to hydrogen and tritium missions.

Future Challenges

The HPG will assist the DPD in meeting the three major challenges facing the future operation of the tritium facilities:

1. The existing tritium process must be refined and aging components must be replaced.

2. The Tritium Extraction Facility must be started up and its operation integrated into the existing Tritium Process.

5. The cost of operations, based on each reservoir delivered to the DoD, must be reduced.

Recent Achievements

Funded by the Readiness Campaign, HPG played an integral part in the successful completion of the Tritium Facilities Modernization & Consolidation (TFM&C) project. This project was completed ahead of schedule and under budget, and was presented with a Project of the Year award by NNSA in 2004. HPG led an SRNL team that reviewed the technological risks assumed by the Tritium Extraction Facility Project and recommended ways to reduce those risks in a cost-effective manner.

As part of its Process Development Program, HPG demonstrated a new concept for heating and cooling the major component in the isotope separation system employed in the Tritium Process. This simplified thermal management system may dramatically reduce maintenance costs without sacrificing performance.

5.1.2 Weapons Technology

Description

The Weapons Technology Group (WTG) performs applied research and development activities and provides technical program management in support of Direct Stockpile Work (DSW) for DP. The WTG interfaces with the Design Agencies (Los Alamos National Laboratory [LANL} and Sandia National Laboratory) to test and validate new gas transfer system designs, and transfers the working technology to the Tritium Facility Operations and Engineering groups. The WTG is also responsible for developing and managing the weapon system surveillance program. The WTG provides technical support for investigating operational issues in the Tritium Facility on an as-needed basis.

Future Challenges

The WTG continues to work with Nuclear Weapons Complex, Lifetime Extension Programs, and Product Realization Teams to improve weapons components and support First Production Unit schedules as they are defined. Development and testing the gas transfer systems for the W80 and W88 are currently being performed to support future loading, unloading, and function testing for DSW. An enhanced burst test apparatus is being developed to support specialized system needs. The capacity of the secure network will be increased to enable more data to be managed electronically, to facilitate enhanced capabilities such as high resolution magnified pictures, and to reduce the need to physically relocate and transcribe data. This effort will also reduce the amount of accountable classified removable electronic media (ACREM).

Recent Achievements

As part of the Readiness Campaign and the Enhanced Surveillance Campaign, WTG coordinated the completion of two new diagnostic techniques to better support reservoir surveillance. First, ultrasonic inspection methods were implemented for W62 and B83 reservoirs. Second, improved, remote metallography diagnostics were completed to minimize personnel exposure and reduce reservoir surveillance cycle times.

The report on the newly designed W76-2X reservoir was presented to Tritium Operations, which outlined the enhanced capabilities and defined operational parameters for preparing, loading, unloading, and function testing these new units for Tritium Operations and Engineering. These parameters will guide operations to develop procedures for producing War Reserve units in accordance with the First Production Unit schedule.

Secure network systems were implemented on WTG desktops. These systems allow staff to access secure email, drawings, and files across the Nuclear Weapons Complex from their office. Previously, staff had to access these systems from the computer room, which had limited systems available and limited hours of operations. This evolution has dramatically increased efficiency and reduced ACREM. Secure internet protocol (IP) video capability was established in the SRNL facility with capabilities to connect up to 12 sites concurrently. This access allows for same-day scheduling of classified discussions, which has improved productivity and greatly reduced travel expenses.

5.2 Nuclear Material Management

5.2.1 Plutonium Surveillance and Monitoring

SRNL developed a surveillance program for specialized canisters to ensure safe, long-term plutonium storage.

Description

DOE has embarked on a program to store large quantities of plutonium-bearing materials for extended periods. Materials destined for long-term storage are metals and oxides that are stabilized and packaged according to the DOE storage standard (DOE-STD-3013-2000). Thousands of containers packaged to the 3013 standard are to be stored at SRS and the Hanford Site, and hundreds at LANL and the Lawrence Livermore National Laboratories (LLNL), respectively. The 3013 standard allows for a broad range of plutonium content (>30 wt% Pu) in the stored materials, and requires a set of two nested, welded, stainless steel containers for storage.

At SRS, once the plutonium materials have been packaged in approved containers, the packages will be moved to either K-Area Materials Storage (KAMS) or F-Area Materials Storage (FAMS), eliminating the plutonium inventory in FB-Line. No plutonium storage is planned for FB-Line after 2006. Plutonium materials currently in KAMS also include materials shipped from Rocky Flats Environmental Technology Site (RFETS). These materials are in DOE-STD-3013 containers, packed inside Department of Transportation (DOT) Type B 9975 shipping containers.

Future Challenges

The major challenge at SRS is to provide a safe plutonium storage environment to support the RFETS and FB-Line de-inventory and to provide for storage container surveillance. Although the 3013 package provides for a robust storage system, its long-term safety performance has not been demonstrated. DOE-STD-3013 requires routine surveillance of containers to assess whether or not unusual conditions, particularly corrosion or pressurization, are developing. DOT typically requires that Type B shipping containers be inspected at 1- or 2-year intervals, replacing consumable parts such as O-rings, and other parts as necessary, to maintain their shipping certification. DOE determined that for storage purposes, the refurbishment of the shipping containers could be deferred for at least 10 years without detriment to the package.

SRS has initiated a 3013 Surveillance and Monitoring program and a 9975 program to assess aging and degradation of the storage materials to validate the basis for storage of material in shipping containers, and to support further extension of the refurbishment time.

The complex-wide Integrated Surveillance Program (ISP) was developed to provide a cost-effective manner to meet the requirements of DOE-STD-3013 and provide safe, long-term storage. Activities in the ISP validate the assumptions used in developing DOE-STD-3013 and provide a means of identifying low probability errors and flaws in packaging, as well as unanticipated threats to package integrity during storage.

The ISP is composed of four major components: (1) non-destructive examinations of containers in storage; (2) destructive examinations of containers in storage; (5) shelf-life program; and (4) data base evaluation and management. SRNL is providing support to Limited Extent Surveillance Modification and the Container Surveillance and Storage Capability (CSSC) Line Item project to provide SRS with the capability of performing non-destructive and destructive surveillance of 3013 containers and their contents.

SRNL is also involved in supporting the de-inventory and decommissioning of plutonium facilities at SRS. As F-Canyon and FB-Line move from de-inventory to decommissioning activities, challenges will include characterization, hazard assessment, and remedial action. Removal or mitigation of legacy source term is also required to reduce the risk profile of FAMS. Options to reduce the risk for the affected areas, including decontamination methods, fixatives, and encapsulants, must be developed, evaluated, and demonstrated.

Recent Achievements

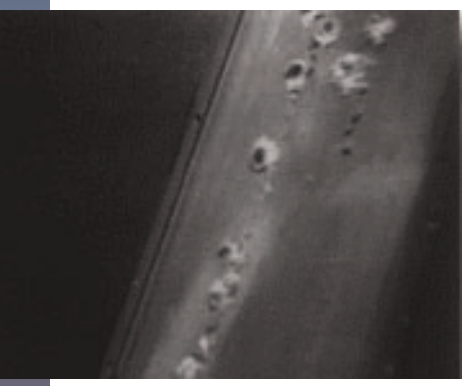
Recent achievements in the Plutonium Surveillance and Monitoring program include:

- Designed, fabricated, tested, and delivered a Can Puncture Device and Digital Radiography System for Limited Extent Surveillance Modification in support of plutonium surveillance in FAMS.
- Worked with the Complex-wide Materials Identification and Surveillance team to develop a plan to transition to the SRS Surveillance and Monitoring Plan.
- Implemented the SRS Surveillance and Monitoring Plan for 3013 packages.
- Completed a test program initiation for baseline validation for safe storage of 9975 packages in KAMS.
- Developed functions and requirements for destructive examination of 3013 packages in support of plutonium Surveillance and Monitoring Plan.
- Completed the FAMS Legacy Source Term Feasibility Study to evaluate the disposition of legacy radioactive material in FAMS.

5.2.2 Spent Nuclear Fuel

Description

Spent nuclear fuel (SNF) from around the world is being received at SRS and stored in L-Basin. The fuel will be stored in the basin until retrieved for ultimate disposition. SRNL provides key technical support for this site mission. Furthermore, SRNL is the Center of Excellence in the DOE Complex for storage, transportation, and disposal technologies for aluminum-based fuel, which is the predominant fuel type in the SRS inventory.



SRS receives both domestic and foreign research reactor fuel and stores it in L-Basin.

The P- and K-Basins and the receiving basins for offsite fuels (RBOF) were de-inventoried and de-activated in 1996, 2002, and 2003, respectively. The site continues to receive foreign and domestic research reactor fuel and store it at the L-Basin, the only remaining facility at SRS for spent fuel storage. SRNL scientists have provided technical support to enable the safe storage of fuel in the basins through the SRNL corrosion surveillance program. To support de-inventory, SRNL engineers have provided fuel materials characterization (isotopic, heat source, and physical condition) to facilitate on-site shipping and assurance of safe handling. SRNL engineers also developed a special apparatus to clean up highly contaminated water to allow retrieval of heavily degraded fuel from isolation canisters for re-packaging and shipment to L-Basin.

Other key technologies developed by SRNL to support world-wide transportation of aluminum-based fuel included a containment methodology to enable shipping cask certification in transporting breached or failed fuel. SRNL engineers also lead in the establishment of dry storage of aluminum-based fuel, road-ready for repository disposal. Established technologies include developed testing protocols, materials degradation analysis, and fuel drying technologies. SRNL will continue to support the site with storage, transportation, and disposal system technologies for its SNF inventory.

Future Challenges

The L-Basin is the only facility that is available to store the site inventory of SNF. There is no scheduled program path for retrieval of this fuel for disposition. Therefore, it is imperative that the L-Basin be available to store the site inventory of fuel, and, if necessary, that safe, acceptable basin storage can be continued for several decades. The corrosion surveillance program provided a successful “discovery based” approach to identify and respond to water chemistries aggressive to fuel cladding corrosion. Recently, SRNL scientists and engineers have developed programs and activities for L-Basin structural integrity and SNF basin storage life extension to support continued wet storage. These programs, in conjunction with the continuation of the water chemistry control and corrosion surveillance programs, enable the demonstration of safe extended basin storage of the site inventory of SNF.

The present L-Basin Water Chemistry Control Program and Corrosion Surveillance Programs consist of four basic parts: (1) identify water quality parameters that affect basin water corrosivity and radioactivity; (2) establish operating limits to minimize corrosion degradation and personnel exposure; (5) monitor and trend corrosion rates and water quality parameters; and (4) implement remedial actions when program limits are exceeded. These elements work together to ensure basin water quality in order to maintain fuel integrity and minimize personnel exposure.

The SNF Life Extension Program was established in 2004 to provide the safe storage, with full technical bases, for continued basin (wet) storage of SNF. The Life Extension Program includes comprehensive task activities designed to develop a technically based chemistry specification for L-Basin that would allow extended SNF wet storage for several additional decades, in conjunction with potentially reduced deionizer operation demands.

The L-Basin Structural Integrity and Life Extension Program provides comprehensive activities to ensure that the concrete and coating conditions maintain their function to provide pool storage with limited deterioration for several additional decades. Recent baseline inspections have been performed to characterize the L-Basin.

Finally, as the only DOE site without an established long-term disposition program, SRS and SRNL will be faced with the challenge of identifying, selecting, developing, and deploying technologies for both interim dry storage of aluminum spent fuel and long-term repository disposition of spent fuels. This promises to be a significant mission for SRS Spent Fuel Projects. SRNL, as the primary technology development arm of the Spent Fuel Projects, is expected to play a key role in this emerging mission.

Recent Achievements

Recent achievements include the following:

- Completed Corrosion Surveillance Report for L-Basin.
- Developed SNF Life Extension Program Plan and Roadmap.
- Developed L-Basin Integrity Program Plan and Roadmap.
- Developed Baseline Inspection Plan underwater inspections for L-Basin and performed baseline inspections.
- Issued Pre-Conceptual Design Report for road-ready dry storage system for SRS SNF.
- Provided technical support for fuel analyses for RBOF de-inventory.
- Developed an underwater deionization system for clean-up of localized, highly contaminated water.

5.5 Nuclear Nonproliferation

Description

The nuclear nonproliferation objectives for SRNL are twofold:

1. Provide the R&D support to SRS/NNSA in assisting the Nuclear Nonproliferation Project Office (NNPO) in successful design, construction, startup, and operation of the Pit Disassembly and Conversion Facility (PDCF), Mixed Oxide Fuel Fabrication Facility (MFFF), and Waste Solidification Building (WSB); expand processing capability for H-Canyon and extend its mission life to the disposition of nuclear materials that represent a proliferation risk.

2. Provide for the technical R&D support for National and International Safeguards, Nonproliferation of Nuclear Weapons and other Weapons of Mass Destruction (WMD) National Security Programs.

The real-time access to sources of local, national, and international meteorological data provided by the Atmospheric Technologies Center ensures that customers receive timely forecasts during rapidly developing situations.

Future Challenges

SRNL will be challenged over the next several years to reduce the nuclear proliferation risk as it pertains to nuclear materials disposition and cleanup at SRS. This effort will involve reviewing PDCF designs, cold testing equipment, and training personnel at LANL in unit operations and selected technologies. This will finally identify technical processing issues for legacy materials selected for disposition in H-Canyon.

As both rogue nations and friendly nations seek to develop nuclear weapons for their own security, the mitigation of this potential major threat will become a significant task. Based on its successful cold war legacy, SRNL is poised to provide the applied technologies and expertise needed. SRNL is already a strong player in nuclear areas such as world-wide monitoring, high-sensitivity measurement, remote sensing, radiation detection systems, meteorological transport, and radiochemical analysis. However, we must continue to strengthen our expertise. In addition to adapting core nuclear technologies, SRNL's highly skilled researchers must make a significant effort to identify and develop new technologies to address critical areas of need such as biological agents, chemical weapons, and explosives.

Recent Achievements

SRNL is deeply involved in supporting the NNSA nonproliferation new missions. SRNL has also built a strong relationship with the national security community over the past 45 years in the detection and assessment of worldwide nuclear proliferation.

Most recently SRNL has:

- Increased support for DOE/NNSA Defense Nuclear Nonproliferation to the Office of International Security.
- Increased support to the DOE/NNSA Nuclear Nonproliferation Office of International Material Protection and Cooperation for the second line of defense initiative in protecting foreign ports from improvised nuclear devices and radioactive dispersion devices.
- Increased support on an ongoing basis of technology integration for DOE/NNSA Office of International Nuclear Safety and Cooperation in Emergency Management and to the Office of Fissile Materials Disposition for excess plutonium.
- Increased SRNL Intelligence Work-for-Others (IWFO) with continuing successful technological support to U.S. defense agencies.

5.4 Homeland Security

Description

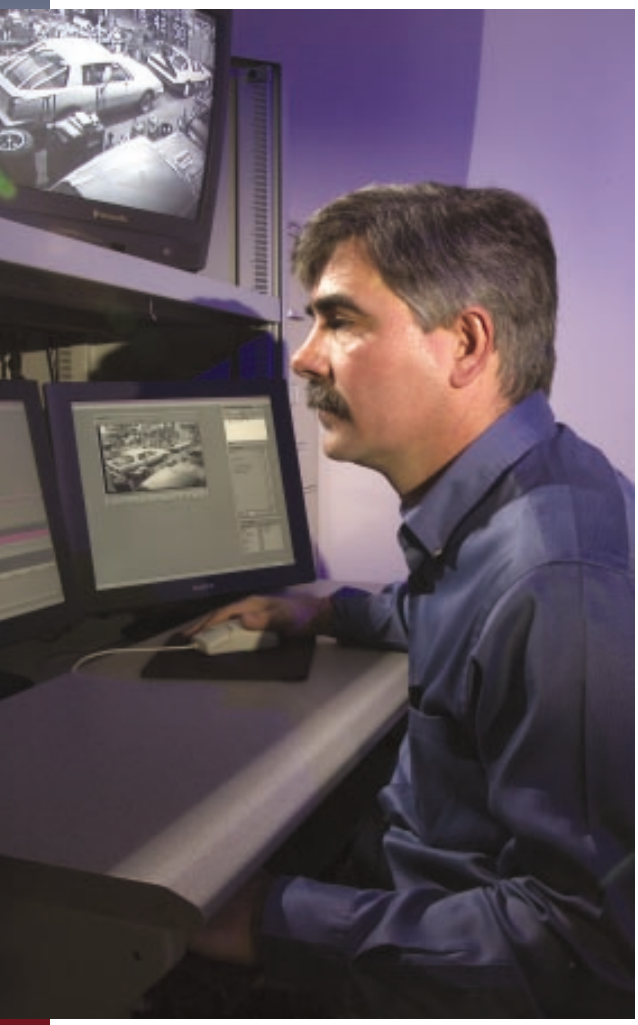
Homeland Security Programs cover a wide array of activities funded by the DHS. Some of the DHS organizations that SRNL is currently involved with include:

- DHS Science and Technology Directorate (S&T)
- U.S. Coast Guard (USCG)
- Customs and Border Protection
- Transportation Security Administration

Future Challenges

SRNL's selection as the tenth Strategic Partner Lab by the DHS S&T provides an excellent opportunity for participation in long-range homeland security R&D programs. DHS S&T has already mapped out a range of technical programs and defined the laboratories that it wants to pursue; however, it will take considerable work at both the program level and the senior management level to have significant participation in these programs.

Audio, video, and cyber forensics tools and techniques are developed at SRNL to support local and federal law enforcement, national defense, and Homeland Security. SRNL also provides technical consulting to law enforcement personnel in the selection of commercial tools to support criminal investigations.



Recent Achievements

SRNL is involved with a variety of programs within the DHS. DHS S&T has utilized SRNL's expertise in a variety of roles to support its Strategic Partner Lab programs. SRNL's largest initiative is a joint DHS/FBI initiative to improve nuclear forensics capabilities (see Section 5.5). Significant progress has also been made with the USCG in establishing SRNL as its technical support arm.

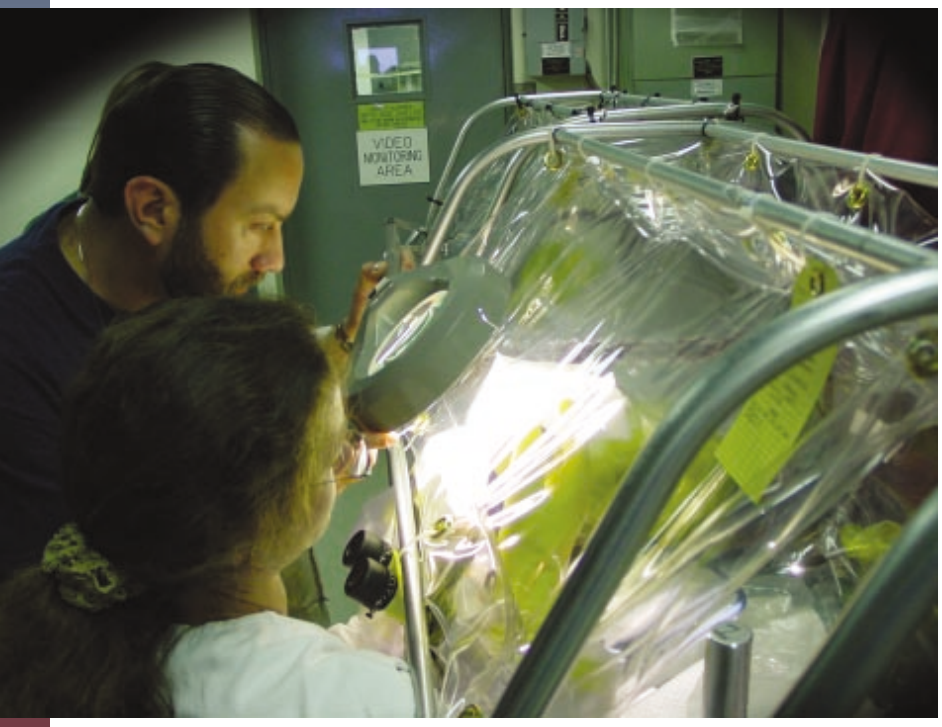
- SRNL, along with LLNL, are expanding their nuclear forensics capabilities in a multi-million dollar joint DHS S&T/FBI Forensic Lab development initiative.
- SRNL provides technical support to the New York/New Jersey Port Authority Radiation Detection Equipment evaluation program led by Sandia.
- SRNL is developing equipment for an S&T nuclear attribution program lead by LLNL.
- In support of the work performed under the Detection Systems for the Rad/Nuc Countermeasures Program, SRNL was awarded two tasks by the Homeland Security Advanced Research Projects Agency (HSARPA).
- SRNL is the lead DOE lab in a program to study the variability of background radiation in the maritime environment for the USCG.
- SRNL is providing technical support to the joint USCG/Naval Research Lab HELGA II effort to demonstrate long distance HPGe radiation detection capabilities.
- SRNL developed the Rad Detection Training Program for the USCG (December 2003) and continues to conduct Rad Detection Training for USCG personnel. At USCG's request, SRNL helped to create a duplicate program at LLNL to provide additional training capability.
- SRNL provides continuing technical support and evaluation testing for the USCG's radiation detection equipment.
- SRNL is providing the technical support for the development of a video training program for utilization of rad pagers by first responders.

5.5 Nuclear Forensics

Description

The Law Enforcement Technology Support Center (LETSC) at SRNL began operation in 1999. Since that time, its customer base has grown in number of agencies and in funding. Today, the LETSC supports federal, state, and local law enforcement agencies through its funding from the Departments of Justice and the DHS. These agencies are:

- Department of Justice
  - FBI
  - NIJ
- DHS
  - Customs & Border Protection
  - Office of Science & Technology



SRNL staff member assists an FBI examiner in performing forensic analysis.

Support to these agencies is provided under the DOE WFO Program. In November 2004, the DOE-Savannah River Operations Office and SRNL renewed their Memorandum of Agreement with the FBI Laboratory Division for another 5 years. An Interagency Agreement between DOE and the NIJ provides the vehicle for technical support to NIJ.

Support from LETSC ranges from a full-time detailee technical staff position in Washington, D.C. to SRNL dedicated facilities for forensic examinations. SRNL provides a variety of specialized training programs for special agents in the collection of hazardous evidence, the forensic examination of hazardous evidence, detection and interdiction protocols for illicit smuggling, expert testimony, and packaging and transportation of hazardous evidence.

Future Challenges

The number one priority of the FBI is to "Protect the United States from Terrorist Attack." To support this mission, the U.S. must be ready and capable of investigating suspected criminal activity involving the use of WMD. The FBI has turned to SRNL to provide radiological support for this highest priority mission. The challenge is to have in place the following assets prior to a major event requiring their use: a suitable facility; trained FBI forensic examiners; vetted laboratory protocols; and agents trained in the collection of hazardous evidence. Together with the DHS, the FBI has launched an effort to establish a complete program to ensure these elements are completed as expeditiously as possible.

First responders to a domestic act of terrorism will most likely be members of local law enforcement or public safety. SRNL has a full-time detailee to the NIJ's Office of Science & Technology in Washington, D.C., to provide technical assistance.

Recent Achievements

SRNL already has made a number of accomplishments in its support of the FBI and the NIJ. For example:

- SRNL renewed its Memorandum of Agreement with the FBI Laboratory to provide radiological and nuclear technical support (November 2004).
- SRNL has extended its technical support to the FBI, especially in the following areas:
  - Shipping container design and development for hazardous evidence (October 2004 – ongoing).
  - Specialized hazardous evidence packaging for sensitive federal law enforcement missions.
  - Highly specialized training classes for the FBI's Hazardous Materials Response Teams (over 400 agents trained) (October 2004 – ongoing).
  - Dedicated facilities to support case work examinations (over 40 FBI examiners trained) (July 2004 – ongoing).
- SRNL developed new training techniques and scenarios exclusively for the DHS, and Customs and Border Protection Special Operations Strike Teams (May 2004 – ongoing).
- Three SRNL technical members were selected by the FBI Laboratory Director to serve in key positions in their newly formed Scientific Working Group Forensic Analysis of Radioactive Materials (May 2004 – ongoing).
- SRNL has placed a full-time technical staff member, in-residence, at the U.S. Department of Justice's NIJ, Office of Science & Technology in Washington, D.C. (February 2004 – ongoing).

5.6 Defense and Space Technologies

Description

SRNL has begun pursuing activities in Defense and Space (D&S). During FY04, SRNL demonstrated the capability to establish programs for the Defense Threat Reduction Agency (DTRA) by developing and delivering field-ready remote systems. Based on the high level of customer satisfaction, SRNL is now contacting the Army, Navy, Air Force, and NASA about the possibility of developing applied technologies to support their key mission activities.

Robotics, sensors, materials expertise, handling environmental issues, and hydrogen storage are only a few of the capabilities that SRNL can provide to D&S. The cross cutting of these areas of expertise within SRNL will have a major impact on future interfaces with D&S.

Future Challenges

The basic challenges are to learn the technology needs of the D&S R&D organizations, and establish the appropriate contacts. Sources of funding will be identified and efforts to obtain this funding will begin. The goal is for this business area to provide 10 percent of the SRNL budget by FY09.

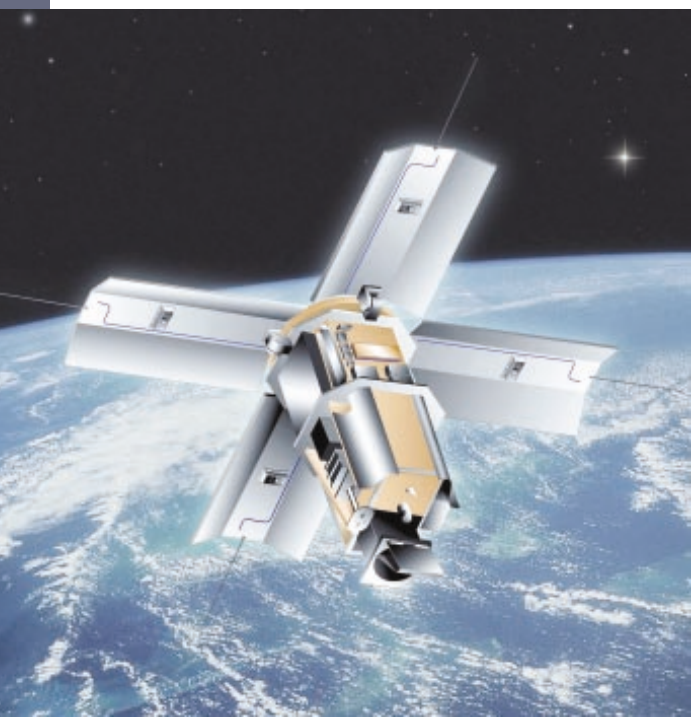
Potential opportunities to share SRNL expertise with D&S have been identified in areas such as planetary and lunar exploration, hydrogen storage for the Navy, base clean-up, and nuclear reactor applications. Initial contacts have been made with all D&S organizations, including the Kennedy Space Center, White Sands, the Naval Research Laboratory, and the Army Edgewood Arsenal.

Recent Achievements

FY05 funded initiatives include:

- Support for NASA Reason Project
- Development for DTRA-provided Robotics
- Defense nuclear event attribution
- Digital Radiography support for NASA at White Sands
- Biological support for Army Edgewood Arsenal
- Training initiatives for DTRA
- Participation on the Army Support Risk Mitigation Team for the Washington Group

Researchers at SRNL compare environmental conditions at ground level to the images "seen" by DOE's Multi-Spectral Thermal Imager Satellite. SRNL selected ground sites across the U.S. and installed sensors to collect data on surface properties such as water and land temperatures and atmospheric conditions. SRNL and other research organizations compare the data and use the results to develop techniques for possible future satellite operations, including military and treaty monitoring, hazardous waste site characterization, and climate research.



Section 6

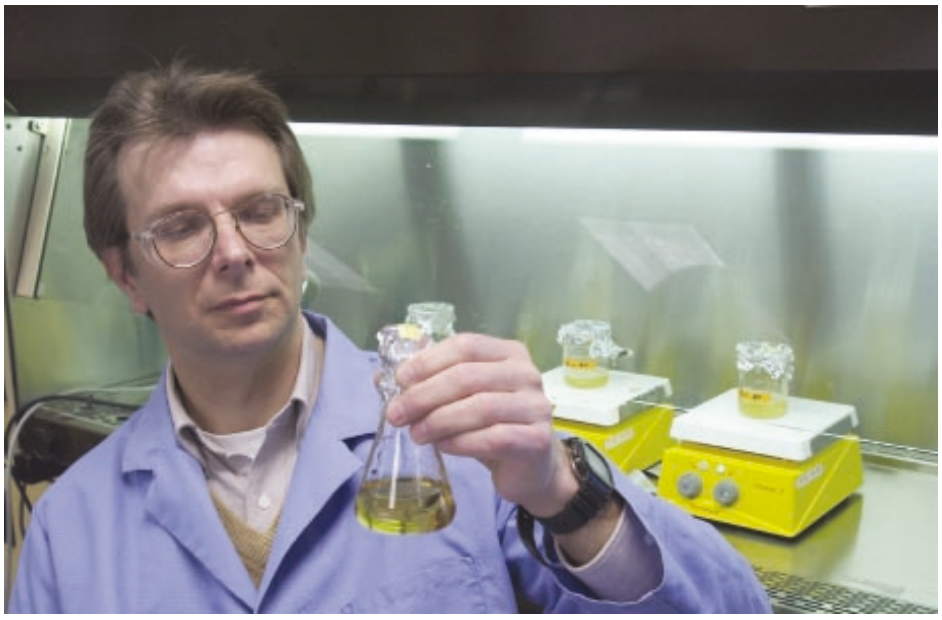
SRNL Research Programs

6.1 EM Independent Research & Development (IRD) Program

SRNL began a basic and applied Strategic Research and Development Program in FY98 to develop new, innovative technologies in areas aligned with the principal missions of SRS. The SRS Business Operating Units funded 33 projects for a total of $5.3M based on site need assessments (see Table 6-1).

In FY04, DOE-HQ asked SRNL to shift its IRD Program from a site focus to a complex-wide focus. The Environmental Laboratory Consortium (ELC), composed of representatives from Hanford, Idaho, Oak Ridge, and SRS, identified problems in the following areas:

- Soil and groundwater closure
- Transportation and storage of actinides
- Waste treatment for the four major sites and other sites, such as Carlsbad, that may impact the closure of all sites.



An SRNL Principal Investigator works on an IRD project.

Table 6-1. IRD Budget

Independent Research and Development (Budget Authorization Dollar Amount in Millions)					
FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006
1	2.1	1	0.5	0.730	2.5 (Proposed)

A list of broad problem needs was developed and serves as a basis for the current SRNL IRD Program. FY04 IRD-awarded projects are listed below:

- Advanced Algorithms for Radionuclide Characterization
- Alternate Methodology for Stabilization of Plutonium-Bearing Residue
- Dissolution of DWPF Radioactive Glass Aged 11 Years in a Subsurface Environment
- Inorganic Decontamination and Stabilization of Contaminated Surfaces and Materials
- Glass Phase Monitoring of Stabilized Metals and Radionuclides

The SRNL IRD Program follows guidelines typical of Laboratory Directed Research and Development (LDRD) programs conducted at the national laboratories. SRNL researchers develop research proposals designed to address specific technology needs for accelerated cleanup and closure. The proposals are evaluated by a peer review panel of SRNL senior technical professionals who represent the Laboratory's core competencies and disciplines relevant to the technology needs being addressed. The proposals are ranked against established criteria using a documented evaluation process. Recommendations are provided to SRNL senior management for final selection.

6.1.1 IRD Program Successes

- Plutonium Oxidation State Chemistry on the SRS
- Tank Structural Integrity: Advanced Fracture Methodology
- High Temperature Materials Development
- Parallel Computing Acceleration of HLW Integrated Flowsheet Model
- Dependence of Intergranular Stress Corrosion Cracking on Weld Residual Stress
- Destruction of Chlorinated Organics Using Modified Semiconducting Nanotubes
- Bioelectrochemical Process Development
- Engineered Tea Bag for In-Tank Removal of Actinides

6.2 IRD Transition to LDRD

The LDRD Program is the mechanism through which authorized DOE national laboratories are able to build and maintain their capabilities for meeting critical national needs in science and technology. The increasing complexity of these needs requires innovative and creative research solutions. Since the demand for solutions frequently occurs at a faster pace than can be anticipated or adopted in the federal budget process, the laboratories use the LDRD Program to maintain an environment in which relevant, creative, and innovative ideas are encouraged and supported. The LDRD Program is the support mechanism by which the laboratories build new scientific capabilities in anticipation of future national needs in science and technology. Guidance for the LDRD Program is provided in DOE Order 413.2A.

6.2.1 SRNL Transition Plan Objective

SRNL has implemented a transition plan to migrate from the current IRD Program to the LDRD Program. The transition plan will address the responsibilities, processes, and procedures needed for an effective migration and will fund research and development activities that focus on early exploration and exploitation of creative concepts to achieve the following objectives:

- Help ensure a strong science and technology base in the technical core competencies and capabilities required to fulfill the Laboratory's missions.
- Encourage novel approaches to scientific and technical problems applicable to SRS and DOE.
- Enhance the Laboratory's ability to address future DOE missions.
- Focus on the advanced study of new hypotheses, new concepts, or innovative scientific and engineering solutions to technical problems.
- Invest in high-risk, potentially high-value R&D.

6.3 Defense Programs Plant Directed Research & Development Program

The DP Plant Directed Research & Development (PDRD) Program was initiated in FY01 to respond to the Congressional intent stated in the Energy and Water Appropriations Act for FY01 (Section 310) and the Defense Authorization Act for FY01 (Section 3165) and has been reauthorized each year since then. These acts authorize the plant manager of designated production plants to allocate up to 2 percent of the site NNSA fiscal year budget for advanced R&D. This program allows the plant manager to invest in long-term, high-risk, forward looking, and potentially higher payoff research activities than can be supported by existing programs.

The focus of the PDRD Program is to "enhance and maintain the vitality of nuclear weapons plants." At SRS, the thrust is to retain and recruit individuals with critical skills, to maintain core competencies for current and future technical missions, and to develop and demonstrate innovative, agile technologies to replace outdated processes. This is accomplished by increasing the engineering and manufacturing capabilities that are required to support the continuing missions at SRS for SRS Tritium Operations and NNSA Defense Programs. The PDRD Program has adopted a "use-driven R&D" approach, looking at fundamental understanding and consideration for practical application and anticipating additional development before deployment.

The process for soliciting and selecting projects includes determination of technical needs, a call letter, proposal submission, technical review, management selection, and NNSA concurrence. The researcher-proposed projects are funded from DP operating funds on an FY to FY basis for up to 24 months. The PDRD Program at SRS is administered by the Tritium Engineering Department with financial tracking provided by SRNL.

From FY01 to FY05, 43 projects have been awarded for a total of $10.75M, as shown in Table 6-2.

6.3.1 PDRD Successes

- Miniature mass spectrometry for hydrogen isotopic analysis
- Pressure swing adsorption modeling of H_2 stripping processes
- An Aspen Custom Modeler™ pressure swing adsorption
- Catalyzation of borohydrides for hydrogen storage
- Fiber-optic laser raman spectroscopy sensor
- Palladium Separation and Recovery Feasibility Study
- Tritium exchange material for tritium stripping

Table 6-2. PDRD Budget

Plant Directed Research and Development (Budget Authorization Dollar Amount in Millions)						
	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006
Funding	0.6	1.6	2.6	2.65	3.3	2.6 (Proposed)
Projects	7	6	17	8	13	

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Section 7

Business Outlook

The focus of SRNL work has evolved over the past 50 years from direct support for weapons production at SRS to defense and cleanup support, currently the largest work activities at the site. Eight years ago the DOE management at SRS challenged SRNL (then SRTC) to share its expertise in applied science with a broader range of customers around the DOE Complex and other federal agencies. It was anticipated that executing this DOE plan would effectively lower the carrying costs for the laboratory at SRS. SRNL has systematically worked on this plan and today the work for onsite customers is approximately 50 percent of total work scope. This transition wasn't easy, but as other groups within DOE and other federal agencies discovered SRNL's valuable core skill set and its drive to put science to work, they became eager to utilize the laboratory. Each of our traditional customers and the new customer base for the laboratory are described below.

SRNL has three major historic customers—NNSA (NA-10 and NA-20) and EM:

- **National Nuclear Security Administration**

  – NA-10 relies on SRNL to support the tritium and legacy material programs at SRS. These activities, which are a result of key expertise developed in support of the weapons complex over the past 50 years, will remain stable over the next 10 years.

  – NA-20 relies on SRNL to support its nonproliferation activities. SRNL has key expertise in weather modeling and ultra-low-level measurements that was developed in support of the broader DOE weapons missions. This expertise has now proven to be extremely valuable for detecting the movement of unauthorized nuclear materials. These activities have grown substantially over the past 3 years and continued growth is predicted for the next 10 years.

- **DOE Office of Environmental Management**

  – EM relies on SRNL to provide expertise in the areas of HLW stabilization and remediation and stabilization of soil and groundwater contamination. SRNL developed its chemical processing expertise through years of supporting the separations activities required for weapons products. Environmental remediation expertise was developed through careful training and hiring over the past 20 years. SRNL is sponsored by EM and acts as its Corporate Laboratory.

SRNL has multiple emerging customers who are able to capitalize on the core capabilities developed in the laboratory over the past 50 years:

- **DOE Nuclear Energy, Science & Technology (NE)**
  - SRNL can support NE through its expertise in chemical processing for spent fuel and its vast experience in handling tritium for the Nuclear Hydrogen Initiative.
- **DOE Office of Science (SC)**
  - With $1.399M of SC funding, SRNL is collaborating on programs in Biological and Environmental Research and Basic Energy Sciences.
- **DOE Energy Efficiency & Renewable Energy (EE)**
  - SRNL is working with other national laboratories to develop the next generation hydrogen storage device. This work, which is enabled by EE funding of $506K, utilizes SRNL's broad experience in tritium handling.
  - For hydrogen production, SRNL is concentrating on technologies that could use nuclear sources of heat.
  - For on-board vehicular storage of hydrogen, SRNL is concentrating on technologies with the potential to meet the DOE/FreedomCAR 2010 and 2015 system gravimetric, volumetric, and cost targets.
- **FBI**
  - SRNL has been named the FBI's east coast nuclear forensics laboratory. In this role, SRNL is prepared to quickly respond to the FBI's needs on an emergency basis. Because of its long history of research and analysis of contaminated materials, SRNL is the ideal place for the FBI to establish this center.
- **DHS**
  - SRNL works closely with several elements of DHS, and is currently providing support for the Coast Guard, Customs, and Border Patrol. SRNL recently was named a National Partner Laboratory for DHS.
- **Industry**
  - SRNL is currently working with several commercial companies to enhance hydrogen storage capacity for both vehicles and stationary applications. These activities are excellent examples of how SRNL expertise and technology developed in the weapons program can successfully be transferred to industry, resulting in a higher degree of energy security for the country.

7.1 Differentiators

"Applied" R&D is what differentiates SRNL from the other national laboratories. The core competencies refined since 1950 position SRNL to readily develop a wide variety of technology solutions and to rapidly deploy them across the national and international nuclear industry. Within hours after the 9/11 tragedy, SRNL had personnel on the scene developing visual monitoring equipment to assist in search and rescue operations. Following the space shuttle tragedy, SRNL responded immediately with equipment to search for wreckage. SRNL's expertise in nonproliferation and nuclear forensics has long been recognized and is being deployed in many countries and/or border crossings worldwide. SRNL trains FBI and Coast Guard personnel in radiation detection methods for on-ship and port inspections and has deployed remote systems to investigate for disarmament.

SRNL has always recognized the wealth of talent in the other national laboratories and has worked closely with them over the years as part of the weapons development complex. That association continues to grow in the aftermath of the Cold War as the weapons technologies are now being applied to National Security, Energy Security, and Environmental Management programs. Strategic partnerships and collaborations have been developed with other national laboratories and universities to utilize the wide breadth of science and technology expertise to its fullest capacity. In today's environment, rapid response is essential. By developing these strategic partnerships and collaborations, a scientific network capable of rapid response can be established across the country, with SRNL as a key resource for the east and southeast.

Pricing—A Competitive Edge

SRNL has historically managed its cost structure to maintain a significant competitive edge. SRNL's fully burdened costing rates range from 10 percent to 60 percent less then those of the other national laboratories. Combining this pricing advantage with our applied nature, as defined in our slogan "We Put Science to Work," attracts many different customers from within DOE and other federal agencies.

Operations Customer Focus

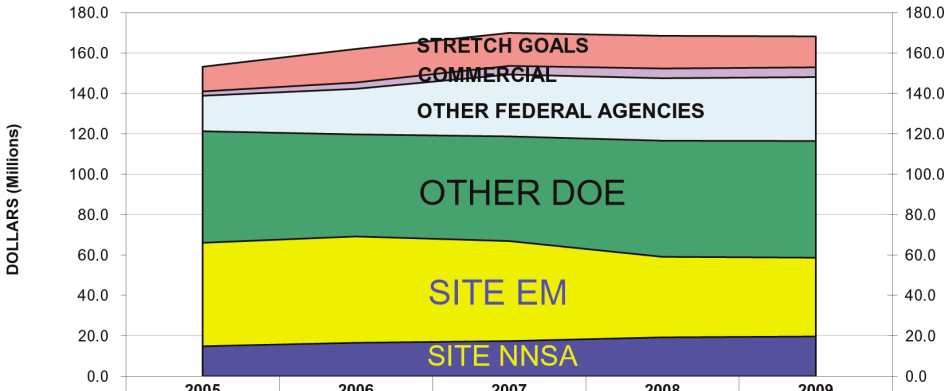
In providing technical solutions at SRS for over 50 years, SRNL has maintained a customer focus unparalleled in the national laboratory system. We recognize that if site customers are not satisfied, we will not obtain repeat business. Virtually all SRNL WFO customers express satisfaction with our focus on solving their problems, not just selling technology.

7.2 Financial Targets

Within the U.S. Government, shifts in programs occur based on changing national priorities. SRNL has established financial growth targets that address increased government needs that offset other national needs that my be declining. Some DOE and other federal agency programs (for example, Nonproliferation or Energy; DHS) are increasing and require SRNL's unique applied R&D capabilities, while DOE-EM is in a declining situation.

SRNL receives direct programmatic funding from DOE for only the IRD Program. Table 7-1 summarizes all work activities for each customer. SRNL works on a task order basis with each of its customers, which means that the customers individually authorize each scope of work.

Table 7-1. SRNL Financial Targets



	2005	2006	2007	2008	2009
STRETCH GOALS	12.2	16.7	16.5	16.2	15.4
COMMERCIAL	2.2	3.1	4.2	4.8	4.8
OTHER FEDERAL AGENCIES	17.5	22.5	30.6	30.9	31.8
OTHER DOE	55.3	50.7	51.7	57.6	57.7
SITE EM	51.2	52.6	49.5	39.8	38.9
SITE NNSA	14.9	16.5	17.4	19.2	19.7
TOTAL	153.2	162.0	169.9	168.4	168.2

* Forecast is in current year dollars and includes ESS & G&A. This data came from the forecast presented in the Business Council Meeting on January 5, 2005.

Section 8

Resources

8.1 Personnel

SRNL has approximately 940 employees, most of whom work in five primary departments—Environmental Sciences and Technology Department, Measurement Technology Department, Strategic Materials Technology Department, Waste Treatment Technology, and Engineered Equipment Systems.

8.1.1 SRNL R&D Population

Figure 8-1 shows the makeup of SRNL's R&D staff.

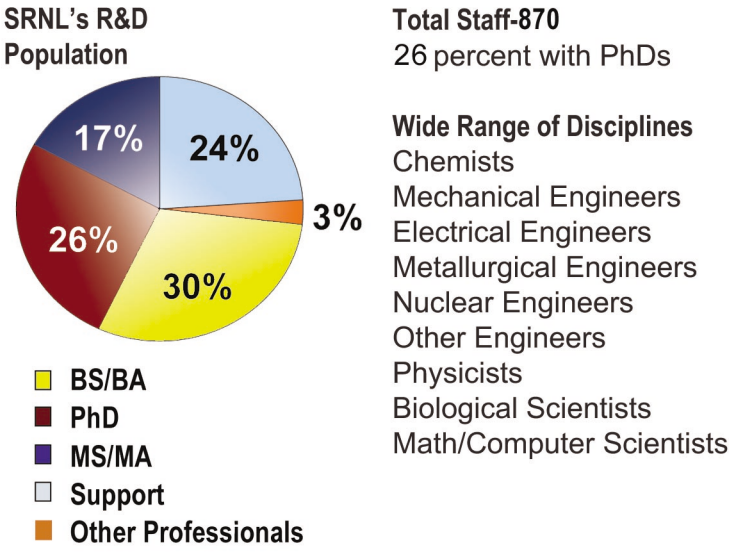


Figure 8-1. SRNL's R&D Population

8.1.2 Hiring and Retaining Critical Skills

Like other organizations throughout the DOE, SRNL is concerned by the loss of qualified people with unique, mission-related skills. The mean age of the SRNL technical staff is 48, and a large segment of the total staff is over 45. Core technical skills that have been developed over the past 50 years are being lost as retirement poses a greater threat with each passing year. It is becoming increasingly difficult to recruit highly qualified or even apprentice scientists in some of SRNL's key areas of expertise such as chemistry, especially analytical, radioanalytical, and actinide chemistry; chemical engineering, especially in waste treatment processing and defense programs; environmental engineering; statistics; microbiology; and materials science.

To respond to these problems, SRNL developed a two-part recruitment strategy that focuses on both traditional methods and creative academic programs. SRNL uses conventional recruitment techniques, such as national annual engineering and science society meetings, to identify candidates for critical positions. To recruit college graduates and to establish a pipeline for future recruitment efforts, SRNL visits campuses for interviews and college fairs and hires students for co-op and summer intern programs. SRNL also advertises on the Internet and in trade journals and newspapers.

8.2 Organization

As SRS adjusts to ongoing budget constraints and reprioritizes its activities, SRNL must assimilate these changes and maintain its core competencies through funding diversification and other strategies. SRNL is focusing on cost effectiveness and is implementing various technologies to increase efficiency and reduce costs. The new processes implemented by SRNL have successfully aligned mission and objectives with core competencies, resulting in an organization structure defined by clear goals.

The following departments comprise SRNL:

- The Environmental Sciences and Technology Department integrates and applies science and technology to identify and solve environmental issues. Activities include identifying, developing, deploying, and optimizing technologies to accelerate cleanup, closure, and habitat restoration; reduce risk; and provide for long-term environmental stewardship. Technologies developed and/or deployed by this department are applied at other sites within the DOE Complex, as well as by other federal agencies and private industry. The functional organizations within the Environmental Sciences and Technology Department are Environmental Biotechnology, Environmental Analysis, Environmental Restoration Technology, and Statistical Consulting.
- The Measurement Technology Department provides the technology required to support the detection, measurement, and transport of radioactive, hazardous chemical, and thermal emissions from SRS, and develops similar technologies for safeguarding special nuclear materials nationally and internationally. The department also provides analytical capabilities, including chemical analysis, material characterization, protocol development, and development of new analyzer technologies. The functional organizations within the Measurement Technology Department are Analytical Development and Non-Proliferation Technology.
- The Strategic Materials Technology Department provides materials, chemistry expertise, and process support to ongoing site activities, and also develops technology to secure future missions. The department supports site programs to prepare residual actinides for stabilization and disposal. It also provides technology and process development R&D for all tritium operations and direct technical support to weapons design agencies upon request. This department is SRS's authority on all materials issues, including assessments of degradation of materials and systems structural integrity, and development of component fabrication technology. The functional organizations within the Strategic Materials Technology Department are Actinide Technology, Materials Technology, and Hydrogen Technology.

- The Waste Treatment Technology Department provides the technical basis and R&D for the storage, treatment, and disposal of all waste at SRS, including liquid, solid, hazardous, mixed, TRU, radioactive, and non-radioactive. The department also provides technology for the DWPF process (vitrification of high-level radioactive waste). The functional organizations within the Waste Treatment Technology Department are Immobilization Technology and Waste Processing Technology.

- The Engineered Equipment and Systems Department provides engineering and technical support to SRS. This support includes instrumentation, data acquisition, remote handling, robotics, specialized process equipment, non-destructive examination techniques, system integrity evaluations, engineering modeling, experimental thermal-fluids analysis, and radioactive material packaging and transportation. The functional organizations within the Engineered Equipment & Systems Department are Remote/Specialty Equipment, Engineering Development, and Instruments and Examination Systems.

- The SRNL Laboratory Services Department (LSD) provides facility operations, engineering, waste and environmental management, and technical support functions for the nuclear and non-nuclear facilities in the SRNL Technical Area (TA). The TA facilities house research in core technology business areas that support current site operations and long-term technology development for SRS Support, other DOE customers, federal agencies and commercial customers. LSD maintains the facilities to allow for safe operation and occupancy consistent with applicable standards, supports SRNL in a manner that maintains an uncompromised facility safety envelope, provides continuous support research and lab operations, and strives to provide "best-in-class" customer support for all TA customers.

- Support departments include Quality Assurance and the Business Management Department. Quality Assurance provides independent oversight through a self-assessment program and guides SRNL in the interpretation and application of regulations. Business Management provides administrative and financial planning activities, partnering agreements, and proposal support for SRNL personnel.

8.2.1 Program Management

As with most program management processes, SRNL's activities begin with planning. SRNL follows a disciplined planning process that mirrors that of SRS. The basis of SRNL's planning process is its Strategic Plan, which presents SRNL's mission, vision, and core values as the foundation for its program and facility goals. The Strategic Plan is developed by the Strategic Council and approved by the Laboratory Director. The Strategic Plan is customer based in order to integrate the functional organizations of the five primary departments across the business sectors.

8.2.2 Program Planning

SRNL uses the Strategic Plan as a guide for program planning. Program Plans are developed for each Business Sector and provide iterative feedback to the Strategic Plan. Each Program Plan presents program goals and objectives, market analysis, financial targets, strategies and general tactics, resource needs, performance metrics, and an assessment of prior year performance. This information is used to manage the program and provide lessons learned to develop future strategies.

8.2.3 Cost Effectiveness

To ensure that we're offering the most cost-effective R&D service, at the high level of quality that our customers demand, we will take advantage of opportunities to conduct work that is unclassified and doesn't require the use of hazardous materials. By performing this work in the new leased facilities described in Section 8.3.4, we can utilize post-doctoral candidates and university graduate students to a much greater extent than has been possible in our traditional facilities and programs.

8.3 SRNL Facilities

SRNL facility planning has focused on the cost and capital projects required to maintain adequate operability of SRNL facilities and the scientific infrastructure to support the demands of current and anticipated DOE missions and WFO. The business outlook and the transition to new business areas is a major consideration in planning for future projects.

In FY04, slightly more than 39 percent of SRNL's budget came from SRS EM-funded work. SRNL is working to increase the customer base well beyond EM and grow future business. Based on current conservative predictions, by 2006 the EM-funded work will fall to approximately 35 percent of the budget, and by 2008 to approximately 26 percent. At the same time, offsite and commercial work is expected to increase from the 2004 level of 51 percent to approximately 53 percent by 2006 and approximately 60 percent by 2008. The overall budget is projected to increase from $139M in 2004 to approximately $149M by 2008.

SRNL has a goal of maintaining the operability of the existing facilities and the competitiveness of scientific capability through FY25 and beyond. From a customer standpoint, much of the business growth is anticipated to come from areas or sources new to SRNL. Customer areas such as Space, Energy, Defense, and Security are anticipated to grow from less than 17 percent today to more than 38 percent by 2008. Growth in the Nuclear Materials research area is anticipated to be in the 20 percent range.

High levels of SRNL support are projected for continuing site missions such as Tritium, Nuclear Materials Management, and Nonproliferation Technology and National Security. New mission activities, such as Hydrogen Technology, Pit Disassembly and Conversion, Mixed Oxide Fuel Fabrication, and, potentially, the Modern Pit Manufacturing Facility, are expected to increase demands on SRNL's scientific and facility resources. Traditional EM customers such as Waste Processing Technologies are anticipated to reduce support requirements by as much as 50 percent between now and 2008, and Environmental Sciences will likely stay flat.

The SRNL TA complex is located on 34 acres near the SRS boundary. The complex consists of approximately 575,000 square feet and includes 66 laboratory, office, and storage facilities, including 180,000 square feet of radiological areas. The main laboratories are located in a Hazard Category 2 facility designed and rated to handle research quantities of radioactive and non-radioactive materials. The unique capabilities of the TA laboratories are focused on supporting the site's national defense mission.

Numerous technological and management challenges are involved with operating and maintaining the TA complex. Supporting a dynamically changing R&D scope requires flexible, yet vigilant, operational and engineering discipline. The LSD facility support responsibilities are technologically comparable to the operations and maintenance of one of the site's materials processing canyons, and possess the same requirements for infrastructure and support systems. Based on the observations of safety consultants supporting the site and other DOE facilities, SRNL leads the DOE Complex in the level of rigor and maturity of Nuclear Safety Management.

8.3.1 Technical Area Facilities

The SRNL facilities provide a full range of technological services focused on supporting the unique capabilities of the SRNL R&D staff. SRNL has built a number of multi-function labs, including the following:

- High- and Intermediate-Level Shielded Cells
- Nonproliferation High-Sensitivity Mass Spectrometer Laboratory
- Savannah River Standards Laboratory
- Chemistry and Analytical Laboratories
- Remote Systems Laboratory
- Engineering Development Laboratory
- Scientific Computing Resource Center
- High-Pressure Test Facility
- Equipment Engineering Development Center
- Atmospheric Technology Center

8.3.2 Lower 700 Area Facilities

The Lower 700 Area houses the test and engineering facilities in which much of SRNL's engineering, prototype construction, and materials fabrication is done. Facilities in this area include:

- Electronics Fabrication Shops
- Engineering Facilities
- Metallographic Facilities
- Large Prototype Testing Facility

8.3.3 Tritium Support Laboratory

The SRNL Hydrogen Technology Section recently completed construction and startup of a new facility in H-Area to replace older existing facilities scheduled to be shut down. The new facility supports the Life Storage Program, which provides new ovens and chambers to expose reservoirs to expected service conditions as well as to more extreme conditions that speed up the aging process. After exposure, the reservoirs may be destructively examined in the adjacent new Metallurgical Laboratory.

The Metallurgical Laboratory also serves the Reservoir Surveillance Operation for destructive examination of reservoirs returned from service. The laboratory is designed for safe destructive examination of contaminated materials. These materials are moved through a series of laboratory hoods containing cut-off saws, grinding wheels, polishing equipment, and etching equipment, to reveal the sample's microstructure. After cleaning and verification that contamination has been removed or fixed, the microstructure of the samples is studied and photographed under a microscope. An additional hood has been outfitted to enable remote examination of highly contaminated samples. This saves time and reduces the potential for personnel contamination.

The Metallurgical Laboratory also includes laboratories for flow testing reservoirs, performing scanning electron microscopy, and performing autoradiography to aid in characterizing reservoirs.

8.3.4 New Research Facilities

SRNL has developed a long-range public/private partnership with Aiken County to provide research facilities with third-party funding. For many years, SRNL researchers used the laboratories at SRS's TNX area to perform important waste treatment and environmental biotechnology research. The area offered numerous buildings and ample laboratory space for research activities. Due to its age and deteriorating condition, it was determined that TNX was not cost effective to maintain and the site made the decision to D&D the area.

The shutdown of TNX made it necessary to find a suitable, more cost-effective replacement facility. After studying a number of options, SRNL decided to lease laboratory space at the nearby Aiken County-owned Savannah River Research Campus (SRRC). In January 2001, WSRC signed an 8-year lease for a new, state-of the-art waste treatment and environmental biotechnology research facility.

The Aiken County Technology Laboratory (ACTL) facility was opened in December 2001. The approximately 21,000-square-foot facility provides over 10,000 square feet of research space in 18 laboratories. In addition to the research areas, the facility contains a library/conference room, lunch room, and assorted storage and support spaces. The offsite location of the research campus facilitates technology transfer between industry and educational institutions for SRNL, and will help SRRC attract other similar technology businesses.

The most recent example of SRNL's partnering is the agreement signed with Aiken County to construct the Center for Hydrogen Research (CHR) in the SRRC. Construction began on the facility in early August 2004. The new CHR will address a critical need to provide additional research facilities for SRNL R&D scientists and engineers. SRNL's 30,000 square foot portion of the facility, called the Hydrogen Technology Research Laboratory (HTRL), will house unclassified work in hydrogen storage, separation, production, and materials development, and will also provide space for universities and other entities doing work in hydrogen technologies. This facility will supplement the work currently being conducted at the existing 50-year-old SRNL facilities.

Aiken County Technology Laboratory

Center for Hydrogen Research

8.3.5 Future Vision

As a national laboratory, SRNL now has a responsibility to propose new programs and/or facilities that address areas of national need and solve problems of national importance. The Laboratory is charting a course for the future by thinking systematically and comprehensively about our role, our strengths, and most importantly, national needs. We need to expand our R&D efforts while remaining grounded in our mission, vision, and core competencies.

SRNL senior managers and scientists identified five initiatives where SRNL's core competencies could make significant contributions. These initiatives are described in the following subsections:

- Hydrogen Production Demonstration
- Research Training Reactor
- Homeland Security Center
- Ecological Park
- Virtual Process Chemical Simulation Center

Hydrogen Production Demonstration—To help secure a clean, domestic, hydrogen-based energy economy for the U.S., SRNL proposes to address the technical issues facing the nuclear-hydrogen option as expeditiously as possible. This can best be accomplished for the thermochemical (TC) cycles by establishing a program to support the laboratory-scale development efforts that are currently planned as part of the Nuclear Hydrogen Initiative (NHI). This program would include process modeling and component testing to optimize the flow sheets for the various TC cycles, which will enable selection of the appropriate cycle for the pilot plant. A pilot plant would then be designed to address the key technical issues and perform the development necessary to support the design of the engineering-scale facility that will be coupled to the next generation nuclear plant. TC water-splitting is the conversion of water into hydrogen and oxygen through a series of three chemically driven reactions that require a temperature of about 900°C. The direct thermolysis of water would require temperatures in excess of 2500°C for hydrogen generation.

SRNL has led a team of industry and academia partners to perform a 3-year study of hydrogen production using nuclear power and a TC process plant for the Nuclear Energy Research Initiative (NERI); a final report of this effort will be completed in December of 2005.

Homeland Security Center—To address the growing terrorist threats to the U.S., SRNL proposes to establish the Southeastern Applied National Security Center. The Center will operate a forensic facility capable of handling nuclear, radioactive, and biologically contaminated evidence. This facility will serve as a resource to the FBI and local law enforcement entities. It will also provide atmospheric and aqueous plume modeling, emergency response vehicles, and robots to respond to any regional emergency, accidental or terrorist. Assessments will be provided to ports in the Southeast to help protect them against terrorist attacks or WMD smuggling. In this leadership role, SRNL will provide universities with necessary information about the technology needs of all Federal agencies protecting the Southeast U.S. and then work with universities and private sector inventors to test, evaluate, and commercialize new technologies. In addition, this facility would serve as the Validation Standard Center for Homeland Security Technologies.

Research Training Reactor—To support the enhanced nuclear program that is expected during the first half of the 21st century, SRNL and its SUNRISE Consortium partners are proposing a Next Generation Research Reactor at SRS to serve the university community. The proposed SUNRISE reactor will be a modern facility producing enough core energy that it will not duplicate research at reactors in the region. SUNRISE will be based on evolving technology to support advanced nuclear energy initiatives such as the NGNP and nuclear hydrogen production. SUNRISE will provide facilities for neutronic and operational studies, high-temperature materials and component testing, and training facilities for the future workforce to support the nuclear resurgence. The SUNRISE design will also include capabilities to support the research needs of the nuclear space program that is slated for significant funding in the coming years. This program also will support small-scale radioisotope production for nuclear medical research.

Ecological Park—SRS was the first of seven parks designated as National Environmental Research Parks (NERPs) by the U.S. Congress. Designation of SRS as the first National Environmental Science and Research Park is in keeping both with the purpose of NERPs—to carry out research to achieve national environmental goals—and the Eco Park concept that has been clearly identified in the President's science policy for the last 2 years. The designation will further utilize this tremendous resource as an ecological observation platform and establish SRS as a Center of Excellence and User Facility for environmental cooperative research involving government, university, and private sector scientists. Integrating the resulting environmental research with research sponsored by DOE, the EPA, the Department of Agriculture, NASA, and the National Science Foundation will significantly enhance the stature of the DOE and SRS, and extend the impact of the DOE investment. Initial projects would focus on current and emerging environmental issues associated with existing and innovative energy technologies, taking advantage of the technical expertise at SRNL and SREL, and the abundance of natural (managed and disturbed) ecosystems at SRS.

Virtual Process Chemical Simulation Center—SRNL proposed to establish a Computational Science Center to conduct applied simulation of materials. This Center would aid in the integration of Smart Materials technology across multiple government agencies. In addition, this Center would conduct research into the use of molecular simulation to accelerate laboratory chemistry research. The core of the SRNL computational plan is to partner with ORNL and utilize their computing resources for the high-end activities.

8.3.6 Homeland Security

SRNL's varied areas of expertise, particularly in international nuclear nonproliferation support and ultra-low-level radiological measurement technology, have proven to be applicable in a variety of security-related areas. Since 1999, SRNL has provided technical assistance to the FBI in the areas of radioactive crime scene processing, hazardous evidence packaging, and forensic examination of radioactively contaminated evidence. Recently, the DOE, NNSA, FBI, and SRNL signed an agreement to further extend the nuclear forensics support the laboratory provides for the FBI.

The new agreement will provide the FBI with a laboratory capable of continuing existing support as well as performing traditional forensic examinations on evidence that is radioactively contaminated. The FBI sought this unique forensic ability as the result of new domestic threats involving the use of radioactive materials. SRNL is providing training to qualify FBI forensic examiners to work in this arena, and SRNL personnel will work alongside FBI personnel conducting forensic examinations. Forensic examiners from the FBI Laboratory's Latent Fingerprint, Firearms/Tool Marks, Chemistry, DNA, Questioned Documents, Explosive Devices, Special Photography, and Trace Evidence Units will be qualified to perform examinations in the new facility.

In addition to the FBI, SRNL provides support for several law enforcement agencies within the U.S. DHS, including Customs and Border Protection and the USCG. These agencies will also be able to take advantage of the capabilities of the new FBI facility, as will U.S. postal inspectors.

In addition to facilities in the TA, SRRC, and the Lower 700 Area, SRNL scientists and engineers are located in shared production laboratories in the Tritium facility to provide direct support during tritium processing.

Nuclear Forensics Laboratory

8.4 Maximizing Facility Utilization

8.4.1 Footprint Reduction

In an effort to increase internal operating efficiencies by consolidating activities in or around the TA and to reduce high maintainance costs, SRNL has closed a number of old process and office facilities. These include the TNX Area, two B-Area buildings, three Gun Site 51 storage buildings, 704-D, two PAR Pond Laboratory buildings and the 305-A, and three associated office trailers. As shown in Table 8-1, more than 200,000 square feet have returned to the site for non-SRNL applications, for example, D&D in the case of TNX.

Table 8-1. Summary of SRNL Excess Activities

Facility	Area (ft^2)
TNX	125,959
Gun Site 51	24,384
Par Pond Laboratories	5,592
B-Area Facilities	31,600
305-A Facilities	24,528
Total	212,063

In 1999, approximately 38 percent of the office space in the TA consisted of temporary, prefabricated, transportable office trailers. Many of these office units were inefficient and inadequate for continued use. Additionally, due to their advanced age and deteriorating condition, most of the office trailers were very costly to operate and maintain. Since 1999, SRNL has aggressively pursued a program to remove temporary office structures from the TA. Today, temporary office structures account for only approximately 8 percent of the total area office space (see Figure 8-2).

This reduction was achieved by removing 14 temporary office facilities, accounting for approximately 26,400 square feet of office space. Figure 8-3 depicts the reduction in temporary office space.

A small amount of space is currently available for new construction within the confines of the TA fence. Should additional space be needed in the future, adjacent portions of the Upper 700 Area could be made available.

The facilities highlighted in pink are being renovated to accept equipment being moved from building 305-A, which has been turned over to Facility Disposition Projects for D&D.

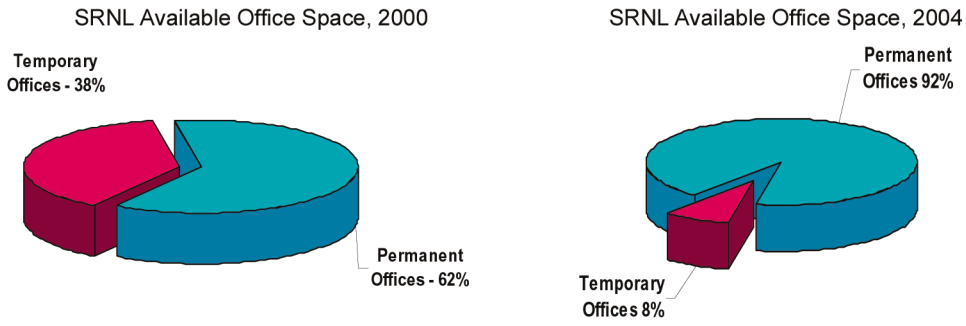


Figure 8-2. Temporary Office Space Removal

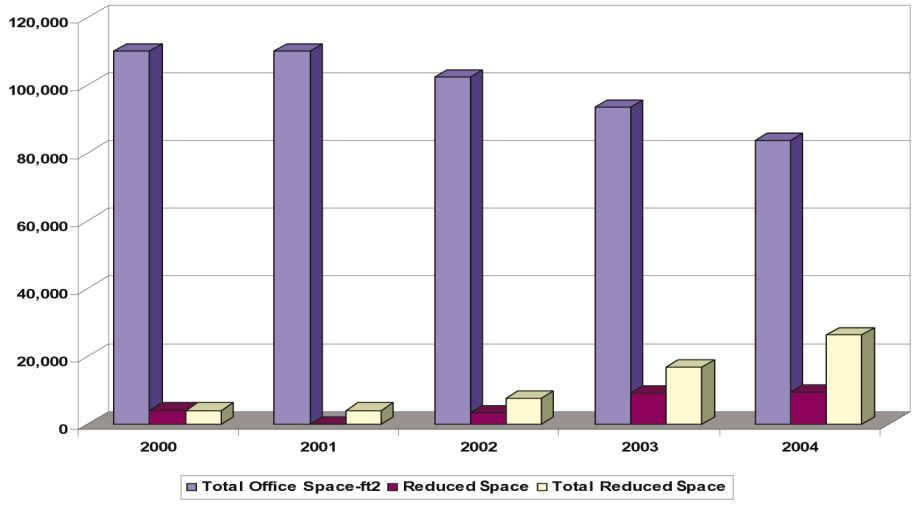


Figure 8-3. SRNL Office Footprint Reduction

8.5 Infrastructure Maintenance

8.5.1 Facilities Infrastructure Systems

The infrastructure systems in the TA require the coordinated interaction of Laboratory Operations, Maintenance, and Engineering to maintain a safe and habitable work environment. The infrastructure systems are maintained and upgraded on a regular basis and are considered to be in adequate condition to meet current mission needs. Upgrades and modifications to various systems are planned for the future and will be executed based on priority and funding availability. The major TA infrastructure systems include the following:

- Sixteen heavily shielded, multipurpose material processing/analysis cells, capable of working with high-dose radiological materials. The cells are equipped for remote manipulator operation and have overhead cranes for loading and unloading.
- Approximately 45 major process exhaust ventilation systems, primarily servicing radiological facilities.
- Heating, ventilation, and air conditioning (HVAC) services are provided to all habitable structures in the TA. The facility utilizes combinations of steam and chilled water and heat pumps.
- An electrical distribution system (480V to 110V) that contains more than 63 motor control centers (MCCs) and more than 347 individual electrical panels and miles of old cable and wiring.
- Radioactive and non-radioactive waste systems, including 10 below-grade holding vessels with associated steam transfer jets and tank loading stations. Associated with this are over-the-road HLW and LLW transfer tank trailers.
- The area steam distribution system has more than 8,000 facility-maintained components within the TA, delivering up to 325 pounds of steam for ventilation, humidity control, and process systems.
- Chilled, de-ionized, domestic, and distilled water are maintained by the facility and distributed within the area.
- Compressed instrument, plant, and breathing air are generated and distributed throughout the area.
- Engineering maintains control of approximately 600 relief devices and pressure vessels, including approximately 400 in direct use for R&D.
- Engineering also provides regulatory monitoring and reporting support on permitted stacks, outfalls, etc., and provides oversight for the RCRA- and NPDES-permitted effluent systems.

8.5.2 Infrastructure Maintenance Improvements

The SRNL laboratory facilities have been in operation since the 1950s. For many years, only minimum investments were made in renovating or renewing deteriorated or obsolete facilities and equipment. In order to ensure that the infrastructure is adequate to support customer needs and to meet current and projected future operational demands, SRNL is using a phased, prioritized approach to restore or replace facilities and equipment. Funding sources for these infrastructure improvements include the Site Infrastructure budget, direct customer budget, and SRNL operations budget. Several recent, key projects are discussed below.

Shielded HLW—Cell Manipulators, In-cell Cranes, and Cell Windows—The Shielded Cell facilities are a unique asset, essential to support the analysis, treatment, and stabilization of HLW materials and the disposition of nuclear materials. The cells also are a vital component in the development and application of site mission support technology. Much of the equipment and many of the systems and components integral to Shielded Cell operations are being renovated or replaced as they reach the end of their design life expectancy. Recent projects to rebuild cell windows and modernize the manipulators have increased the productivity of the operations and extended the useful life of the individual cells.

Contained Scanning Electron Microscope—The scanning electron microscope (SEM) provides analyses and characterization that are essential for continued operation of the Canyons, Pu-238 processes, waste vitrification, environmental restoration, and tritium. This project replaced an 18-year-old contained SEM that was experiencing 25 percent downtime.

735-A Air Dryer—The 735-A Air Dryer project supports critical environmental monitoring, homeland security, national defense initiatives, and NNSA activities. This project enabled replacement of the 20-year-old obsolete air dryer in 735-A, which had experienced frequent failures.

Supply and Exhaust Ventilation Systems—The ventilation system is the key safety system used to protect both the public and facility workers from process events. Due to the age of the ventilation system, SRNL began a phased replacement of many of the air handling units and fans. Efforts have also been underway to upgrade the HEPA filtration system's current design standards. Continued efforts are required to improve the Process Exhaust Monitoring and Control System to meet current standards.

Repair or Replace Analytical Equipment—Efforts have been underway for some time to replace obsolete or failed laboratory analytical equipment and facilities. Over the past 8 years, the lab has made a substantial investment in new equipment and has upgraded or extended the life of equipment where cost effective. However, much is still needed. The upgrade of laboratories, including service utilities, laboratory furnishings and hoods, gloveboxes, and related analytical equipment, is ongoing and a priority in all project planning.

Motor Control Centers, Electrical Distribution Panels, and Lighting Panels—The facility is following a prioritized replacement schedule for the various MCCs and distribution and lighting panels. Equipment is replaced as budgets allow and replacement is expected to continue over the next few years.

Laboratory Roofs—The facility developed a multimillion dollar, cost-funded project to restore the roofs of the major laboratory facilities in the TA.

Inductively Coupled Plasma-Mass Spectrometer—This project replaced a failing, 10-year-old contained Inductively Coupled Plasma-Mass Spectrometer (ICP/MS). This instrument is used to perform isotopic analysis for criticality control. The results of these analyses are used to meet HLW regulatory compliance agreements and for nuclear safety. The ICP/MS supports Tritium and Closure materials stabilization programs.

X-Ray Diffraction System—SRNL replaced an 18-year-old, contained X-ray diffraction system that was often unavailable. The new unit is the only contained X-ray diffraction system on site. The materials data provided by this unit support all high-dose radiological programs on site, including DWPF, Tritium, HLW treatment, and Nuclear Materials Stabilization.

8.5.3 Facility Project Process

The Facility Infrastructure Board controls the SRNL Facility Project Process. The Board is composed of management and technical representatives from R&D and Facilities Operations and Engineering. The board's function is to prioritize facility project requests to ensure that scarce capital funds are allocated to the most important projects at a given time. The Board examines customer requirements and mission essential work scope; project cost-to-benefit analysis, including return on investment; and risk reduction, including programmatic and personnel safety issues. SRNL research and engineering staff and management will eliminate projects of marginal benefit, or unsubstantiated or poorly substantiated need. The SRNL Facility Infrastructure Board, with the assistance of R&D staff, reviews and prioritizes projects nominated for the Ten Year Plan. This process ensures unqualified support of the final prioritization results when the projects are recommended to the Site Infrastructure Committee.

8.5.4 Infrastructure Funding

Over the last 2 years, SRNL CE/GPP infrastructure project capital funding has been minimal due to site priorities. Between 1995 and 2003, SRNL averaged approximately $9 million per year in project capital funding. While this enabled improvements in equipment and facilities, much remains to be done. Laboratories must have reliable instrumentation and analytical equipment, as well as a sound facility infrastructure, in order to support customers with reliable, technologically sound, yet cost-effective results. The average annual SRNL recapitalization rate has been less than 1 percent of replacement value, versus industry standard recapitalization rates of 3 percent to 5 percent.

Currently, SRNL has a deferred backlog of $14.5 million in facility maintenance-related GP projects and $10 million in R&D-related CE/GPP projects. The deferred projects require the facility to extend the life of old, obsolete equipment and ultimately increase operating costs due to increased maintenance and reduced productivity through unplanned shutdowns. SRNL is managing this situation by limiting restoration or renewal projects to safe, mission-essential activities. This enables the lab to maintain its capabilities while minimizing repairs or renewal activities.

Figure 8-4 graphs the numbers of projects and the estimated cost of those projects through 2015. For comparison purposes, the chart includes the history of actual project funding received in 2002 through 2005 and the number of projects approved.

Focus on Replacement of Instruments—Limited SRS infrastructure funding in FY04 and FY05 has delayed the normal replacement cycle for old, failing instruments. The purchase of new instruments to provide increased capability for current and future missions has also been delayed. Instrumentation used by SRNL researchers has a limited lifetime. Typical of any item, instruments experience failures and require normal maintenance, which increases with age and use. Instruments also become obsolete as new measurement techniques and data processing methods increase the capabilities of new instruments and the information they provide.

Consequently, the near-term focus will be to purchase replacement instrumentation and new capability instrumentation to ensure data are available to safely operate the site and meet current and new mission requirements.

Focus on Laboratory Restoration—Like instruments, laboratories also experience "wear and tear" and eventual obsolescence. Laboratories must be maintained so that analyses and experiments can be performed safely. Typically, hoods and gloveboxes provide the first line of safety for researchers working with radioactive and hazardous materials. Over time, major maintenance or renewal of these facilities is required to ensure adequate facilities to support site processes and operations.

The objective of the focus on laboratory restoration in the mid-years of the Ten Year Infrastructure Plan is to ensure adequate facilities to meet future mission needs. The transfer of some lab work to HTRL will enable SRNL to systematically remove labs from service for renovation without having adverse impacts upon SRNL's customers. The renovated labs will provide safe, efficient lab space to meet the needs of our customers.

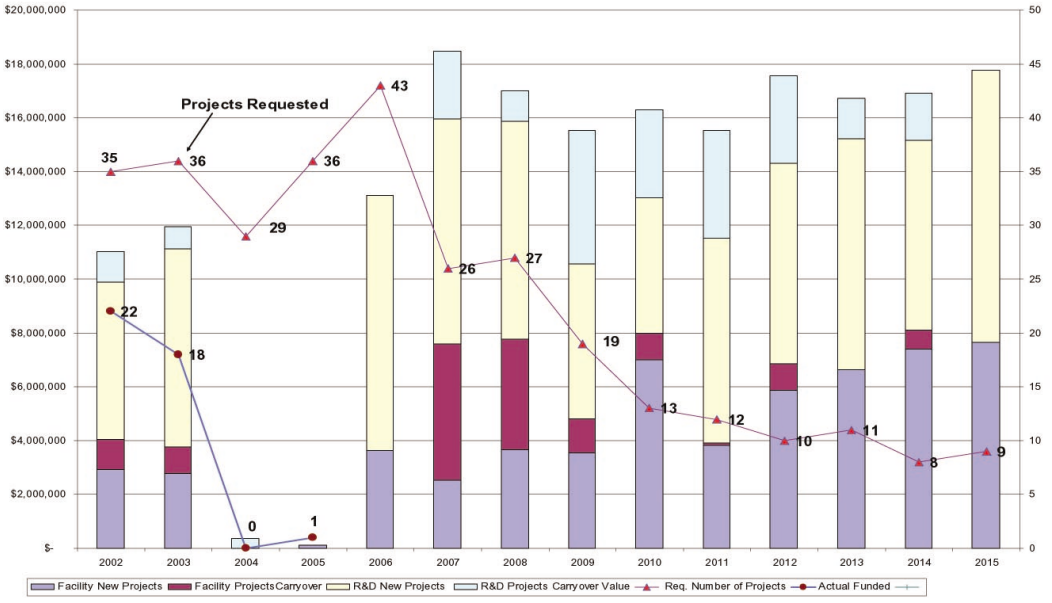


Figure 8-4. SRNL FY05 Ten Year Infrastructure Project Plan

Focus on Legacy Removal—As with the rest of SRS, SRNL has an ongoing initiative to eliminate excess facilities and equipment remaining after the first 50 years of operations. The third phase of the SRNL Ten Year Infrastructure Project Plan will address the disposition of SRNL excess facilities and equipment in the out years. Abandoned, contaminated hoods and related laboratory equipment will be removed to maintain safety and minimize exposure to facility operating and R&D personnel. Equipment such as the obsolete HLW trailer are awaiting materials characterization in preparation for plans for their eventual disposition. The Ten Year Infrastructure Project Plan also includes projects to remove abandoned nuclear material processing equipment and facilities that are creating excessive background radiation levels and require increased levels of surveillance and maintenance. Permanent disposition of these legacy facilities will result in substantial risk reduction and operating efficiency for SRNL.

8.6 Conduct of Business

"The Conduct of Research & Development Business Practices for the R&D Environment" is the second in a trilogy of manuals that provide guidance in the conduct of research and development within SRNL. As the name implies, the manual focuses on business practices and was developed by a team of subject matter experts in key business areas. The primary purpose of the manual is to provide guidelines to ensure best business practices are used for developing, initiating, and performing work both onsite and offsite.

SRNL is committed not only to excellence in research, development, and deployment, but also to being recognized for sound business practices. This manual will maintain our reputation for fiscal responsibility, protection of sensitive and classified information, accountability of nuclear material, and other government assets and ethnical behavior in all business activities.

8.6.1 Management Assessments

External Review—In 1997, SRNL established the external review process to conduct annual reviews of SRNL technologies. This process is patterned after the DOE Order 5000.2B, Section 10 Annual Appraisal Report that is followed by all national laboratories.

External Review Board (ERB) members are selected from national laboratories, academia, other federal agencies, and the private sector by the SRNL Laboratory Director. They serve to help improve the delivery of applied R&D services to customers and to ensure that the strategic direction meets future needs.

In-depth evaluations of SRNL's technical business areas are based on the following criteria:

- **Quality of science and engineering**—The ERB will consider subjective and objective indicators for excellence, including impact of scientific and engineering contributions, leadership in the scientific and engineering communities, innovativeness, and sustained achievement. As appropriate, they may also evaluate other performance measures, such as publications, citations, and awards.

- **Quality of applied R&D support for SRS**—The ERB will consider subjective and objective indicators of excellence. These include the impact of SRNL programs on the core business needs of SRS customers, evidence of joint ownership of the flow sheets with operating divisions, success in transferring the resulting technology to non-SRS customers, success in bringing in new technologies and approaches from external collaborations and partners, and sustained contribution to successful SRS operations. As appropriate, they will also evaluate other performance measures, such as trade journal publications, patents and licenses, and customer commendations.

- **Relevance to national needs and agency missions**—The ERB will consider the impact of SRNL research and development on the present and future mission needs of SRS, the DOE Weapons Complex, and other agencies funding the programs. Such considerations include national security, environmental management, and economic competitiveness, as well as the goals of DOE and other SRNL funding agencies in advancing applied science. The ERB will also stress the impact on industrial competitiveness and national technology needs. The Review Committee will assess characteristics that are not easily measured, including relevance of a research program to national technology, and effectiveness of outreach efforts to industry. As appropriate, they may also consider such performance measures as licenses and patents, collaborative agreements with industry, and the value of commercial spin-offs.

Facility Evaluation Board—The Facility Evaluation Board (FEB) independent assessment program provides WSRC facility/project and senior management with performance-based information to support continuous improvement, direct leadership resources, adjust personnel and financial resources, and identify areas of excellence. In addition, the FEB program establishes a mechanism to satisfy the contractual and regulatory obligations WSRC has made to its customers for company-level independent oversight.

The FEB independent assessment program periodically (12-18 months) performs performance-based assessments of facilities/projects, support departments, and programs.

FEBs are responsible for the following tasks: (1) measuring a facility's performance effectiveness in completing its mission, (2) assessing the adequacy of the self-assessment process within the assessed facility, and (3) ensuring adherence to DOE ESH&QA requirements. They also evaluate facility implementation of site-level programs and activities for which ESH, radiological control, or QA oversight is required.

The 2-week-long assessments sample seven functional areas:

- Organization and Administration
- Operations
- Radiological Control
- Engineering
- Maintenance
- ESH&QA
- Training and Support

The results of each evaluation are reported directly to the WSRC President.

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Section 9

Technology Transfer

The transfer of technology to private industry is an important part of the work done at SRNL. Technology transfer moves existing government-developed technologies into the private sector, helping businesses to compete in the national and international marketplace. Through government/industry partnerships for the development of new technologies, SRNL also benefits from industry expertise in identifying the best solutions to mission challenges. In broad-based technology transfer activities, SRNL plays key leadership roles in the informal DOE technology partnership working group.

Since 1996, there have been 537 patent disclosures at SRNL. In FY05, SRNL submitted 47 invention disclosures and four copyright disclosures. Four patents were awarded on SRNL-developed technologies.

Table 9-1 summarizes the technology transfer activities at SRNL from 1996 through July 2005.

Table 9-1. SRNL Technology Transfer Record

	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05	Totals
Invention Disclosures	85	73	69	67	33	28	59	39	37	47	537
Patent Applications	10	11	10	9	13	12	8	10	10	9	102
Patents Issued	1	2	4	9	5	10	12	11	2	4	60
Copyright Disclosures	6	12	20	17	7	4	9	10	1	4	90
Licenses	2	4	6	13	11	8	1	7	23	4	79
CRADAs	4	2	0	2	1	1	1	0	2	1	14

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Section 10

Community Relations

SRNL, through SRS, has developed an excellent working relationship with the surrounding communities through its strong involvement in outreach activities. SRNL's efforts on behalf of the community are described below.

10.1 Community Education and Outreach Programs

In support of local education and outreach programs, SRNL staff members teach at community colleges; support science fairs, engineering week, the Traveling Science and Mathematics Demonstrations Program, DOE Science Bowl, and Tech Day; and act as reviewers for the Excellence-in-Teaching Mini-Grants Program.

- For the 2003-2004 school year, the Traveling Science and Mathematics Demonstrations Program reached over 25,000 students in K–12. This program, presented by WSRC in cooperation with the University of South Carolina–Aiken, sends scientists and engineers to perform hands-on science and math demonstrations. SRNL volunteers conducted 52 demonstrations, reaching nearly 6,300 students. SRNL volunteers made presentations on a wide range of topics—from robotics, astronomy, and electricity to acoustics and birds of prey.
- SRNL employees enthusiastically support and participate in the "Introduce a Girl to Engineering" program, presented by WSRC, the Ruth Patrick Science Education Center, and the Central Savannah River Area (CSRA) Society of Women Engineers. In its fourth year, the workshop provided an opportunity for 42 middle school girls to interact with SRS engineers to promote the students' interest in engineering careers.
- WSRC's Excellence-in-Teaching Mini-Grants Program provided $50,000 in grants to classroom teachers who submitted innovative ideas to enhance elementary and middle school science and math curricula. In the 2003–2004 school year, 109 projects were funded.

The interest of girls in science, math, and engineering is encouraged by interactions with SRNL scientists and engineers as part of the "Introduce a Girl to Engineering" program.

10.2 Community Support and Relations

SRNL works closely with the community to support the following efforts:

- The Westinghouse Community Giving Program contributed $650,000 to organizations within the CSRA in CY04.
- Public and private schools from Columbia and Richmond counties in Georgia, as well as Aiken, Allendale, Bamwell, and Orangeburg counties in South Carolina, received over $440,000 of surplus equipment through the DOE "Computers for Learning" program, which supports math and science in grades K–12. Equipment worth over $20 million has been donated since the program's inception.

SRNL also works closely with the Citizens Advisory Board, which is composed of 25 people from South Carolina and Georgia. Chosen from approximately 250 applicants by an independent panel of citizens, board members reflect the cultural diversity of the population affected by SRS. The members, who serve 2- or 3-year terms, represent all walks of life, including the business world, academia, local government, environmental and special interest groups, and the general public.

The Citizens Advisory Board provides advice and recommendations to the DOE, EPA Region IV, and the SCDHEC on environmental remediation, waste management, and related issues.

Students enjoy the hands-on activities provided through the Traveling Science and Mathematics Demonstrations Program.

Section 11

Safety, Security, and Quality

As the Nation's premier applied science laboratory, SRNL is committed to excellence in research. This excellence is exhibited in creative and accurate experiments and calculations, in performing work safely and cost effectively, and in complying with requirements, all while meeting the needs of SRNL's customers.

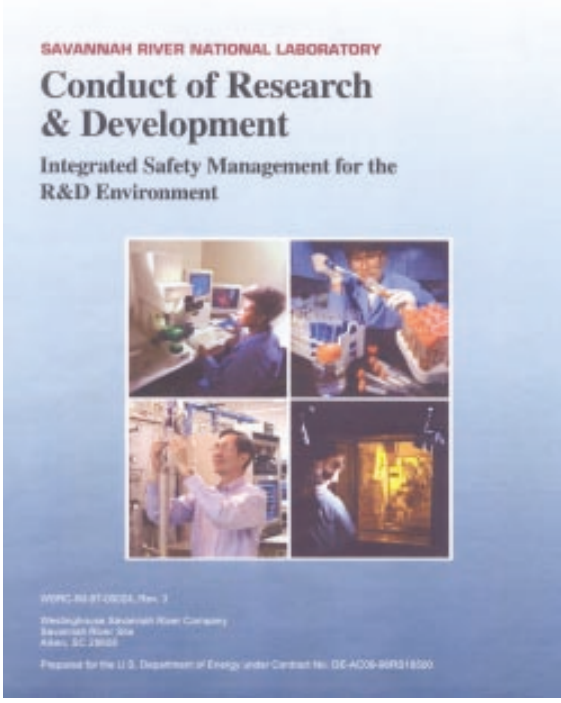
11.1 Conduct of Research

"The Conduct of Research & Development, Integrated Safety Management for the R&D Environment" is a document written by SRNL researchers for use by fellow researchers.

The primary purpose of this document is to provide a comprehensive process by which the hazards inherent in R&D activities may be identified and mitigated. By so doing, it clearly expresses the safety commitment and philosophy of SRNL. This philosophy is built on the common-sense approach of Integrated Safety Management (ISM), which systematically integrates safety considerations into management and work practices at all levels. Using this document ensures that the core functions of ISM are implemented in the pursuit of R&D endeavors, from planning to performance to closure.

In addition to communicating the SRNL approach to safety, this document provides guidance on the initiation, execution, and conclusion of R&D activities. The manual also provides standards to guide the performance of R&D and describes good research practice, derived from the experience of senior researchers at SRNL.

"The Conduct of R&D" manual shows how a disciplined but graded approach, consistent with the hazards involved, ensures that the work performed is both responsive and appropriate. The disciplined process is applicable to a wide range of research types and to work for both onsite and offsite customers.



"The Conduct of R&D" manual resulted in the issuance of 37 Government Use Notices and three NCSS licenses. This represents a cost avoidance of approximately $2.4 million. Focusing on the DOE Complex and other government partnerships, 60 no-revenue-bearing government agreements were signed. The fees and royalties for WSRC and DOE-owned licenses go to WSRC for distribution in accordance with the DOE-approved Royalty Sharing Policy.

11.2 Integrated Safety Management Systems Quality Assurance

SRNL continues to achieve safety excellence, recently achieving a milestone of over 3.7 million hours worked without a lost workday. This represents more than 2.5 years without an on-the-job injury that resulted in time away from work. We achieved this excellent performance by focusing on identifying hazards, implementing appropriate mitigating actions, and, most of all, executing work safely.

The SRNL Integrated Safety Management System consists of five elements, each of which makes a unique contribution to the safe execution of R&D activities:

- Safety Basis Strategy
- Operations Strategy
- Quality Assurance Program
- Feedback and Improvement Programs
- Employee Involvement Programs

SRNL's principal process document for the implementation of ISM for R&D activities is "The Conduct of R&D" manual. This manual provides a systematic approach to identifying and mitigating hazards associated with R&D activities. Recent evaluations of SRNL's approach to ISM by the Defense Nuclear Facilities Safety Board (DNFSB) and the DOE National Lab Improvement Council have commended the manual for the following:

- Providing a consistent framework to conducting research in compliance with applicable standards
- Emphasizing researcher responsibility for hazards assessment and mitigation
- Facilitating the use of the ISM infrastructure for R&D work
- Providing a gateway to required safety program elements and subject matter expertise

Safety Performance

SRNL continues its distinction as the safest national laboratory in the DOE Complex. SRNL has achieved the lowest injury case rate for national laboratories over the 4-year period from 2001 through 2004 (see Figure 11-1). In addition to achieving the lowest injury case rate performance, SRNL has the added distinction of a continuous injury case rate improvement trend over the same period (see Figure 11-2). This performance can be directly attributed to SRNL's commitment to safety as a core value and an integral part of our operating culture.

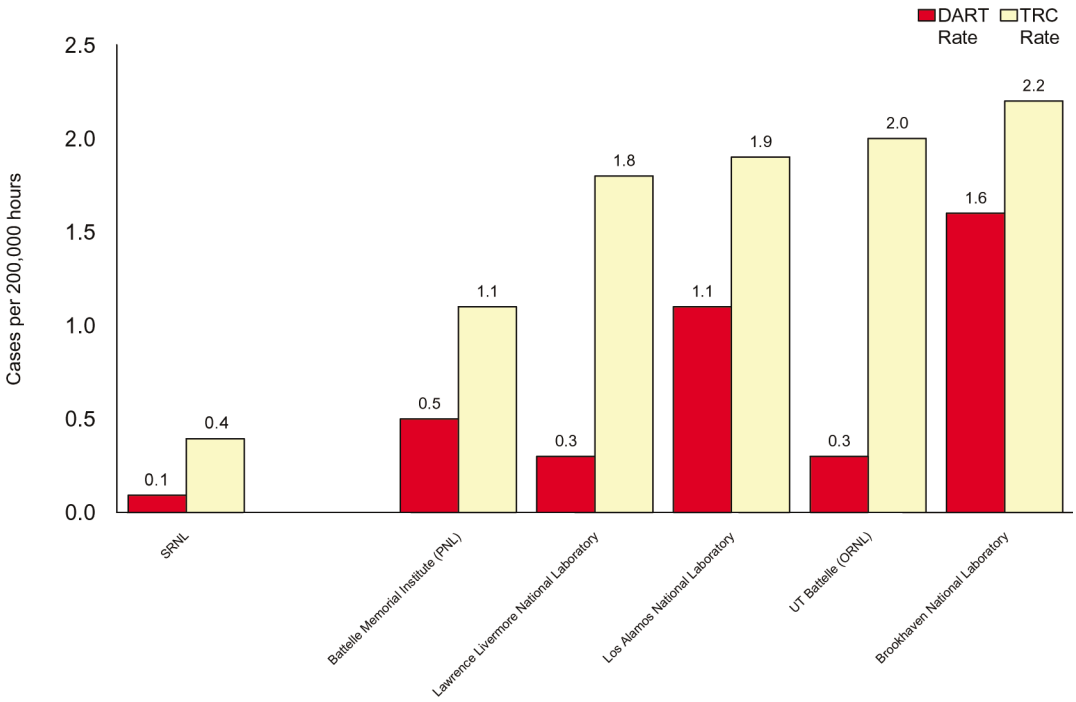


Figure 11-1. Injury and Illness Ranking of DOE Research Contractors

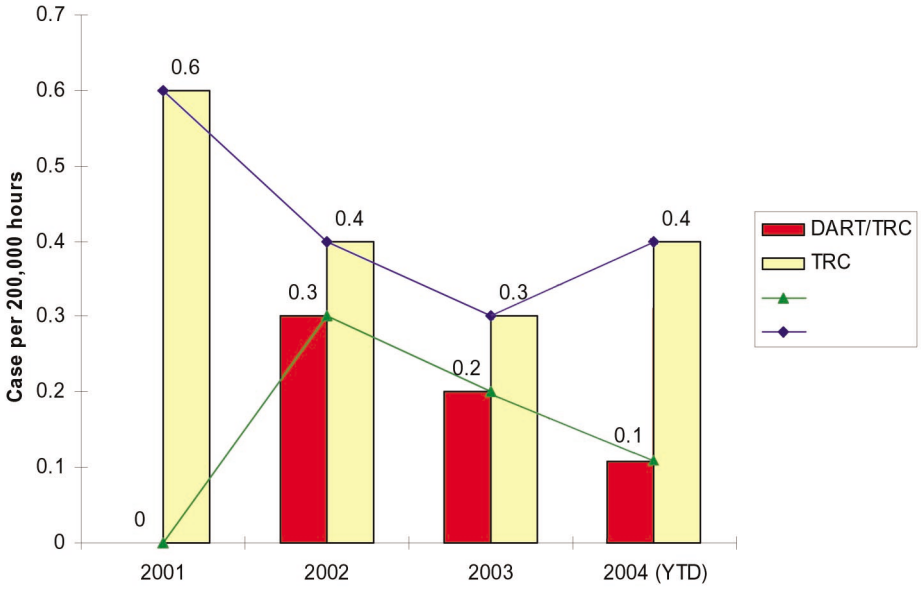


Figure 11-2. SRNL Injury and Illness Rate Trend (2001-2004)

11.3 Security

Because SRNL plays a pivotal role in stockpile stewardship, security of both materials and information is always a top priority. SRNL is situated in a Limited Area and adheres to a broad-based security program that features a number of mutually supportive elements:

- Program Management ensures implementation of established security policies and integration of those policies within the facility.
- Protection Program Operations provides physical security measures designed to protect safeguard and security interests such as special nuclear material, classified computer systems, classified and sensitive unclassified information, and precious metals.
- Computer and Information Security Program ensures the protection of all information generated, transmitted, or stored (classified and unclassified) in accordance with applicable DOE and site regulations. Operations Security (OPSEC) is a segment of the SRNL Computer and Information Security Program. The objective of the OPSEC program is to prevent unauthorized, inadvertent release of sensitive information or activities through identification of critical information; analysis of threats; analysis of vulnerabilities, risk assessments; and application of appropriate countermeasures.
- Nuclear Materials Control and Accountability Program provides for the accountability and control of SRNL's accountable nuclear material inventory.

The SRNL Safeguards and Security Program is assessed annually using specific assessment criteria. The SRNL Safeguards and Security Program has been rated satisfactory by DOE-SR and WSRC Safeguards & Security Oversight for the past 5 years.

Appendix A

Acronym List

ACREM	Accountable Classified Removable Electronic Media
ACTL	Aiken County Technical Laboratory
AFCI	Advanced Fuel Cycle Initiative
ASTD	Accelerated Site Technology Deployment
BAA	Broad Agency Announcement
CE/GPP	capital equipment/general plant projects
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHR	Center for Hydrogen Research
CRADA	Cooperative Research and Development Agreement
CSRA	Central Savannah River Area
CSSC	Container Surveillance and Storage Capability
D&D	Decontamination and Demolition
D&S	Defense and Space
DARPA	Defense Advanced Research Projects Agency
DHS	Department of Homeland Security
DNA	Deoxyribonucleic Acid
DNAPL	Dense Non Aqueous Phase Liquid
DNFSB	Defense Nuclear Facilities Safety Board
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DP	Defense Programs
DPD	Defense Programs Division
DSW	Direct Stockpile Works
DTRA	Defense Threat Reduction Agency

DWPF	Defense Waste Processing Facility
EA	enhanced attenuation
EERE	Energy Efficiency and Renewable Energy
EM	Environmental Management
EMSP	Environmental Management Science Program
EPA	Environmental Protection Agency
ERB	External Review Board
ESH&QA	Environmental Safety Health & Quality Assurance
EUS	Enriched Uranium Storage
FBI	Federal Bureau of Investigation
FE	Fossil Energy
FEB	Facility Evaluation Board
GA	Georgia
GIS	Geographic Information Systems
HAW	High Activity Waste
HEPA	High Efficiency Particulate Air
HLW	high level waste
HPAC	Hazard Prediction and Assessment Capability
HPG	Hydrogen Processing Group
HQ	Headquarters
HSARPA	Homeland Security Advanced Research Project Agency
HTRL	Hydrogen Technical Research Laboratory
HVAC	Heating, Ventilation and Air Conditioning
HyS	Hybrid Sulfur
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory
ICP/MS	Inductively Coupled Plasma-Mass Spectrometer
INL	Idaho National Laboratory
IRD	Independent Research & Development
ISI	in-service inspection

ISM	Integrated Safety Management
ISP	Integrated Surveillance Program
IWFO	Intelligence Work-for-Others
KAMS	K Area Materials Storage
LANL	Los Alamos National Laboratory
LDRD	Laboratory Directed Research & Development
LETSC	Law Enforcement Technology Support Center
LEU	low enriched uranium
LLNL	Lawrence Livermore National Laboratory
LLW	low level waste
LPDM	Lagrangian Particle Dispersion Model
LSD	Laboratory Services Department
MCC	Motor Control Center
MFFF	Mixed Oxide Fuel Fabrication Facility
MNA	monitored natural attenuation
NABIR	Natural and Accelerated Bioremediation Research
NASA	National Aeronautics and Space Administration
NCSS	National Cooperative Soil Survey
NDE	Non-Destructive Examination
NE	Nuclear Energy, Science and Technology
NEPA	National Environmental Policy Act
NERI	Nuclear Energy Research Initiative
NESHAP	National Emission Standards For Hazardous Air Pollutants
NGNP	Next Generation Nuclear Plant
NHI	Nuclear Hydrogen Initiative
NIJ	National Institute of Justice
NNPO	Nuclear Nonproliferation Project Office
NNSA	National Nuclear Security Administration
Np	neptunium
NP	nuclear power
NPDES	National Pollutant Discharge Elimination System

OPSEC	Operations Security
ORNL	Oak Ridge National Laboratory
PDCF	Pit Disassembly and Conversion Facility
PDRD	Plant Directed Research & Development
Pu	Plutonium
PUREX	Plutonium Uranium Extraction
R&D	Research and Development
RAMS	Regional Atmospheric Modeling System
RBOF	Receiving Basin for Offsite Fuels
RCRA	Resource Conservation and Recovery Act
RDECOM	Research, Development and Engineering Command
RFETS	Rocky Flats Environmental Technology Site
RL	Richland
S&T	DHS Science and Technology Directorate
SC	Office of Science
SC	South Carolina
SCDHEC	South Carolina Department of Health and Environmental Control
SCH2	South Carolina Hydrogen Coalition
SEM	Scanning Electron Microscope
SL	shelf life
SNF	spent nuclear fuel
SREL	Savannah River Ecology Laboratory
SRL	Savannah River Laboratory
SRNL	Savannah River National Laboratory
SRRC	Savannah River Research Campus
SRS	Savannah River Site
SRS	Savannah River Site
SRTC	Savannah River Technology Center
SUNRISE	Southeast Universities Nuclear Reactors Institute for Science and Education
SWPF	Salt Waste Processing Facility

TA	Technical Area
TC	thermal chemical
TFM&C	Tritium Facilities Modernization and Consolidation Project
TRAC	Tracking Atmospheric Radioactive Contaminants
TRU	transuranic
UREX	Uranium Extraction
USCG	U.S. Coast Guard
VOC	Volatile Organic Compounds
WFO	Work for Others
WGII	Washington Group International, Inc.
WIPP	Waste Isolation Pilot Plant
WMD	weapons of mass destruction
WSB	Waste Solidification Building
WSRC	Westinghouse Savannah River Company
WTG	Weapons Technology Group

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