Savannah River
Pit Production Overview and Capabilities

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Pit Production Program Meeting
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Major SRS missions and programs

- Nuclear Materials Management
- National Nuclear Security Administration Programs
- Savannah River National Laboratory
- Liquid and Solid Nuclear; Hazardous Waste Management
- Environmental Compliance and Area Closure
Environmental Management
- Management, stabilization and disposition of nuclear materials
- Management and disposition of solid, liquid and transuranic wastes
- Spent fuel management
- Environmental remediation and cleanup

National Nuclear Security Administration
- Tritium operations, extraction
- Helium-3 recovery
- Nonproliferation support
- Mixed Oxide Fuel Fabrication Facility
- Uranium blending and shipping
- Foreign fuel receipts

Work for Others
- Other federal agencies
- Other DOE sites
- Private industry
- Other minor entities

Percentages as of September 2018

SRS By the numbers

310 square-mile site
Located near Aiken, S.C., on the Savannah River. SRS covers 198,046 acres, including parts of Aiken, Barnwell, and Allendale counties in South Carolina.

11,700 current employees
(contractors and federal agencies)
(as of August 2018)

65% Environmental Management
- Management, stabilization and disposition of nuclear materials
- Management and disposition of solid, liquid and transuranic wastes
- Spent fuel management
- Environmental remediation and cleanup

31% National Nuclear Security Administration
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- Helium-3 recovery
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$2.1 billion annual budget
$2.6 billion annual regional economic impact across the two-state area
$200 million spent annually in local procurements
The ‘City’ of SRS

To support operations, SRS maintains an infrastructure akin to that of a small city.

- Fire department and emergency services
- Medical facilities
- 230 miles of roads and first S.C. cloverleaf
- Water and electrical utilities
- Weather center
- Information technology networks
- Locomotive and train tracks
- Biofuels plant for power generation
Safety and Security Begin with Me!

The SRS goal is to achieve world-class safety performance.

SRS consistently earns DOE’s top safety designations (Voluntary Protection Program Star of Excellence and Legacy of Stars).

SRNS employees have worked 16M+ hours without a lost time injury.

Savannah River National Laboratory has been safest DOE national lab 8 of past 10 years.

Security of the nation’s nuclear assets is a top priority at SRS.
The Savannah River Site

65+ years of national service

1949: Russia tested its first atomic weapon.

1950: The Atomic Energy Commission asked Du Pont to undertake a new atomic project, which became SRS.

Six South Carolina towns were moved and 6,000 people relocated to build SRS.

Du Pont operated SRS for nearly 40 years.

The original facilities at SRS included:
- Five reactors
- Two chemical separations plants
- Heavy water extraction plant
- Nuclear fuel and target fabrication facility
- Waste management facilities
SRS production experience: Facilities

M Area
Fuel and target fabrication

F, H Areas
Chemical separation

D Area
Heavy water rework

J, S, Z Areas
Waste management facilities

E Area
Solid Waste Management

C, K, L, P, R Areas
Nuclear reactors
SRS production experience: Nuclear manufacturing

Heavy Water Rework → Nuclear Reactors → Fuel and Target Fabrication

Products:
- Pu-239
- Tritium
- Pu-238
- Others

Chemical Separations

DWPF

Waste Management

Salt Stone
SRS production reactors

Heavy Water extraction, distillation and electrolysis

Manufacturing fuel and targets by alloying, casting and extruding
36 metric tons of plutonium were produced at SRS, about 1/3 of U.S. production.
SRS production experience

Plutonium manufacturing

Plutonium metal ingot

Canyon operations

Plutonium tri-fluoride

Glovebox operations
SRS production experience

Other SRS products

Plutonium 238: Heat source for deep space probe electric generator

Neptunium oxalate

Low enriched uranium liquid
Other SRS nuclear materials operations

Manipulator operations in hot cells

Spent highly enriched uranium fuel handling, storage and processing

Safe plutonium storage, monitoring and management
SRS Solid Waste activities

Solid Waste Management facility dispositions
- Sanitary
- Low level (both on- and off-site)
- Hazardous
- Mixed
- Transuranic (TRU) waste

SRS’s experience with TRU waste is extensive and successful:
- Storing,
- Characterizing
- Packaging
- Shipping TRU waste to WIPP

Ample capacity exists to support the pit mission, so no modifications would be required.
Savannah River National Laboratory

Technical production expertise

From the start, SRNL has provided integrated technical leadership to SRS through flow sheet development, process improvements, and talent rotations to manufacturing facilities.
Pit handling experience
- Past receipt and storage of Pu pits
- Bisected and dissolved pits for recycling and purifying plutonium in FB Line special recovery
- Alloyed Pu with Ga before shipment to Rocky Flats

Pit facility design and construction projects
- New Special Recovery and Pit Storage Facility: Designed, constructed, and turned over to Operations
- Actinide Packaging and Storage Facility: Designed and ground broken, but not constructed
- Modern Pit Facility: Design only
- Pit Disassembly and Conversion Facility: Conceptual design only

Parent company pit experience
Both Fluor and HII on team at LANL
Transitioning missions at Savannah River: A history of successful start-ups

Over the years, SRS has undergone many changes and successfully started up new missions.

- Repackaging Pu for re-designation and shipment off-site
- K Area Pu blend down
- Enriched uranium recovery from spent fuel after extended down time
- Start up of Pu recovery in HB Line after extended down time
- Highly Enriched Uranium blend down to Low Enriched
- Replacement of H Canyon exhaust fans
- NRU/NRX receipts in L Area
- Pu-238 removal for Risk reduction in 235-F
- American Recovery and Reinvestment Act ramp up to deactivate and decommission P Reactor, R Reactor and Materials Test Reactor
- Actinide Removal Process and Modular Caustic Side Solvent Extraction Unit (ARP/MCU) in Liquid Waste
<table>
<thead>
<tr>
<th>Facility</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>K Reactor building</td>
<td>Non-pit plutonium storage</td>
</tr>
<tr>
<td>K Interim Storage</td>
<td>Blend down plutonium oxide</td>
</tr>
<tr>
<td>L Reactor Spent Fuel Pool</td>
<td>Storage for foreign/domestic research reactor fuel</td>
</tr>
<tr>
<td>H Canyon</td>
<td>Recovery of plutonium-238 from neptunium billets</td>
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<tr>
<td></td>
<td>Recovery of plutonium-239 from LEU reactor fuel</td>
</tr>
<tr>
<td>H Canyon Truckwell</td>
<td>TRU repackaging facility</td>
</tr>
<tr>
<td></td>
<td>Unloading liquid HEU for recovery in H Canyon</td>
</tr>
<tr>
<td>HB Line Phase I</td>
<td>Plutonium scrap recovery to plutonium blend down</td>
</tr>
<tr>
<td>HB Line Phase II</td>
<td>Changed from processing plutonium to oxide, then neptunium, and back to plutonium</td>
</tr>
<tr>
<td>HB Line Phase III</td>
<td>Plutonium-238 recovery to plutonium-239 repackaging</td>
</tr>
<tr>
<td>F Canyon</td>
<td>Plutonium recovery to TRU repackaging (ARRA)</td>
</tr>
<tr>
<td></td>
<td>Americium/curium recovery from MPPF reactor targets</td>
</tr>
</tbody>
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Savannah River National Laboratory
Multi-Disciplinary:
Protecting the nation through applied science

Mobile Plutonium Facility
Interior of Defense Waste Processing Facility
Chemical Process Intensification

SRNL Low Count Facility
Tritium: Maintaining a safe, secure, reliable nuclear deterrent

Stockpile Surveillance Testing
- Enhanced Surveillance Program Management
- Life Storage Program Management
- WR and First Production Unit GTS Materials testing and analysis
- Annual Stockpile Assessment Documentation

Processing and Gas Transfer Systems
- Technical support to on-going reservoir loading mission
- Technology provider for tritium processing, recycle and GTS loading/testing
- Technical bridge between Design Labs (LANL, SNL) and SRS Tritium Operations for GTS loading and Life Extension Programs (LEPs)
- Performs collaborative R&D with Design Labs
Savannah River National Laboratory

Analytical Laboratories:
Extensive experience, capabilities to characterize and analyze plutonium

- Historical analytical laboratory support for 24x7x365 production operations
- Plutonium and uranium analytical methods
- WR QA experience with tritium
- Key plutonium analytical capabilities:
  - Controlled-potential coulometry (for Pu assay).
  - Thermal ionization mass spectrometry (for isotopic content)
  - Inductively coupled plasma mass spectrometry or ICP-MS (for trace impurities)
  - Counting room suite
  - Carbon analyzer
Notional compressed program schedule to achieve 80 pits per year by 2030

Success depends on fostering program-wide sense of urgency
Requires Savannah River schedule compression: 413.3B process, process verification

AoA: Analysis of Alternatives
D&R: dismantlement and removal
DEV: Development Phase
EA: Engineering Assessment
FPU: First Production Unit
ORR: Operational Readiness Review
PPI: Process Prove-In Phase
QUAL: Qualification Phase
PPY: pits per year
WR: War Reserve

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SRS Pit Production

Strategic Planning

- Will require strategic, informed Risk Acceptance to execute mission on desired 2030 schedule
- Will require paradigm shift in Business Operating Policies, Capital Projects management and decision-making
- Accelerate regulatory process or revise practices that delay design and long-lead procurement
- Establish SRNS Program VP & Program Management Team with internal roles, responsibilities, authority and accountability
- Establish technical support contract with experienced pit talent
- Establish communication strategy and protocols: Internal, client, community
- Establish partnerships with LLNL and LANL to ensure mission success

Next Steps

- Establish an M&O Pit Program organization
- Develop SRS program implementation plan (informed by NNSA HQ plan)
- Support development of Program Requirements Document and Design Agency Requirements
- Initiate cyber and IT secure communications and administration space for full collaboration
- Develop facility plans for personnel housing and early mission activities
- Early start on regulatory process strategy: Consider proceeding at risk with design and long-lead procurement while NEPA is in progress
- Establish a human resources transition plan to minimize impact to MOX project workforce
- Initiate partnerships and equipment procurement for training center
SRS Actions

**M&O**
- Review SRS prior pit programs
  *Modern Pit Facility, Pit Disassembly and Conversion Facility*
- Review Pu Pit Production Analysis of Alternatives and the Engineering Assessment
- Participation in Implementation Plan Management Focus Areas
- Participation in Conceptual Design
- Procure design engineering resources and pit expertise

**Site Infrastructure**
- Determining the classified and unclassified work spaces needed to execute the program:
  - Classified computing, servers, SharePoint, conference rooms

**Community**
- Engagement with regional community leaders
  - Aiken Technical College, USC Aiken

**Corporate**
- Board and parent company experience and reach back
Workforce Sustainment: Current and future

- **2,384** new full-service employees (FY14-present, approximately 500 per year over the next three years)
- **80%** hired from local area during past five years
- **24%** decrease in attrition of non-retirement eligible employees seeking other employment
- **11.2%** veteran hires (FY17) exceeds Office of Federal Contract Compliance Programs 6.7% goal
- **48** average age of employees down from 54 in 2008

- **37** average age of new hires
- **~90%** acceptance rate of offers made
- **66%** fewer days cycle time for new hire process reduced from 120 to 40 days
- **87%** reduction in average days for eQIP to DOE for clearances
Workforce Sustainment: Preparing the pipeline

26 in 11
Presence at 26 college and university career fairs in 11 states (FY 2017)

40,000 students + teachers
reached through STEM-related Education Outreach 2016-2018

100% internship increase
from 2014, with ~174 students in summer 2018; 28% hired since 2014

$5.3 million
total funding provided by SRNS to higher education institutions since 2008

11 partnerships
with local universities and technical colleges
Aiken Technical College
Augusta Technical College
Claffin University (HBCU)
Clemson University
Florida Int'l University
Midlands Technical College
Orangeburg-Calhoun Technical College
South Carolina State University (HBCU)
University of South Carolina
University of South Carolina-Aiken
University of South Carolina-Salkehatchie

In 2015, SRNS established a Nuclear Operations Program at Aiken Technical College. This certificate program serves as a foundation for future employees who wish to work in nuclear facilities. SRNS participates in the SRS Community Reuse Organization (CRO) regional nuclear workforce development initiative. The CRO has administered $4.8 million in grants to local institutions.
Savannah River can do this...

- World-class safety culture
- Plant operations experience
  - Plutonium processing and handling (actinide separations and purification)
  - Plutonium glovebox operations
  - 24/7 operations since site inception
- Nuclear processing infrastructure and support personnel
- War Reserve mission experience
- Applied National Laboratory
- Mission transition expertise
- Experience with repurposing on-site facilities
- Experience with nuclear waste handling
- Demonstrated success in on-boarding and training high volume of personnel during ARRA project
- Strong community support