

# Savannah River Pit Production Overview and Capabilities

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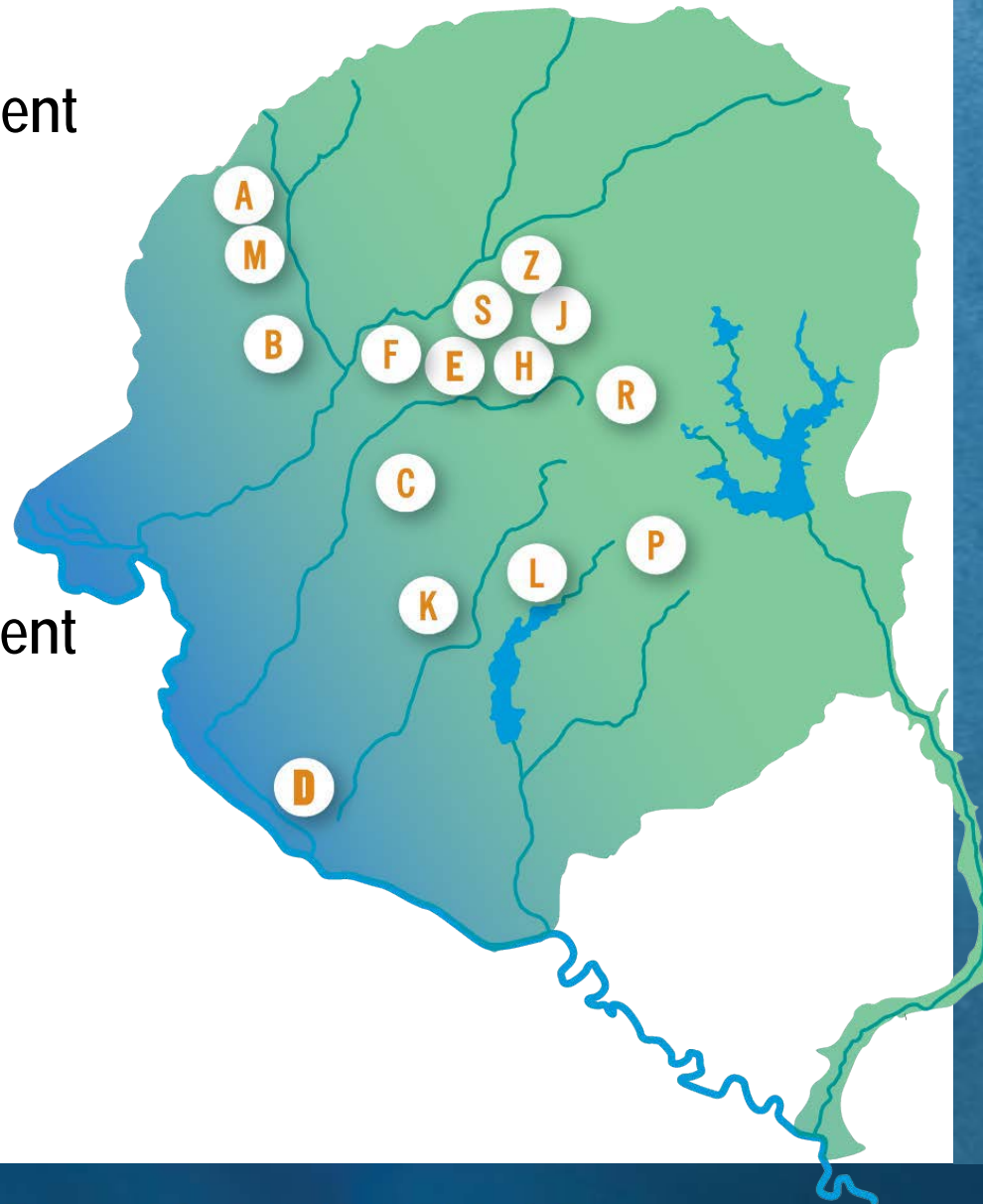
**David Dooley, PhD**

SRNS Pit Program Director

*Pit Production Program Meeting  
October 2-4, 2018*

# 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



## Who's at SRS?

Savannah River Nuclear Solutions  
*Management and Operations;*  
*Savannah River National Laboratory*

Savannah River Remediation  
*Liquid Waste Operations*

CB&I AREVA MOX Services  
*Mixed Oxide Fuel Fabrication Facility construction*

Parsons  
*Salt Waste Processing Facility*

Ameresco  
*SRS Biomass Cogeneration Facility*

Centerra  
*SRS Security*

University of Georgia  
*Savannah River Ecology Laboratory*

U.S. Forest Service–Savannah River  
*Federal entity*

# 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)*



**\$2.1**

**billion**

annual budget

**\$2.6**

**billion**

annual regional economic impact across the two-state area

**\$200**

**million**

spent annually in local procurements

**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

Tritium operations, extraction

Helium-3 recovery

Nonproliferation support

Mixed Oxide Fuel Fabrication Facility

Uranium blending and shipping

Foreign fuel receipts

**4%**

## Work for Others

Other federal agencies

Other DOE sites

Private industry

Other minor entities

*Percentages as of September 2018*

# 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).

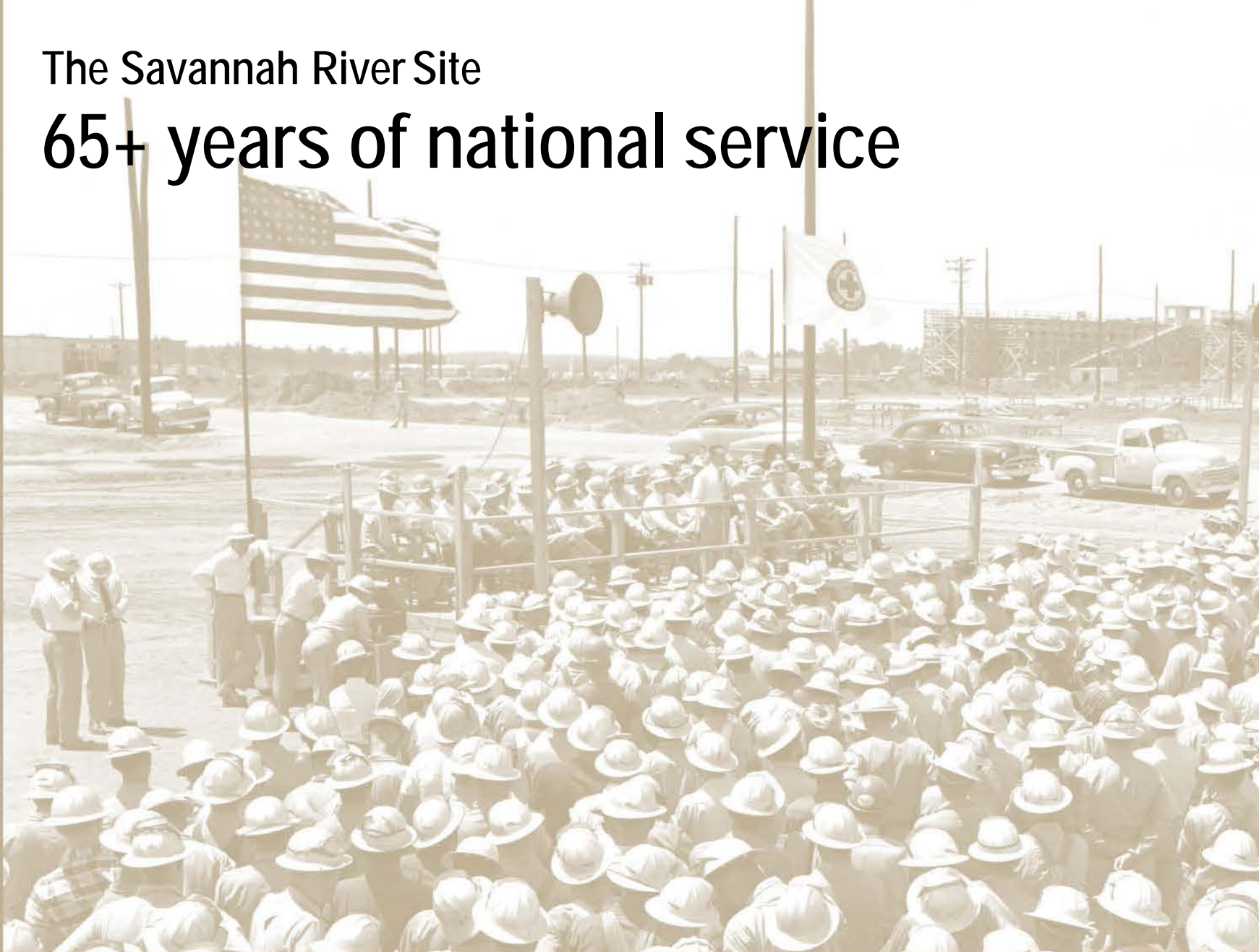
SRNS employees have worked 16M+ hours without a lost time injury

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:

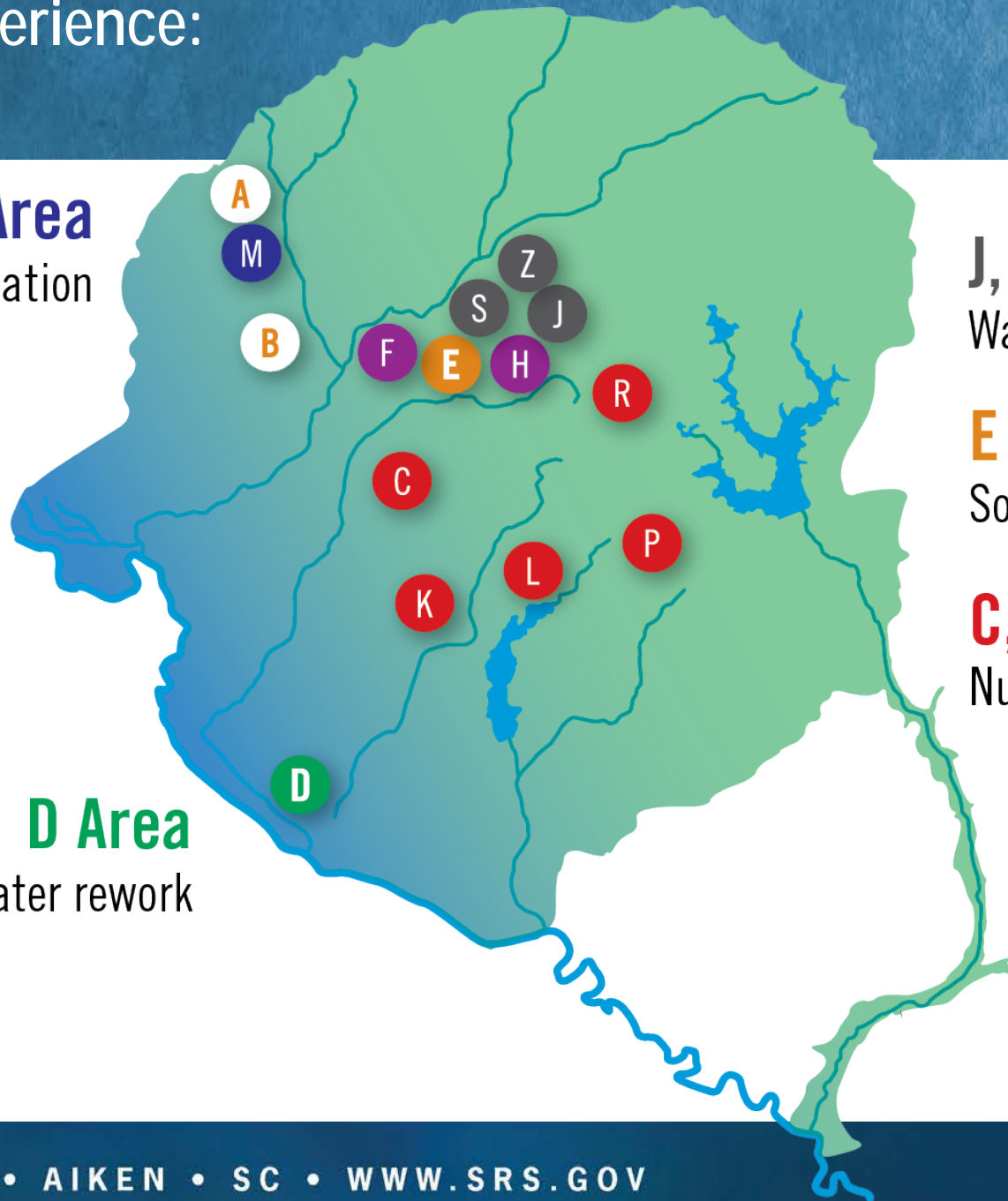
- Five reactors
- Two chemical separations plants
- Heavy water extraction plant
- Nuclear fuel and target fabrication facility
- Waste management facilities

# SRS production experience: Facilities

**M Area**  
Fuel and target fabrication

**F, H Areas**  
Chemical separation

**D Area**  
Heavy water rework

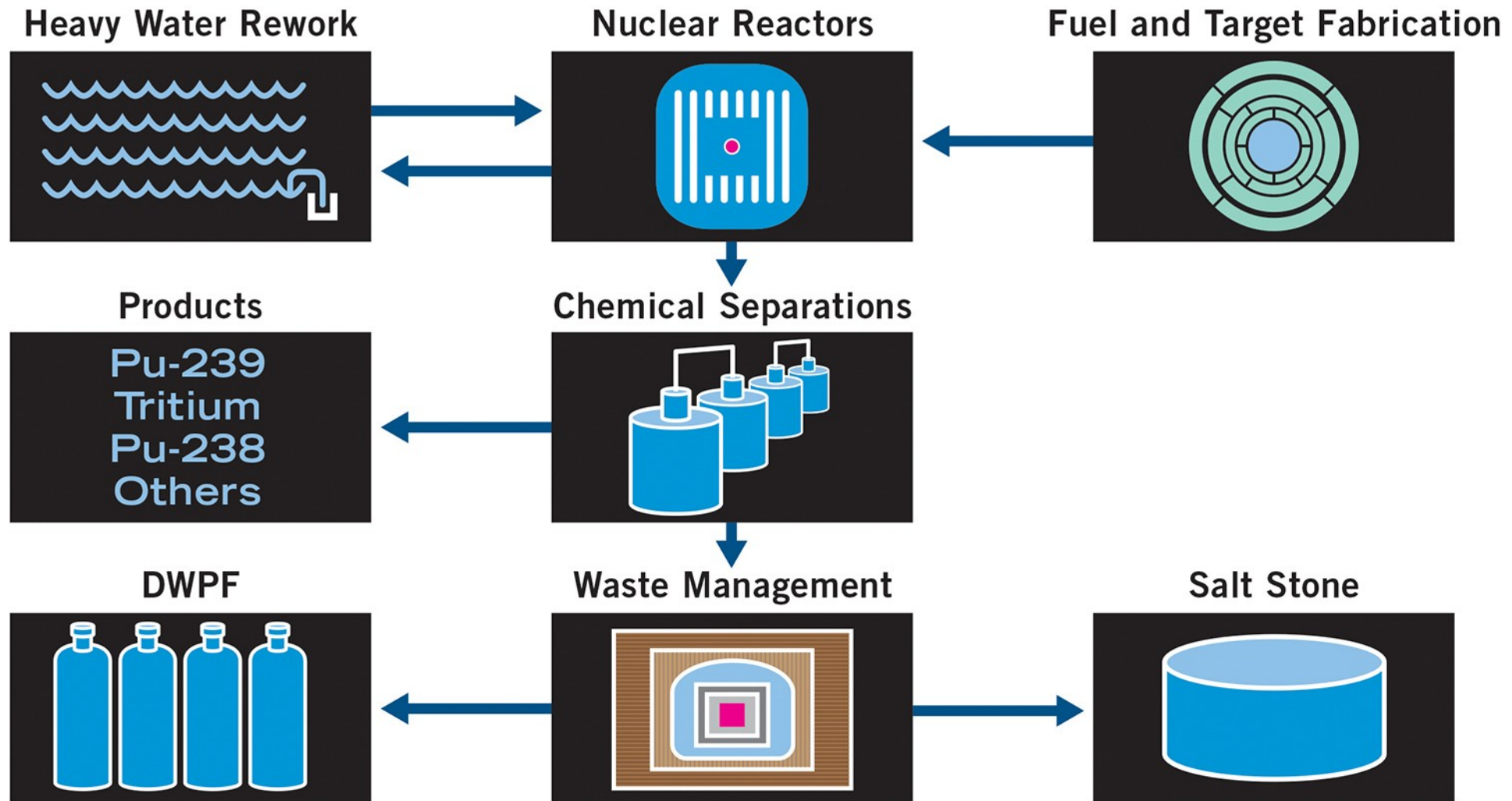


**J, S, Z Areas**  
Waste management facilities

**E Area**  
Solid Waste Management

**C, K, L, P, R Areas**  
Nuclear reactors

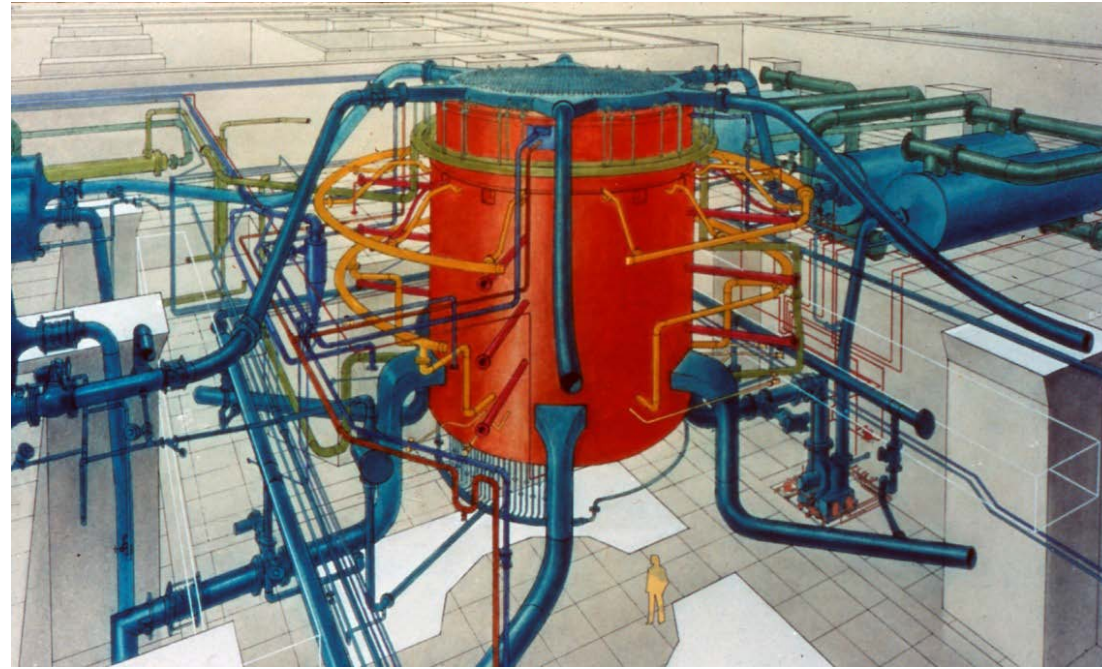
# SRS production experience: Nuclear manufacturing





# SRS production experience

Heavy water,  
fuel fabrication,  
reactor operations



SRS production reactors



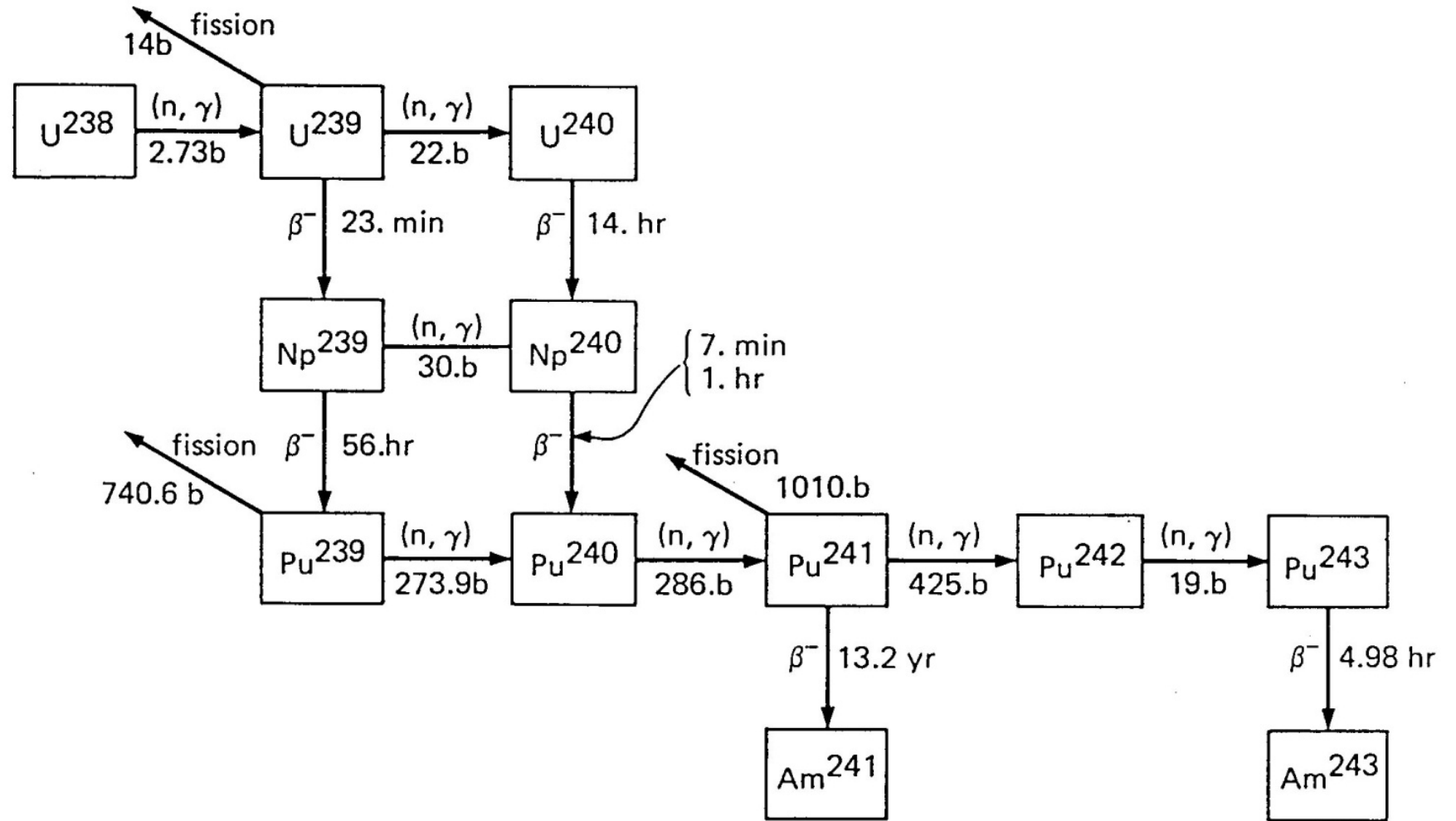
Heavy Water extraction, distillation and electrolysis



Manufacturing fuel and targets  
by alloying, casting and extruding

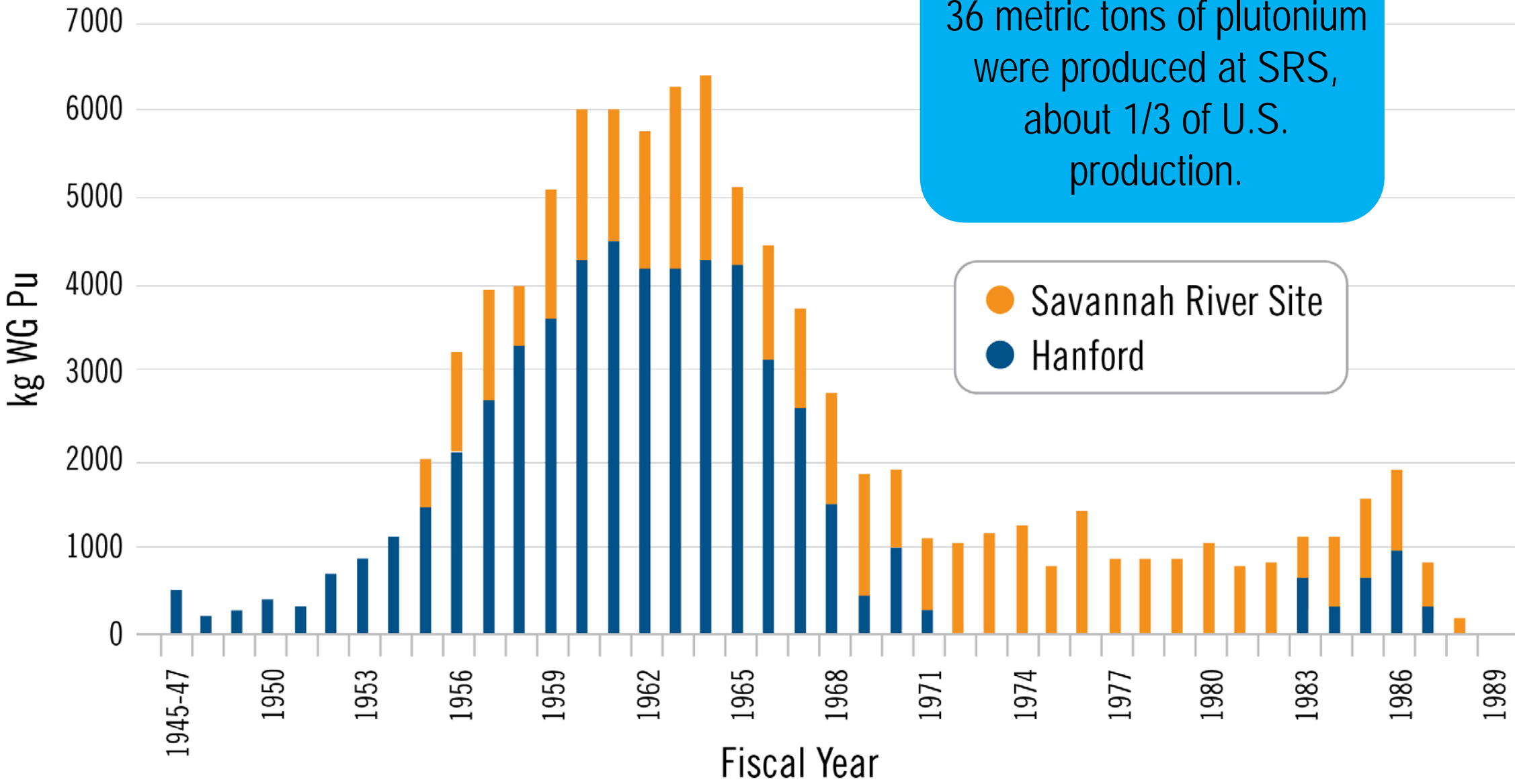
# SRS production experience

## Plutonium production



# SRS plutonium production experience

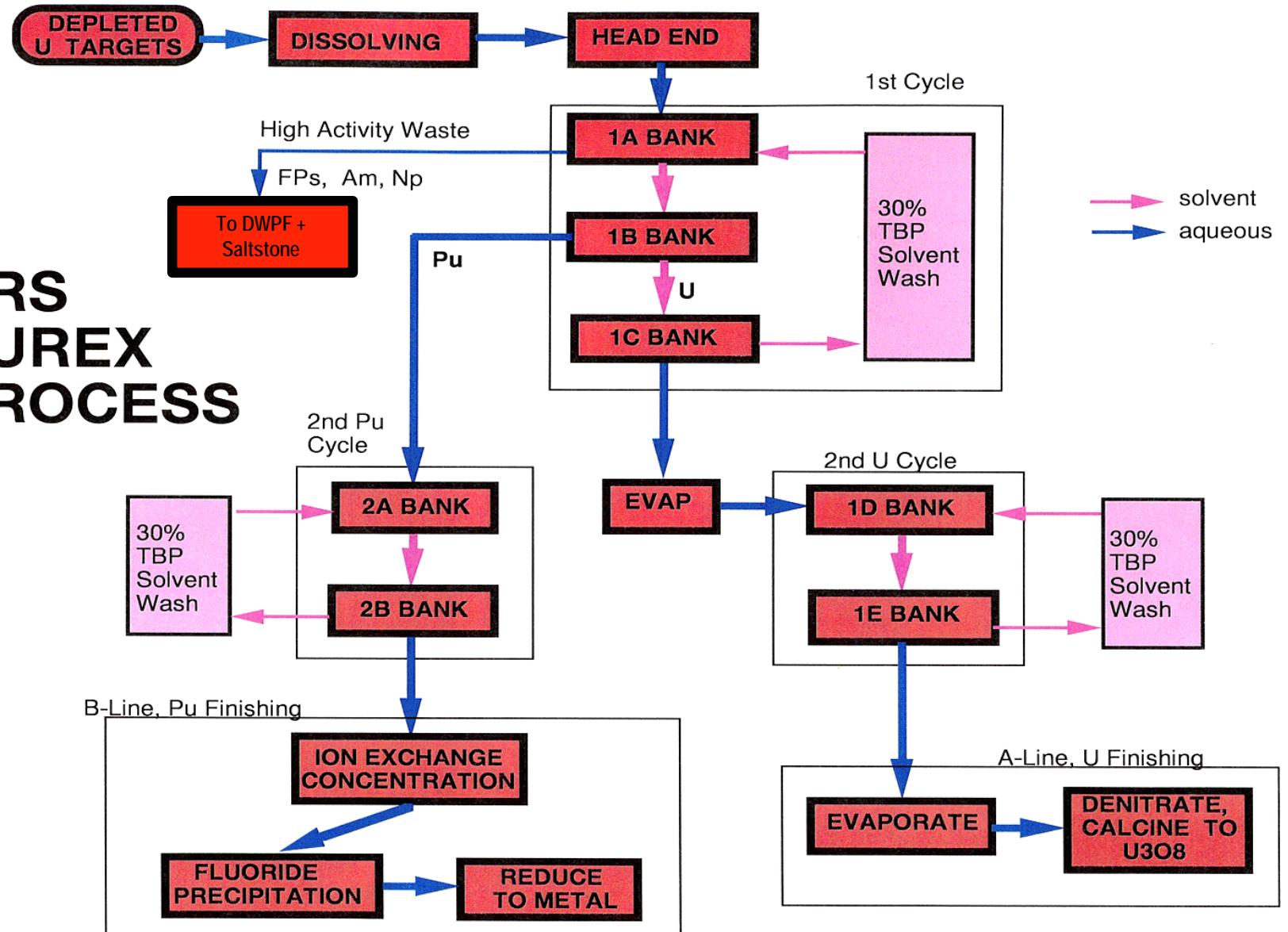
36 metric tons of plutonium were produced at SRS, about 1/3 of U.S. production.



# SRS production experience

## Plutonium extraction

### SRS PUREX PROCESS

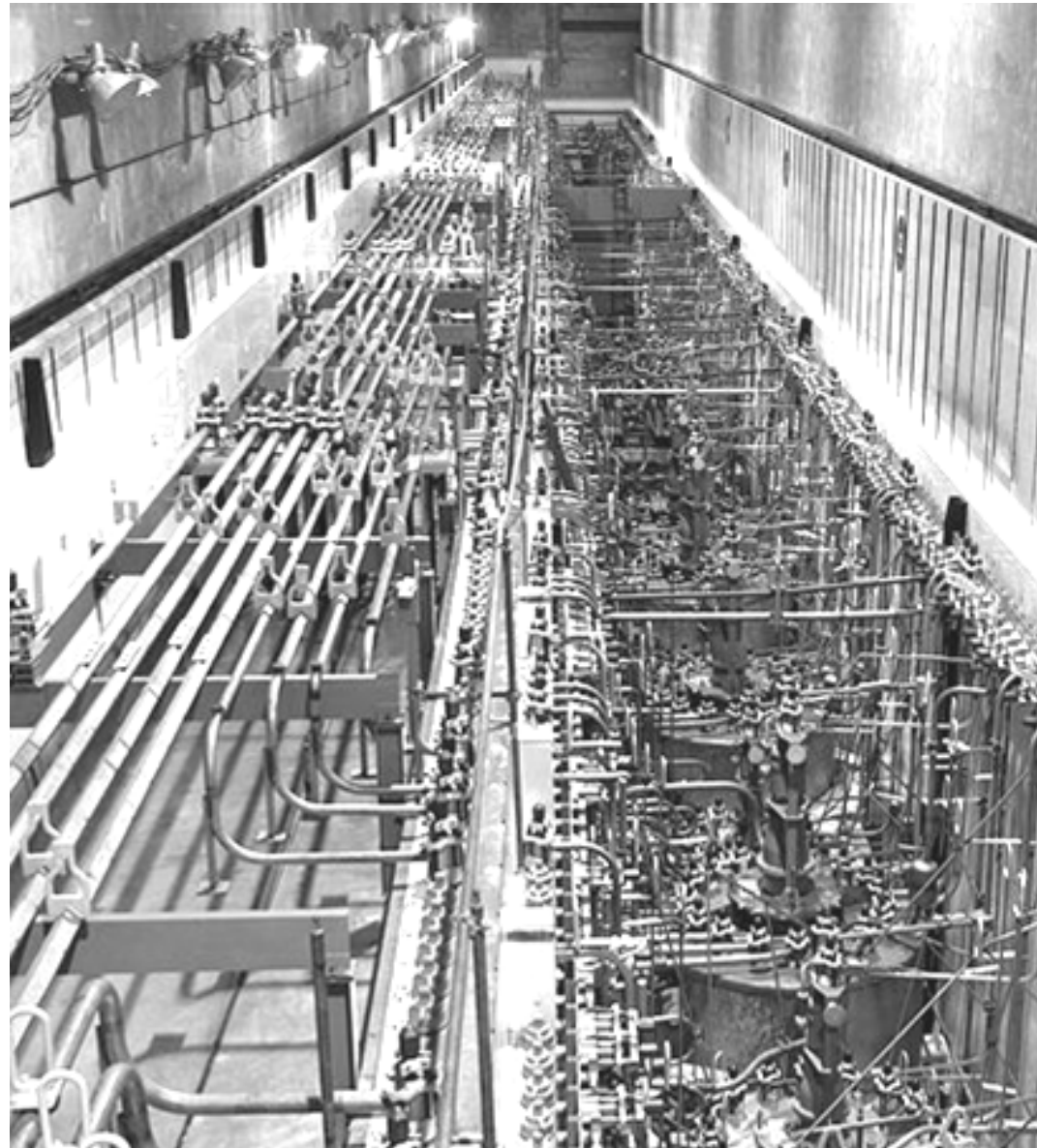


# SRS production experience

## Plutonium manufacturing



Plutonium metal ingot



Canyon operations



Plutonium tri-fluoride



Glovebox operations

# SRS production experience

## Other SRS products



Neptunium oxalate



Plutonium 238: Heat source  
for deep space probe  
electric generator



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.



Solid Waste  
Management facilities



TRU waste drum loading



TRU waste shipment to Waste Isolation Pilot Plant



# 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.



High radiation area inspection robot



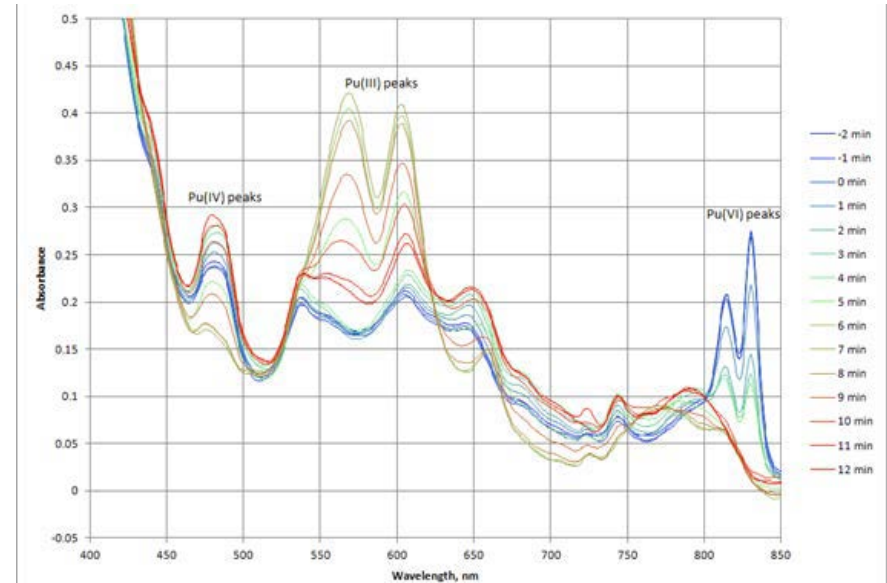
Chemical flowsheet development



Equipment integrated with H Canyon sampler

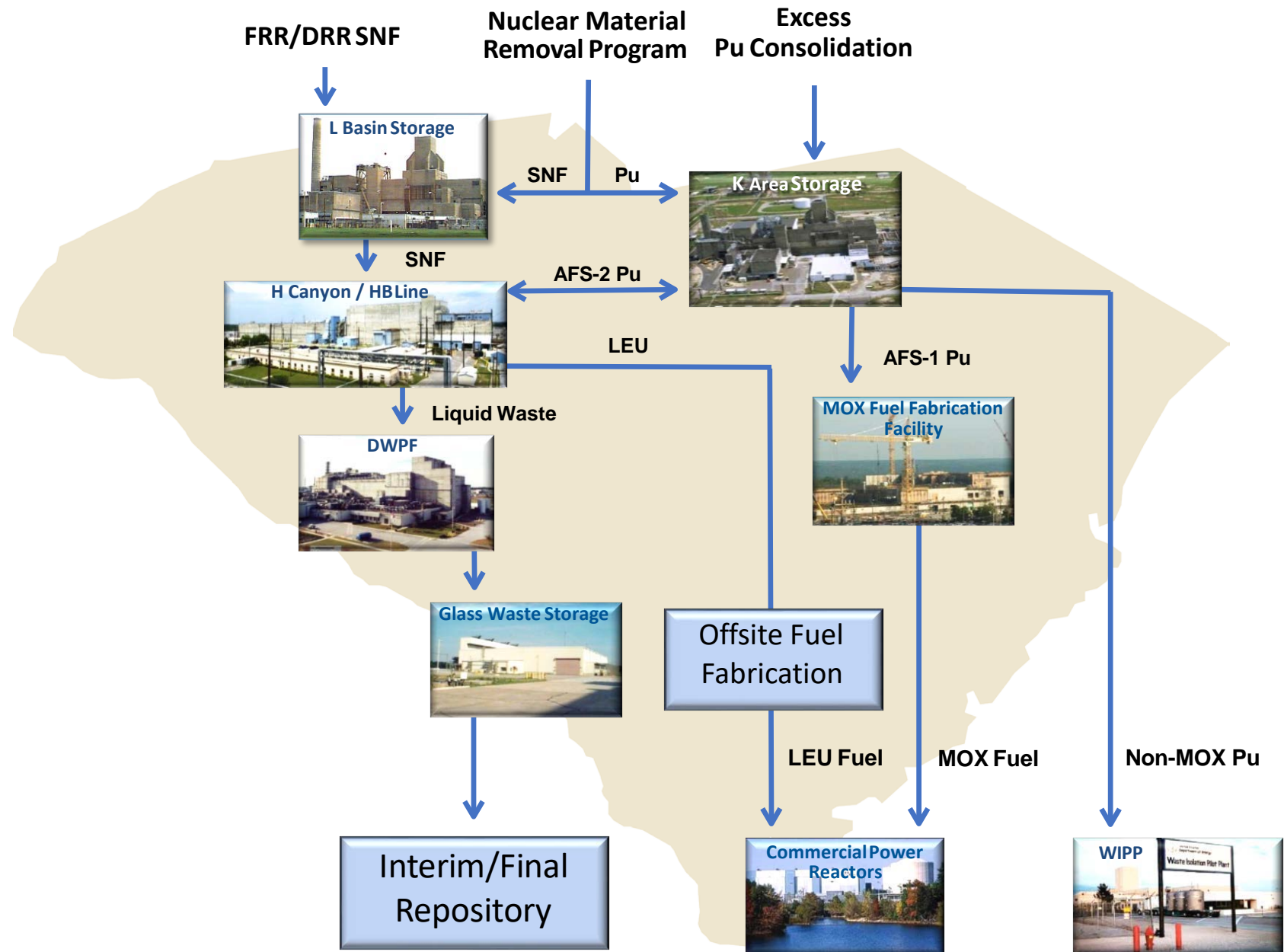


Pu concentration analysis for online monitoring in HB Line



# SRS nuclear materials management

- FRR Foreign Research Reactor
- DRR Domestic Research Reactor
- LEU Low Enriched Uranium
- AFS Alternate Feed Stock
- MOX Mixed Oxide
- SNF Spent Nuclear Fuel



# Pit experience at SRS

## Pit handling experience

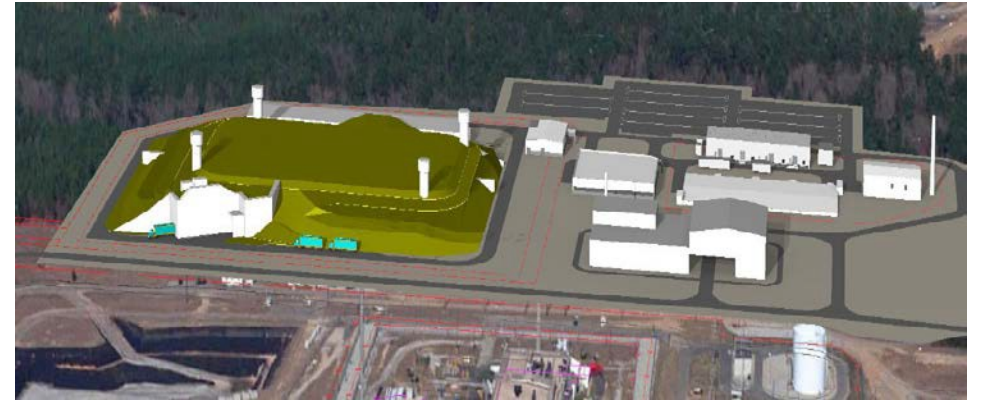
- Past receipt and storage of Pu pits
- Bisected and dissolved pits for recycling and purifying plutonium in FB Line special recovery
- Alloyed Pu with Ga before shipment to Rocky Flats

## Pit facility design and construction projects

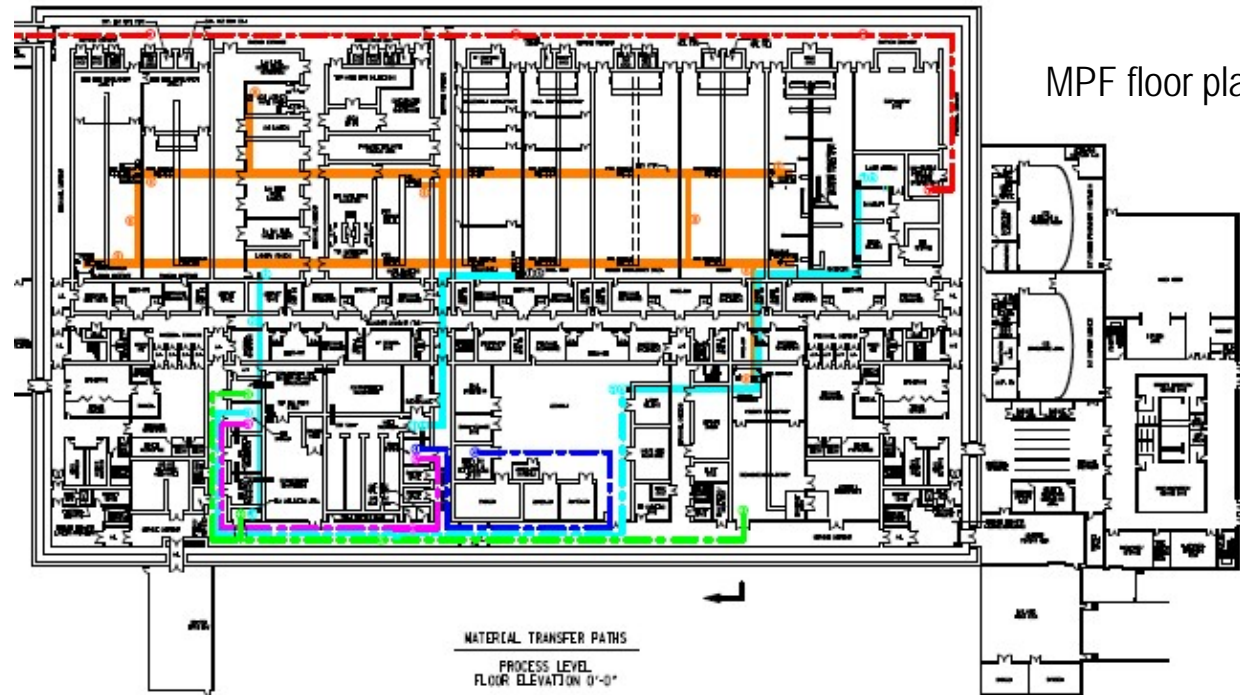
- New Special Recovery and Pit Storage Facility: Designed, constructed, and turned over to Operations
- Actinide Packaging and Storage Facility: Designed and ground broken, but not constructed
- Modern Pit Facility: Design only
- Pit Disassembly and Conversion Facility: Conceptual design only

## Parent company pit experience

Both Fluor and HII on team at LANL



Final APSF artist rendering

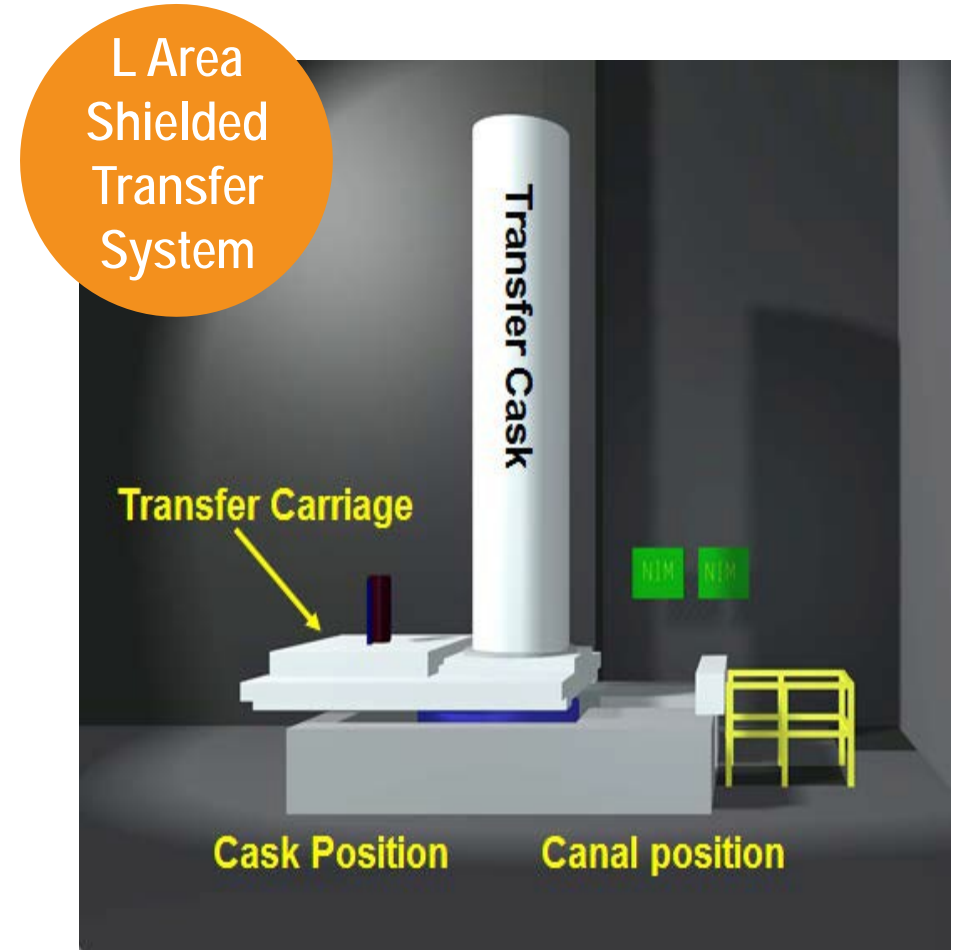


MPF floor plan

# 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 LArea
- 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



# SRS repurposed facilities



K Reactor



H Canyon, HB Line



F Canyon

- K Reactor building** → Non-pit plutonium storage
- K Interim Storage** → Blend down plutonium oxide
- L Reactor Spent Fuel Pool** → Storage for foreign/domestic research reactor fuel
- H Canyon** → Recovery of plutonium-238 from neptunium billets  
→ Recovery of plutonium-239 from LEU reactor fuel
- H Canyon Truckwell** → TRU repackaging facility  
→ Unloading liquid HEU for recovery in H Canyon
- HB Line Phase I** → Plutonium scrap recovery to plutonium blend down
- HB Line Phase II** → Changed from processing plutonium to oxide, then neptunium, and back to plutonium
- HB Line Phase III** → Plutonium-238 recovery to plutonium-239 repackaging
- F Canyon** → Plutonium recovery to TRU repackaging (ARRA)  
→ Americium/curium recovery from MPPF reactor targets

# 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

## Savannah River National Laboratory

# 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:

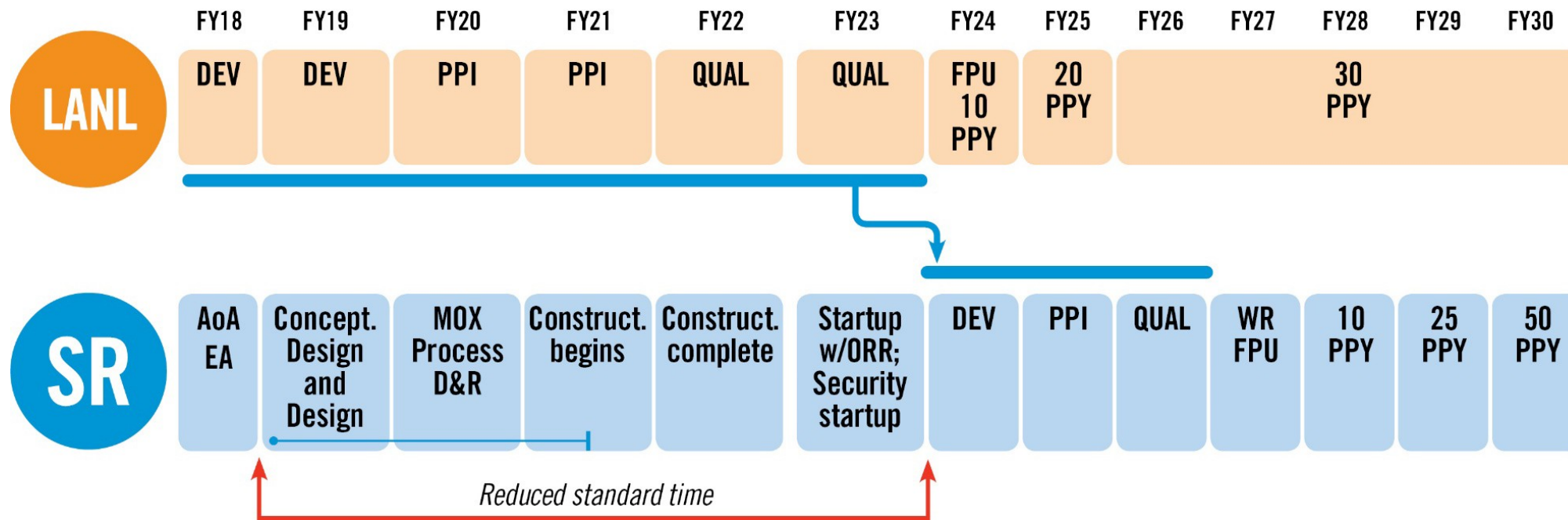
Extensive experience, capabilities to characterize and analyze plutonium

- 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  
DEV: Development Phase

D&R: dismantlement and removal  
DEV: Development Phase

EA: Engineering Assessment  
FPU: First Production Unit

ORR: Operational Readiness Review  
PPI: Process Prove-In Phase

PPY: pits per year  
QUAL: Qualification Phase  
WR: War Reserve

# 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



FY14-present  
Approximately 500 per year  
over the next three years



during  
past five years



of non-retirement  
eligible employees seeking  
other employment



exceeds Office of Federal  
Contract Compliance  
Programs 6.7% goal



down from  
54 in 2008



average age  
of new hires



in average days for eQIP  
to DOE for clearances

# Workforce Sustainment: Preparing the pipeline



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



reached through STEM-related Education Outreach 2016-2018



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



total funding provided by SRNS to higher education institutions since 2008



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.

**11** partnerships with local universities and technical colleges

- Aiken Technical College
- Augusta Technical College
- Clafin 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

# 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**
  - NQA-1, NNSA Policy letter NAP-24A, Weapon Quality Policy, U.S. DOE order 414.1D, DOE Quality Assurance manual
- **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**