Enterprise•SRS Initiatives
Progress Updates

Bringing Enterprise Value to the Nation / Advancing Enterprise•SRS Strategic Initiatives

U.S. Department of Energy–Savannah River
Savannah River Site
Aiken, S.C.
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Why Enterprise•SRS Matters
Because SRS is the only place in the world with the resources to address and manage all of these challenges

Core Competencies
- Transforming legacy nuclear materials into valuable assets and stable waste forms
  - Unique processing capabilities, including H Canyon and Defense Waste Processing Facility (DWPF)
- Developing highly innovative approaches to address national nuclear material and nuclear waste management challenges
  - Intellectual leadership, and research and development driven by the Savannah River National Laboratory (SRNL)
- Securing materials to prevent unwanted global proliferation
- Sustaining the nation's only tritium supply for our nuclear weapons deterrent
- Providing economic impact to the region while reducing environmental risk

Where We Are Today and What We Are Doing
Based on lessons learned from two years of Enterprise•SRS "under our belt," DOE and SRS contractors are sharpening collective efforts by grouping Strategic Initiatives into logical Focus Areas and then prioritizing actions.

Initiatives
- National Security
- Clean Energy
- Environmental Stewardship

Focus Areas
- Surplus Nuclear Materials Management
- Environmental Risk Reduction
- Next Generation Tritium Supply
- Global Monitoring and Securing of Nuclear Materials

Cross-cutting Priorities
- Sponsorship / funding
- Ensuring and using available resources
- Maximizing return on investment
- Improving probability of success
Focus Area
Surplus Nuclear Materials Management

Disposition of Highly Enriched Uranium (HEU)

Utilizing Resources: H Canyon is capable of dissolving, purifying, and blending down “weapons-usable” HEU to low-enriched uranium (LEU) for use in commercial nuclear reactors. In 2013, H Canyon completed delivery of approximately 301 metric tons of LEU over a 10-year period for use in manufacturing fuel for Tennessee Valley Authority (TVA) commercial nuclear plants. This material is now providing electricity for homes throughout the Southeast. The next campaign will make available 40 metric tons LEU over the next five years.

Recovery of “National Asset” Isotopes

A range of long-lived, radioactive trans-plutonium (Pu) isotope materials may have programmatic use throughout the Department. Most of the remaining long-lived trans plutonium isotopes are contained in material currently in storage in SRS’s L Basin. Isotopes of interest include plutonium-244 and isotopes of americium and curium. Some of these isotopes could have valuable uses, and the plutonium-244 contained in some material stored in L Basin is the only remaining source available in the world and may never be generated again. SRS has the potential to support the recovery of these isotopes.

Plutonium Oxide Preparation

To further reduce the threat of nuclear weapons proliferation, H Canyon/HB Line Facility provides the unique capability to convert stored plutonium material into an oxide form (Alternate Feedstock-2, or AFS-2) that will either meet the Mixed Oxide (MOX) Fuel Fabrication Facility specifications as feed for commercial reactor use or would be suitable for disposal as transuranic waste at the Waste Isolation Pilot Plant (WIPP) in New Mexico.

Plutonium Disposition to WIPP

Serving as DOE’s only Category 1 special nuclear materials (SNM) storage facility, the SRS K Area Complex (KAC) provides for the safe handling and interim storage of both plutonium and uranium from across the Complex. KAC is developing the capability to blend down and package surplus non-pit Pu, unsuitable feedstock for the MOX Facility for eventual disposal at WIPP.

Domestic and Foreign Research Reactor Receipts

Used nuclear fuel (UNF) from the Site’s production reactors as well as from domestic and foreign research reactor programs continues to be safely and securely stored at the SRS L Area Complex (LAC) awaiting final disposition. Since 1996, LAC has received 10,000-plus assemblies (in approximately 500 casks) from offsite sources in support of nonproliferation objectives.

Advanced Safeguards Instrumentation Testing

H Canyon is being used as a “test bed” facility for the Next Generation Safeguards Initiative (NGSI) Program managed and funded by NNSA. The goal of the program is to facilitate transfer of proven safeguards technologies from the laboratory to an operational environment for national and international safeguards application. Benefits include affording the U.S. advance technology demonstration and proof testing capabilities without relying on international cooperation and/or restrictions as well as providing the ideal platform to install the next generation of safeguards instrumentation while processing nuclear materials. Additionally, it facilitates accelerating transition of technologies that contribute to process monitoring/control, materials accountability, and diversion detection. Instruments could support advanced fuel cycle research and development.

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**Focus Area**

**Environmental Risk Reduction**

**Tank closures**

With the December 2013 closures of Tanks 5 and 6, SRS has operationally closed six waste tanks, including the first two in the Nation in 1997. Working closely with SRS regulators, these certified closures represent the most substantial environmental risk reduction achievement for the State of South Carolina. With numerous tanks in various stages of closure preparation phases, Tank 16 is the next tank targeted for closure completion in 2015.

**ARP/MCU Life Extension**

The originally planned service life of the interim salt disposition processes of the Actinide Removal Process (ARP) and Modular Caustic Side Solvent Extraction Unit (MCU) was reached in 2012. A detailed engineering analysis identified the key parameters necessary for continued use of this treatment. Evaluation concluded that ARP/MCU can continue to operate effectively with reasonable maintenance and periodic equipment replacement. The passive process components, such as piping and structures, were determined to have service life in excess of 2025. The facilities are being appropriately maintained to extend operating life.

**Enhanced Throughput**

The critical path to progress/completion of the SRS Liquid Waste Disposition mission is treatment of salt waste, and the critical path to timely, near-term operational closure of old-style tanks to meet regulatory commitments is retrieval and treatment of salt waste. Available resources to the base Liquid Waste program are being applied to significantly increase salt waste treatment efficiency and capacity by upgrading the chemical solvent at MCU, increasing ARP/MCU throughput, and consideration of deploying supplemental, at-tank Small Column Ion Exchange (SCIX) treatment capability. This enhanced throughput and supplemental treatment strategy provides the basis to achieve 7-8 million gallons/year processing rate.

**Saltstone Disposal Units**

Construction of additional Saltstone Disposal Units (SDU) continues to be on critical path for maintaining uninterrupted ARP/MCU/Saltstone operations to advance the salt waste disposition mission. Doing business better and smarter, SDUs 3/5 were completed in 2013 ahead of schedule and under budget. The new circular technology for Saltstone Disposal Units have proven to be successful in the dispositioning of low-level radioactive salt waste and advancing the SRS liquid waste mission and risk reduction goals. SDU 6, presently under construction with a targeted May 2017 completion, will be the largest mega-vault at 30 million gallon saltstone capacity.
SRNL R&D and Cleanup Technologies

SRNL innovations have created over $5 billion worth of projected savings in the past five years for our nation’s legacy waste cleanup program, providing greater than 15-fold return on investment to the tax payer.

Now celebrating 60 years of service to our Nation and 10 years as a national laboratory, SRNL personnel are applying unique expertise and applied technology capabilities to reduce technical uncertainties and assist in cleanup at sites across the DOE Complex. Playing a more integral role in the operations structure at DOE sites in Washington, Tennessee, and Ohio, SRNL is the underpinning of Site missions and catalyst for deployment of enhanced cleanup innovations near and far, to include: treatment of mercury contamination in the subsurface at DOE’s Oak Ridge Site; sharing tank waste management operations expertise and joint development of at/near-tank waste treatment, waste retrieval and closure with DOE’s Hanford site; and providing modeling support to obtain regulatory acceptance for On Site Disposal Cell technology (expected to save $240 million over excavation and off-site disposal).

In Situ Decommissioning of Reactors. This special process saved over $400 million. The P and R Reactors at SRS were successfully decommissioned in 2011. Using conventional methods, the reactors would have been dismantled, piece by piece, and the waste buried. SRNL developed a plan that used the existing structure as a disposal site and entombed miles of piping and tons of contaminated equipment “in place” through the use of a specialized grout. Not only did this process save money, it also eliminated the need for a new waste disposal site, and reduced the risk of exposure to workers, the public, and the environment.

Groundwater Remediation/In Situ Stabilization of Contaminants. Innovation has also been demonstrated in efforts to remediate contaminated groundwater from the decommissioned F Area at SRS. A pump and treat system had been deployed, but it was a costly approach and its effectiveness was not satisfactory. SRNL devised a method to modify the natural groundwater flow patterns to create sufficient retention times and focused treatment zones, allowing for in-situ stabilization of contaminants. This “funnel and gate” system has the potential for world-wide use to remediate groundwater, and has a projected savings at SRS of over $415 million.

Next Generation Solvent Technology. SRNL developed facility improvements that allow for an increased production rate and the creation of a Next Generation Solvent to be used in MCU and Salt Waste Processing Facility (SWPF). The technology alone will lead to $1.35 billion in cost savings due to the reduction required in processing time.

Small Column Ion Exchange (SCIX) and Rotary Microfiltration. Researchers at SRNL, in partnership with Oak Ridge National Laboratory, developed the innovative solution of the SCIX treatment capability. SCIX is a modularized process using filtration and ion exchange to remove Cs-137 from High level Waste salt solution. Filtration is performed using the rotary microfilter where an ion exchange media is used until saturated with Cs-137, and then ground and sent to the Defense Waste Processing Facility for vitrification. This modular approach allows for the installation in existing risers in waste tanks, avoiding the cost and schedule impact of new buildings. It also allows for rapid deployment and acceleration of waste treatment. SRNL modified the filter to enable its use in remote and challenging applications, such as a high level waste tank. The rotary microfilter has the potential to reduce the SRS lifecycle schedule by six years and $3.6 billion.
Focus Area
Next Generation Tritium Supply

**Helium-3 Recovery**

Tritium radioactively decays to helium-3, which has become a precious commodity. One reason for the tremendous growth in demand for helium-3 is its use in neutron detection equipment that is being installed all over the world to protect our nation and its allies from terrorism. Savannah River Tritium Enterprise recovers, purifies, and bottles this valuable byproduct of tritium, and is the sole source of helium-3 gas in the United States.

**Tritium Supply**

Identify a long-term (60 year) tritium sustainable supply, produced within the limits of current U.S. Government agreements, policies and statutes.

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Focus Area
Global Monitoring and Securing of Nuclear Materials

**Disposition of Canadian Liquid HEU**

After several years of processing irradiated targets to produce medical isotopes, Atomic Energy of Canada Limited (AECL) has accumulated about 6,000 gallons of HEU. The Department has a contract with AECL to ship the HEU solutions to SRS for recovery and down blending of the HEU to LEU. The LEU will be shipped offsite for fabrication into fuel for Tennessee Valley Authority commercial nuclear plants.

**Americium-241 Recovery**

Americium-241 is used in smoke detectors, neutron sources for oil well logging, moisture gauges in agriculture, and quality control gauges in construction and manufacturing. In addition, there is a projected need for americium-241 for fast-reactor fuel research and development. The European Space Agency is also evaluating its use in future Radioisotope Thermoelectric Generators (RTGs) to generate electric power for deep space missions in lieu of plutonium-238. The domestic supply of separated and purified americium-241 was exhausted in 2003. Currently, Russia is the only supplier, and production is being allocated to existing customers through exclusive sales contracts. Commercial demand for americium-241 is high and the shortage has resulted in rising prices over the last few years. The plutonium-239 planned to be processed for NNSA has significant amounts of americium-241. With some modifications, HB Line could be used to recover the americium-241.

**Mobile Plutonium Facility**

Another example of unique capabilities is the newly-operational Mobile Plutonium Facility. This facility is the world’s only rapid response capability that can be deployed to characterize, stabilize, and package plutonium for shipment to a recipient location.
This stand-alone operating environment is completely self-sufficient. The Mobile Plutonium Facility has a modular design made of standard shipping containers. These modules can be assembled quickly to execute a recovery mission within a country from which materials are being removed. Most importantly, the Mobile Plutonium Facility can stabilize plutonium in forms expected to be found in the plutonium recovery and extraction process, so that it is safe to ship and store temporarily until decisions can be reached on ultimate disposition of the material.

**FBI Forensic Lab/SRNL**

The Federal Bureau of Investigation's Laboratory at SRNL allows for the forensic examination of radiological materials and associated evidence. The Radiological Evidence Examination Facility provides a full spectrum of traditional forensic analysis on contaminated evidence. This forensic laboratory takes advantage of long-standing security, safety and radiological protection capabilities already in place at SRNL and allows the FBI to focus on forensic examination in consultation with SRNL experts. Innovative solutions have been created to adapt existing DNA, latent fingerprint, hair and fiber, and other techniques for safe use in a radiation controlled environment.

**SRNL Partnering with Homeland Security/ CBRNE Training**

To address the evolving challenges of today's world, SRNL's National Security group has partnered with the U.S. Department of Homeland Security to offer chemical, biological, radiological, nuclear and explosives (CBRNE) training at SRS. With a strong focus on national security, SRNL offers unique CBRNE training opportunities to military response units, first responders, and federal, state and local law enforcement agencies. The facilities and venues available at SRS are ideal for conducting exercises in chemical, biological, radiological, nuclear, and explosives situations or emergencies. SRNL personnel have extensive experience in conducting training scenarios in radiological detection, decontamination and response, all required skills in today's rapidly changing threats to our nation.

**SRNL Applied Research / Wireless Technology**

SRNL has extensive experience working with the intelligence community with applied research used for the analysis of weapons of mass destruction, remote sensing, and nonproliferation policies. Researchers at SRNL have created a new wireless technology that allows for the transmission of classified data not intended for public disclosure. In the laboratory, this new secure wireless network design will allow for the elimination of electrical cables and wired sensors, saving an estimated $50 million for a planned nuclear facility.

**SRNL Applied Research / Radiation Mapping Technology**

Unique technology at SRNL has also led to the creation of the GrayQb™ radiation mapping device. Nuclear facilities face a difficult challenge in how to safely determine the exact location of radioactive contamination, whether due to routine operations or unexpected incidents. Some areas may be too small or too problematic to deploy personnel, who must wear protective equipment and face the risk of contamination. GrayQb™ is approximately the size of a soccer ball and can be deployed remotely to an area of concern. This device uses highly sensitive plates that can detect even low doses of radiation. This information is then transferred to a commercially-available scanner and superimposed over an image of the area being surveyed. This allows for the precise location of hotspots so that cleanup efforts can be very specifically targeted without exposing personnel to risk.
Teaming with TEPCO on Fukushima Cleanup

Since the March 2011 earthquake and tsunami that damaged the Japanese nuclear plant, SRNL researchers have been involved with other National Laboratories in DOE-led efforts to provide advice and support to Japanese government officials in the development of potential mitigation and recovery strategies in the areas of radiation detection, fate and transport of radionuclides, treatment and reuse of contaminated water, inspection and characterization of spent fuels, stabilization and decontamination of reactor sites, as well as characterization, remediation and control options for contaminated soils, biota and water in surrounding regions. The SRS Environmental Bioassay Laboratory (EBL) was one U.S. asset that played a key role in the DOE Consequence Management Home Team’s response to assist the Government of Japan, by analyzing soil and air filter samples for radiological contaminants related to the Fukushima Daiichi reactor incident. The EBL was one of the first SRS capabilities to play a specific role in the Japan aid effort. SRNL is currently engaged in a 2nd contract with TEPCO to provide specific technical scope on various stabilization and remediation approaches.

Partnering with NDA Sellafield

DOE and NDA Sellafield have partnered in the personnel and information exchanges to advance joint cleanup projects and risk reduction goals. Information sharing, lessons learned and best practices has focused on topical areas including: waste characterization; nuclear materials receipts/disposition; remote operations (mock-ups); in-situ decommissioning; innovative groundwater cleanup technology; area completion strategy; contracts management; regulatory interface; major construction project deliverables. Future teaming is planned to continue to share ideas on doing business better and smarter.

Partnering with SC National Guard for Military Training

The South Carolina Military Department and DOE signed an MOU in February 2014 outlining the use of land and the construction of facilities at SRS. The agreement will integrate relevant SRS and South Carolina National Guard capabilities in order to better enhance our nation’s ability to respond to natural, man-made or criminal events involving chemical, biological, radiological, nuclear, and explosive materials. The facilities will serve the SCMD, other military organizations, other federal agencies, and the Savannah River National Laboratory.

Supporting U.S. Nonproliferation Efforts

DOE/NNSA’s Global Threat Reduction Initiative (GTRI) reduces and protects vulnerable nuclear materials. SRS works with nations throughout the world to secure global materials, provide safe interim storage and convert them to reusable assets and stable waste forms.

Proposed Use of SRS Facilities to Disposition German Research Reactor Pebble Bed Fuel

In April 2014, DOE and the Federal Ministry of Education and Research of the Federal Republic of Germany signed a Statement of Intent to support the Department’s evaluation of German research reactor pebble bed fuel for possible acceptance, processing and disposition at SRS facilities. Receipt of this material supports the United States’ efforts to reduce and eventually eliminate enriched uranium from civilian commerce. Technical and engineering work, along with environmental impacts analyses, will be completed prior to any decision on this material. All work will be fully funded by the German Government.