

An Overview of the Savannah River National Laboratory



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Environmental & Chemical Process Technology

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SRNL Mission



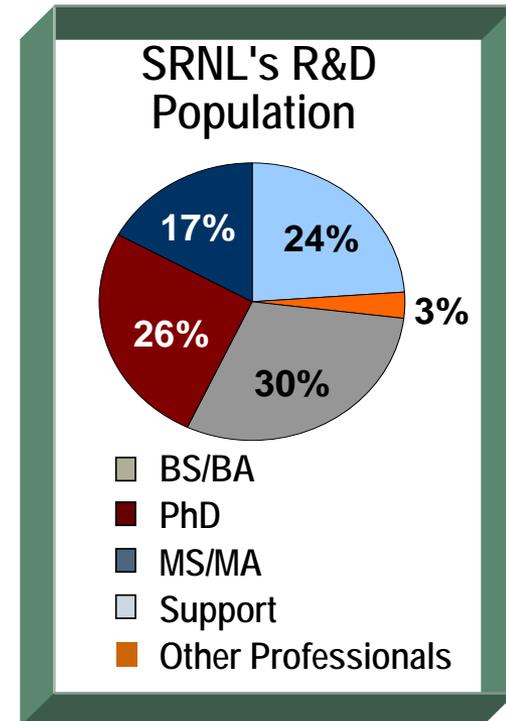
- The mission of SRNL is to
 - Enable the success of SRS operations.
 - Provide technical leadership for future site missions.
 - Utilize our technical strength to provide vital support for national programs.
- The vision of SRNL is to
 - Be the nation's premier applied science laboratory in National Security, Energy Security and Environmental, Science and Technology.

SRNL Today – Our People



SRNL continues to put science to work
for the nation

- Total staff- 940
- Research staff – 752
- 26 percent with PhDs
- Wide range of disciplines
 - Chemists
 - Mech Eng
 - Chem Eng
 - Elec Eng
 - Met Eng
 - Nuc Eng
 - Other Eng
 - Physicists
 - Bio Sci
 - Math/Comp Sci



SRNL Capabilities

- **Integrated chemical process development**
 - Laboratory, bench, and pilot scale
 - Strong analytical chemistry capability
 - Analytical methods development
 - At-line instrumentation
 - Specialized analytical laboratories
- **Materials Development and Analysis**
 - Metallurgy, ceramics and corrosion analysis
 - Glass and grout formulation and development
- **Process and engineering modeling**
- **Radioactive process development and plant support**
- **Nuclear engineering**
- **Mechanical Engineering, Remote Systems, and Robotics**

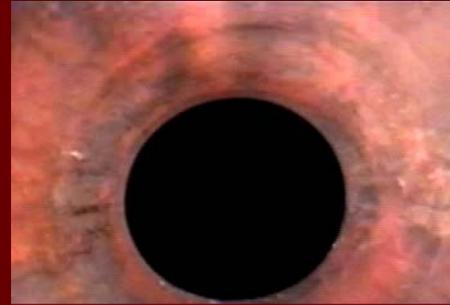
SRNL: Our Competencies Have Been Formed and Demonstrated Through Technology Delivery



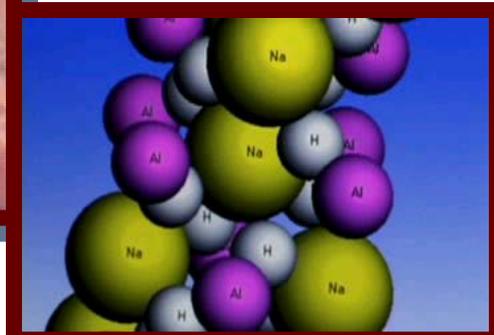
Process Development



Real Time Solutions



Plant Support

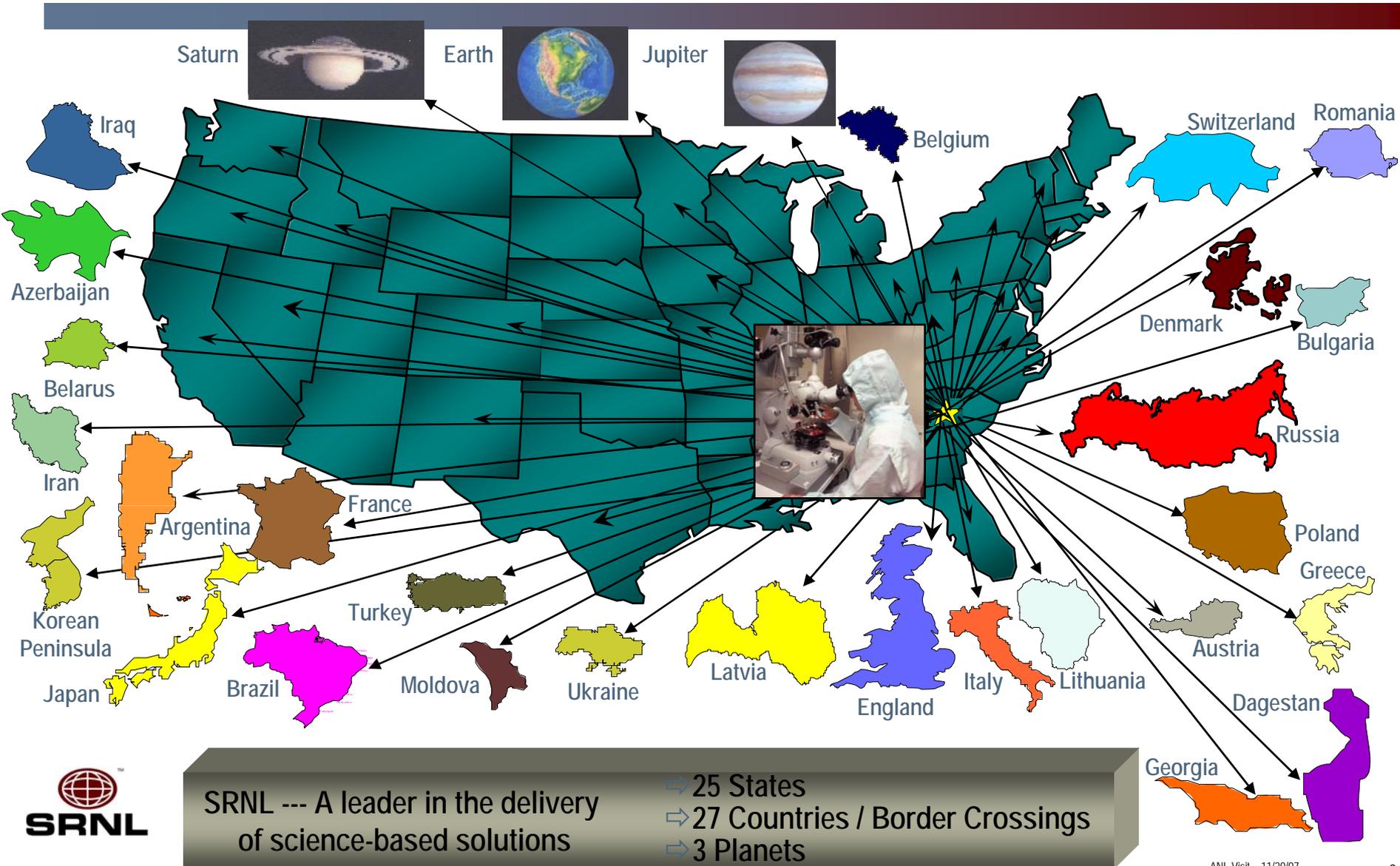


Hydrogen Research



Solve Problems for Other Government Agencies

SRNL: Where We Work...



SRNL Support for National Programs

Business Volume (FY07) (\$M)

Site EM	67.0
Site NNSA	18.0
Offsite NNSA	32.0
Office of Science	7.0
Other Federal Agencies	13.0
Other DOE	15.0
Commercial	<u>2.0</u>
	\$154M

- ~\$154M annual business
- 45% of funding by offsite sources



A diverse customer base

SRNL Research Emphasis Areas



National Security

- Tritium Technology
- Plutonium Technology
- Homeland Security
- Non-Proliferation Technology



Energy Security

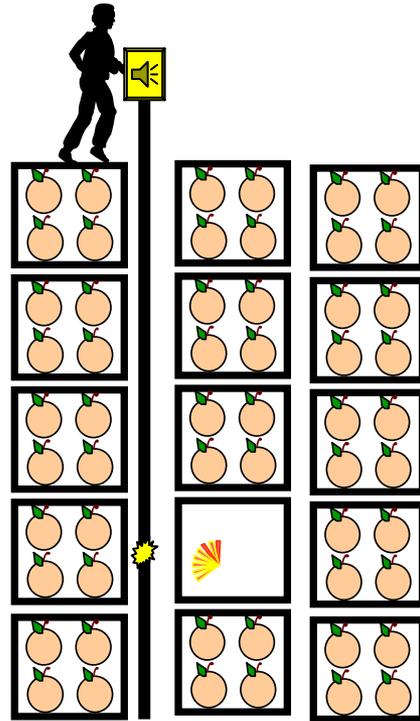
- Hydrogen Technology
- Nuclear Energy Projects



Environmental Science and Technology

- Materials Disposition
- Cleanup Technologies

National Security



- Plutonium disposition
- Reactor fuel programs
- Nonproliferation
- Law enforcement
- Homeland security
- Weapons program
- Warfighter technologies

SRNL is providing a prototype of RAD ROPE to the US Coast Guard



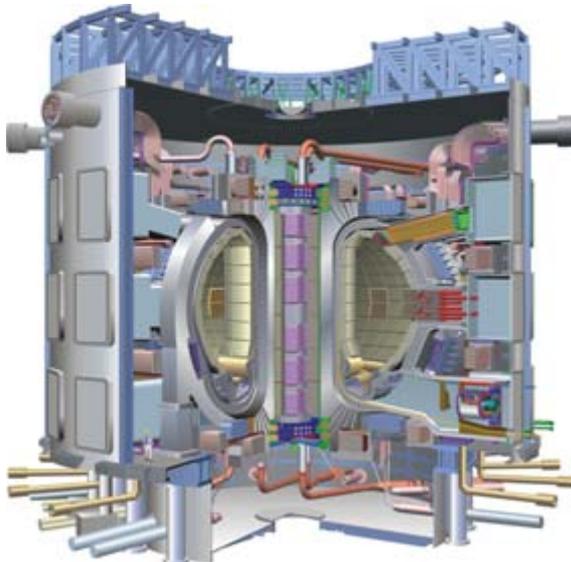
Competencies supporting critical missions of our nation

Energy Security

Center for Hydrogen Research

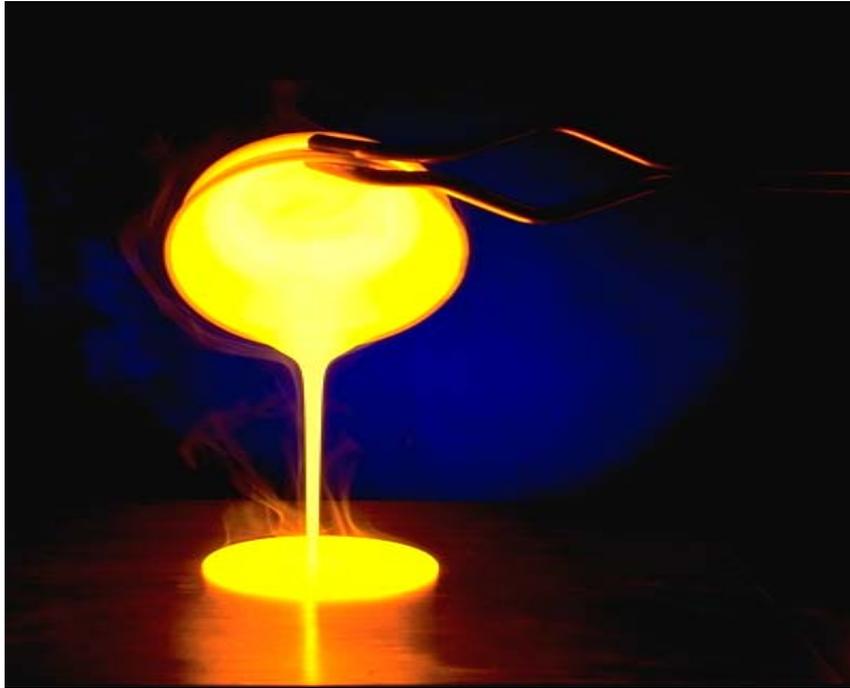


The ITER Tokamak



- National Energy Programs
 - Hydrogen Technology
 - Storage
 - Production & Separation
 - Safety and Codes & Standards
 - Renewable Energy
 - H₂ & Fuel Cell Vehicles
 - Alternative Fuels
 - Carbon Sequestration
 - Nuclear Energy Projects
 - Thermochemical Production of Hydrogen
 - Global Nuclear Energy Program (GNEP)
 - ITER

Environmental Science and Technology



Glass Formulation Tailored to Key Process Improvements

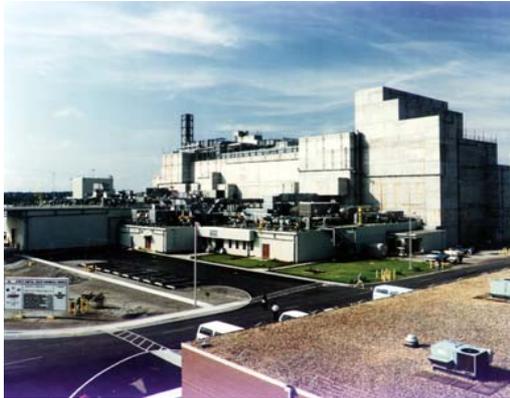
- Vitrification & material storage
- Chemical processing
- Facility disposition
- Soil & groundwater projects

SRNL – DOE's EM Corporate Laboratory

Providing Innovative Solutions to Solve Complex Problems



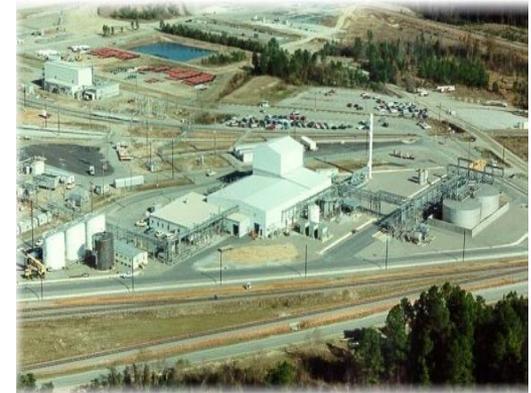
Support for All EM/Closure Activities



DWPF



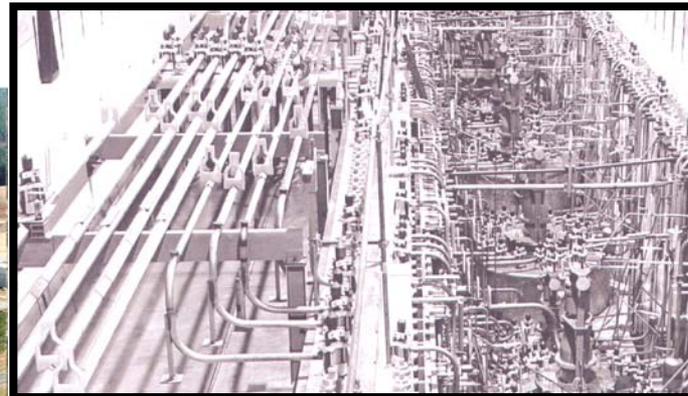
Tank Closure



Effluent Treatment Facility



Saltstone



F-Canyon



Vault Disposal

An 'Embedded' National Laboratory

- National Laboratory at SRS
 - EM activities have been a major mission for 40 years
 - “World-class” expertise in HLW/LLW technologies
 - Applied R&D
 - Focus on solving customer problems
 - Project/results oriented “We Put Science to Work”



Engineering Development Laboratory



Sampler Technology

Facilities for All Types of Testing



Intermediate-Level Cells



Gloveboxes



Shielded Cells



Radiological Hoods



ACTL - New Nonradioactive Lab

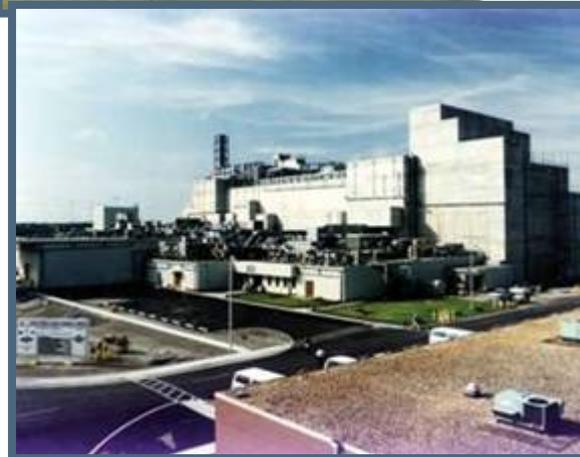


Nonradioactive laboratories

SRNL Capabilities – From Conception to Closure

- Pretreatment – Tank Farm
 - Supporting the management & retrieval of waste from Tank Farms
- Immobilization
 - US largest operating vitrification & LAW grout plants
- Tank Closure Acceleration
 - **Only HLW tanks closed in US**
- Environmental Remediation Expertise
- Pu Management
- TRU Waste Management

SRNL Core Capabilities
Process Development, Pilot Testing, Design, Construction, Regulatory Document & Startup Support, Production Support & Process Optimization



SRNL's New Environmental Lab - From Research to Full Production

Pretreatment & Tank Farm Operations Support

- Sampling Tools
- Cross Country Shipping Expertise
- Waste Characterization/ Production Analytical Development
- Waste Retrieval & Inspection
- Slurry Flow Characterization
- Simulant Development
- Filtration
- Ion Exchange
- Solvent Extraction
- Evaporation
- Process Modeling & Planning
- Safety Basis

SRNL Accomplishments

- **Alternative Resin Development**
- **Completed 100M Research Program for Hanford**
- **Co-Developed Caustic Side Solvent Extraction for SRS**
- **Developed Sludge Washing Process**
- **Developed Baseline Analytical Methods for Slurry Characterization**

Full Scale Pump Testing



SRNL Cells Unit Filter



Remote Sampling Tool



Waste Immobilization – Science to Plant Optimization

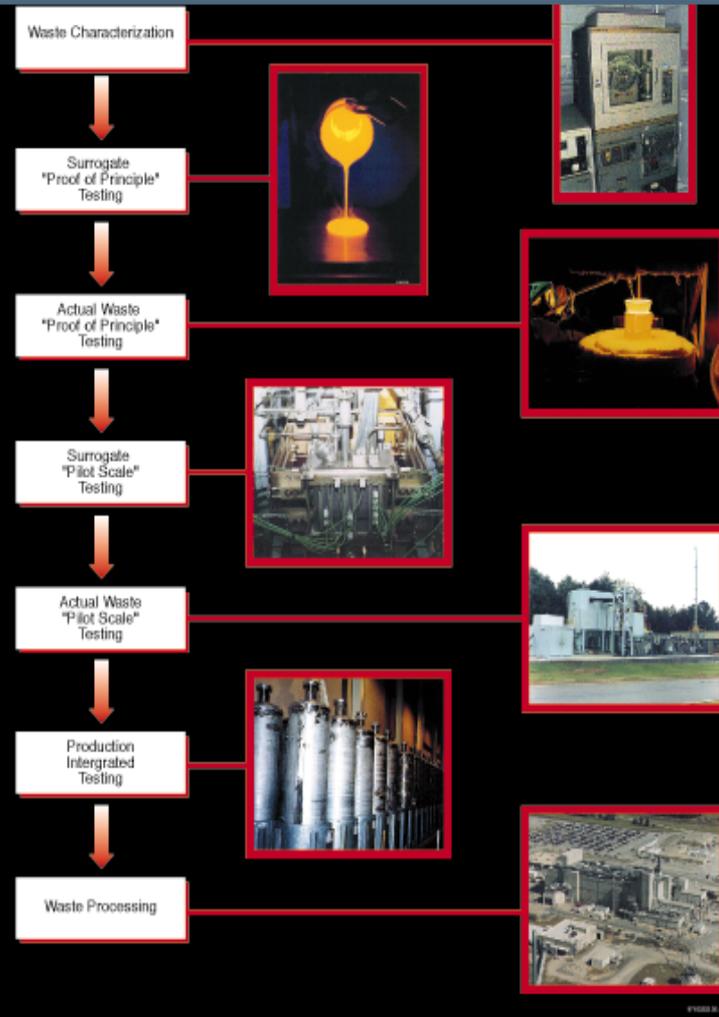
- EM R&D, Design/Construction, Startup & Plant Support – We are the only National Lab with experience in all these areas
- Internationally Recognized Grout Expertise
- Internationally Recognized Glass/Ceramic Science Expertise
- Supporting the US Largest HLW Waste Glass & LAW Grout Plants

SRNL Accomplishments

- Invented Baseline DWPF Process
- SRNL saved EM \$180M YTD; \$1,450M lifetime
- Eliminated the need for 1,000 canisters, reducing Yucca Mountain disposal costs by \$500M
- Co-Developed Idaho Calcine Glass Formulations – Tested in Melter
- Developed Small Scale Steam Reformer & Tested with Idaho Wastes



SRNL R&D Process Development Methodology

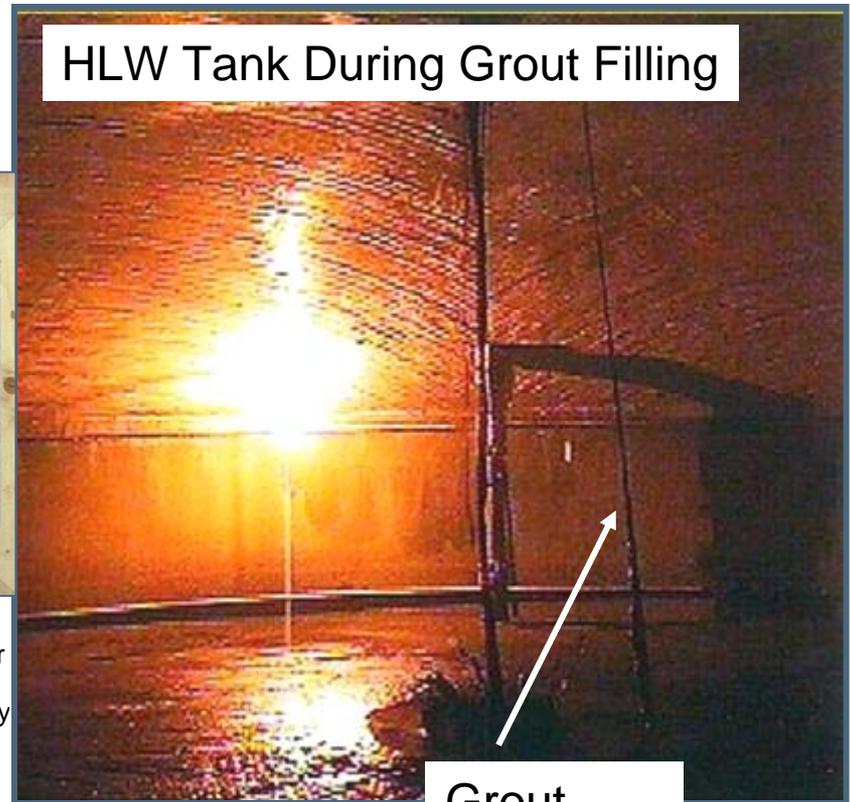


Tank Closure Acceleration

■ Tank Closure

- Proven Grout Formulations
- Performance Assessments
- Chemical Cleaning
- Sampler Technology
- Applied Robotics Experience

SRNL Accomplishments
• **Closed Two HLW Tanks**



Grout
Stream

- **SCDHEC:** “The high-level tank closure process is a positive example of the DOE, the contractor and the regulatory community working together toward a common goal. Under a very aggressive schedule, we pooled our technical and regulatory resources to tackle this challenging project (Tank 20 closure).” Keith Collingsworth, SCDHEC Federal Facility Liaison.



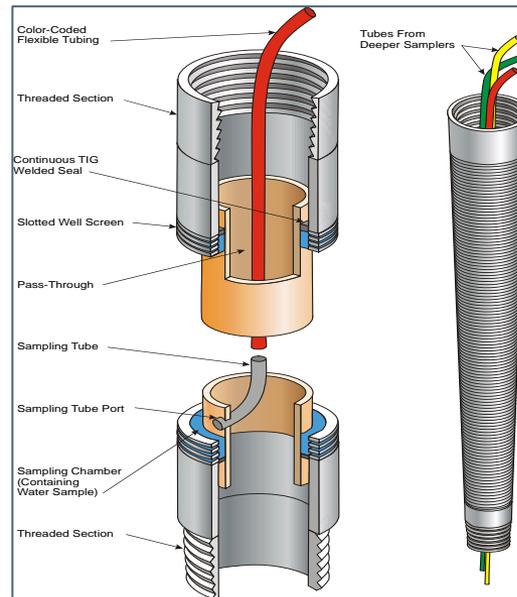
Environmental Remediation

SRNL is Recognized Leader in Reliable & Low Cost Environmental Remediation Technology

what we do - environmental



GeoSiphon Makes Effective Use of Water



Strata Sampler – Multi Sampler Using One Well

- SRNL can assist in its environmental planning and remediation
- Many years of expertise solving environmental insult “in-situ” and ex-situ
- “Applied Science” nature of laboratory – *Solutions Provided in Near Term*



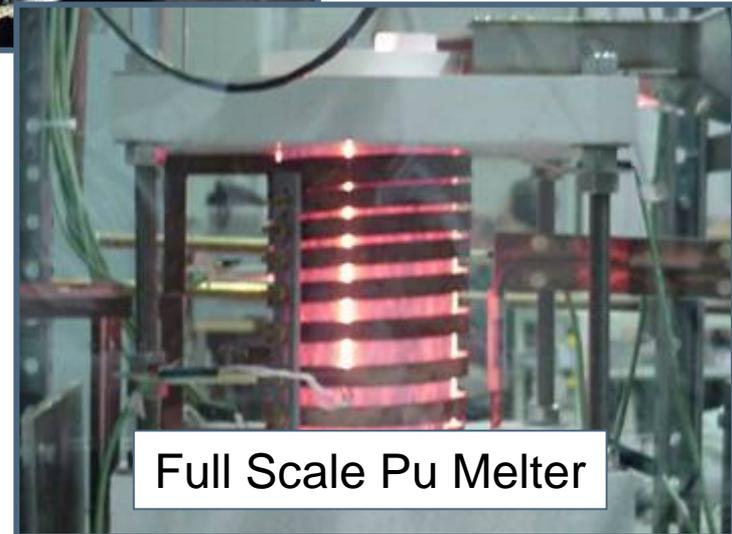
Ground Water Modeling

Pu Management & Immobilization

- Supporting the Nation's Pu Stockpile – Located at SRS
- 3013 Storage Cans
- Pu Vitrification Demonstration – Can-In Can
- Pu Vitrification – Full Scale Pilot



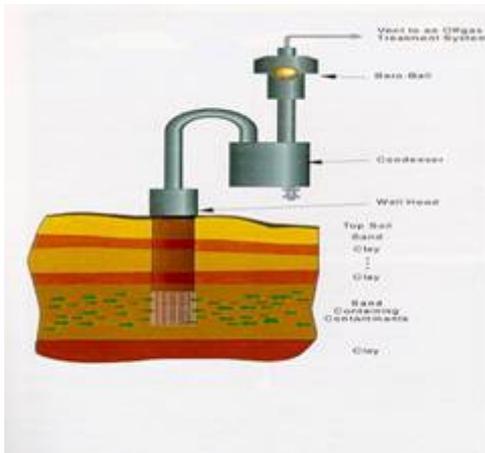
Full Scale
Canister – Pour
At DWPF



SRNL Technology Deployment – Safe, Reliable, Low Cost Solutions Provided to Solve Today's Problems

- **DWPF Melt Cell Crawler**

(Designed & built in 10 days;
completed cleanup job in 8 days;
2 days ahead of schedule)



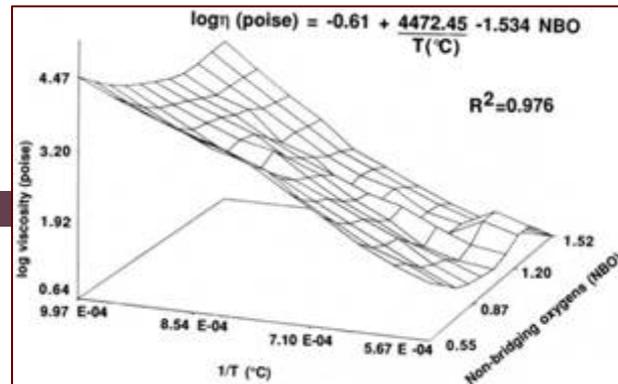
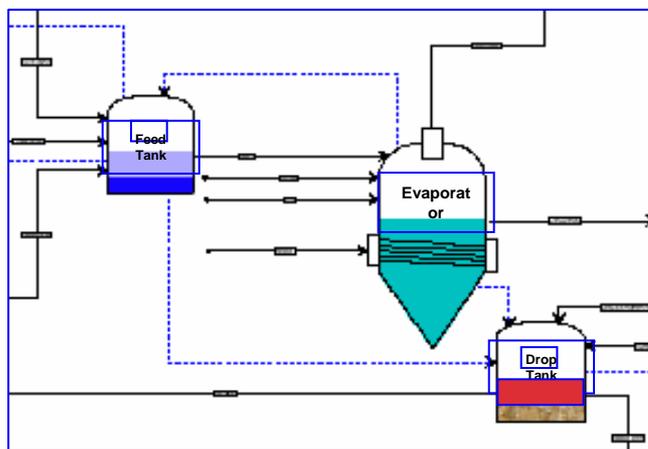
- **Baro Ball™**

Removes volatile contaminants
from soil-Very Low Cost

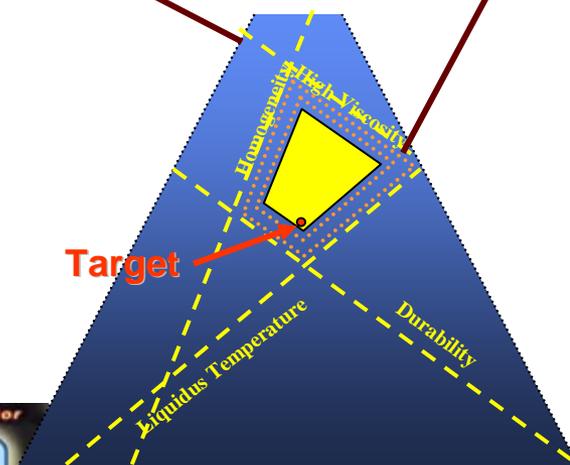
SRNL Technology Deployment – Models Are Deployed in the Field & Operate Plants

- DWPF Glass Product & Composition Control Models -
- Evaporator Model
 - Simplified for facility operating staff use
 - A building block for an integrated flowsheet model
- Integrated Flowsheet and Planning Model
 - Detailed engineering calculations
 - or
 - Faster planning calculations

SRS Evaporator Model



Glass Formers



DWPF Glass Control Model



Integrated Flowsheet Model



SRNL Technology Demonstration Capability

- Pilot Operations:
 - Evaporation
 - Filtration
 - Ion Exchange
 - Melters
 - Chemical Reactors



Key Capabilities/Business Areas

- Chemical process research – lab- to pilot-scale
- Separations science
- Actinide chemistry and processing
- High level radioactive waste characterization and treatment
- Radioactive waste tank closures
- Waste and effluent treatment
- Solid radioactive and transuranic waste treatment
- Groundwater & soil remediation
- Decontamination

Key Products

- Complete product analysis, characterization, qualification, and flowsheet development
- Glass, ceramic, and grout formulations and processing
- Small-scale to full-scale demonstrations (non-radioactive)
- Small-scale radioactive demonstrations
- Process design and equipment specification
- Process and product modeling
- Performance modeling for LLW disposal
- Startup and operations technical advisory services

Key Customers & Programs

- Savannah River Site (SRS)
 - Nuclear Materials Management [F-Closure/H-Completion]
 - Liquid Waste Disposition
 - Waste Solidification [Defense Waste Processing Facility (DWPF) & Saltstone]
 - Environmental Restoration/Facility Decommissioning
 - Low-Level & Solid Waste
- Other DOE Sites - Hanford, INL, Oak Ridge, Small Sites
- EM-21 & Office of Science
- Lab-Directed R&D

Chemical Process Research Facilities

- Non-radioactive laboratories
- Radioactive hoods
 - Variety of sizes
- Radioactive glovebox laboratories
 - Single units to 6-glovebox systems
 - Stainless steel and Kynar lined
 - High Activity Waste System
 - Currently, 400 grams SNM in a laboratory
- Intermediate-Level Cells
- Shielded Cells



SRNL Shielded Cells

- 16 cells, each 6' by 6' by 15' high
- 3' x 3' Lead-glass windows, 3' thick
 - Designed to reduce 10,000 R/hr to 1 mR/hr at the face
 - ~10,000 Ci source w/ 1 Mev γ 's



SRNL Shielded Cells

- Each cell has 2 electrically-assisted manipulators
 - 6-axes
 - 20-pound lifting capability
 - Can pass items over/thru-the-wall to adjacent cells



SRNL Intermediate-Level Cells (ILC)

- 2 Cells; Each with 2 windows with 4 manipulators



- Designed to shield a 5 Ci Cs^{137} point source



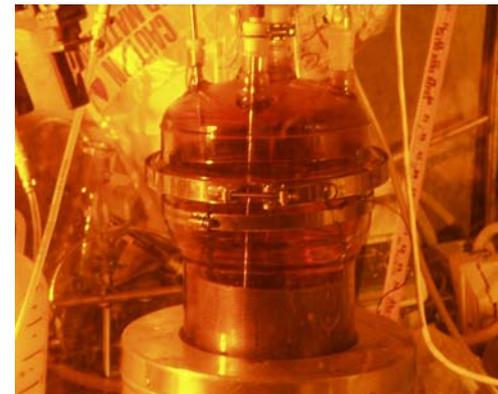
SRNL Intermediate-Level Cells (ILC)

- Items come in through hood pass-through or via doors on back of cells



Chemical Process Development

- Dissolution/Fuel Processing
- Ion Exchange
- Solvent Extraction
 - Centrifugal Contactors
 - Mixer Settlers

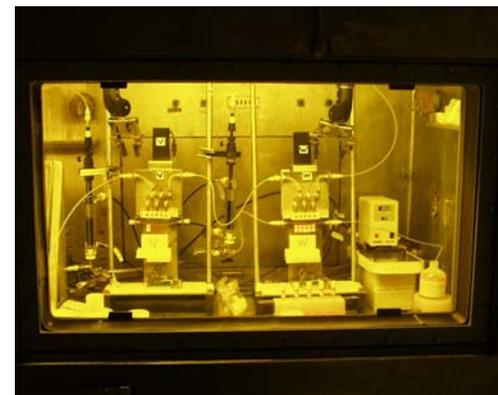


Dissolution of Dresden Fuel



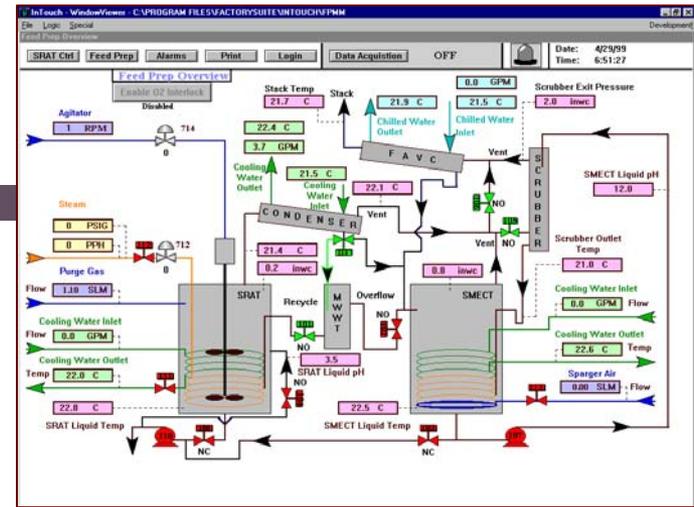
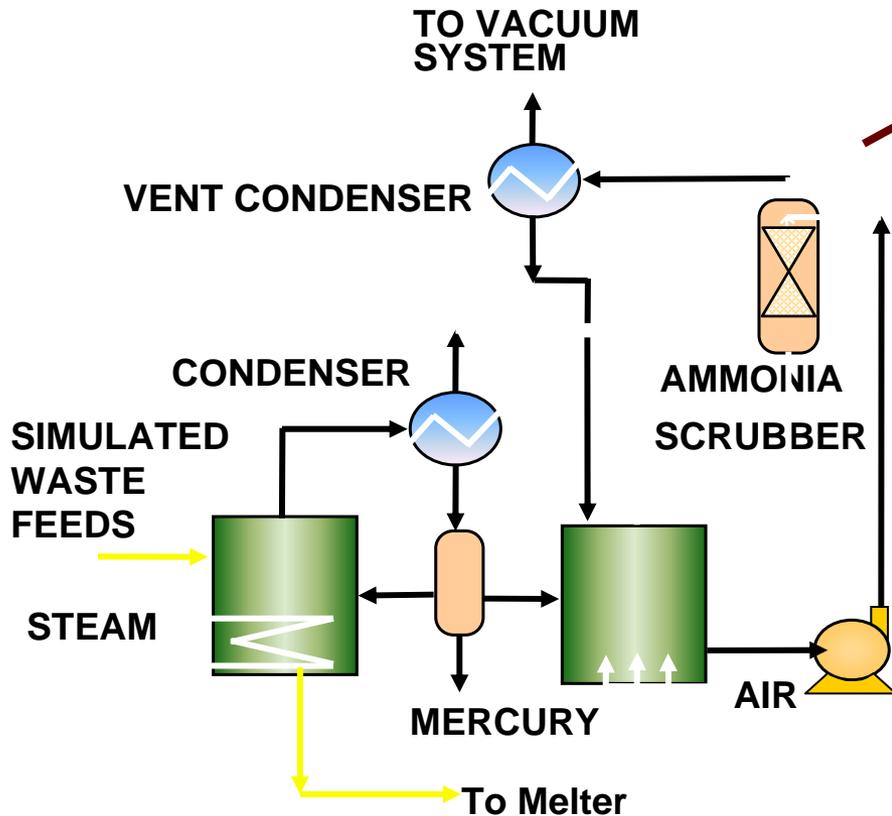
Mini Mixer Settlers for HEU Blenddown

Centrifugal Contactors for UREX Test



Ion Exchange of Hanford HLW Waste

Pilot Scale Testing

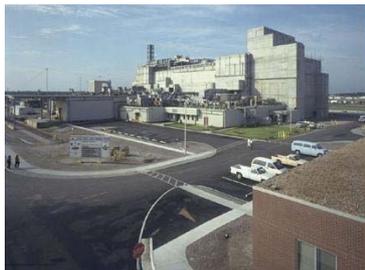


1/240th Pilot Scale ITS
Melter Feed Preparation System



Leveraging Our Experience Base

SRNL Provides Process Development & Basic Research for the SRS Accelerated Closure Missions



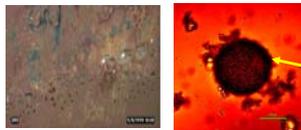
SRS Defense Waste Processing Facility

SRNL Developed, Tested & Assisted with Startup of the DWPF Process

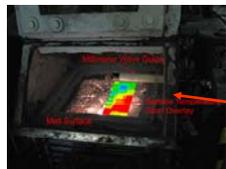
Glass Technology Improves Waste Loading & Dramatically Decrease Plant Life Cycle Costs



Antifoam Technology Developed with University Collaborations & Office of Science Basic Research Grants

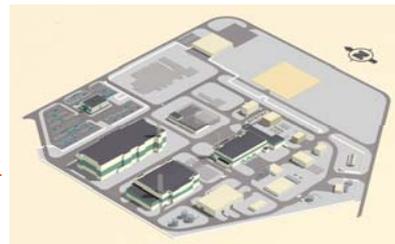


Waste Foam



Advanced Sensors (Temp/Viscosity) For Harsh-Remote Environments

SRNL Lessons Learned Applied to Meet the Hanford Environmental Mission



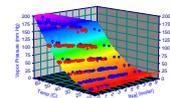
Hanford, WA River Protection Project Waste Treatment Plant "World's Largest Waste Treatment Plant"



Ion Exchange Testing with Hanford Samples



Experiments/Modeling Integrated Together

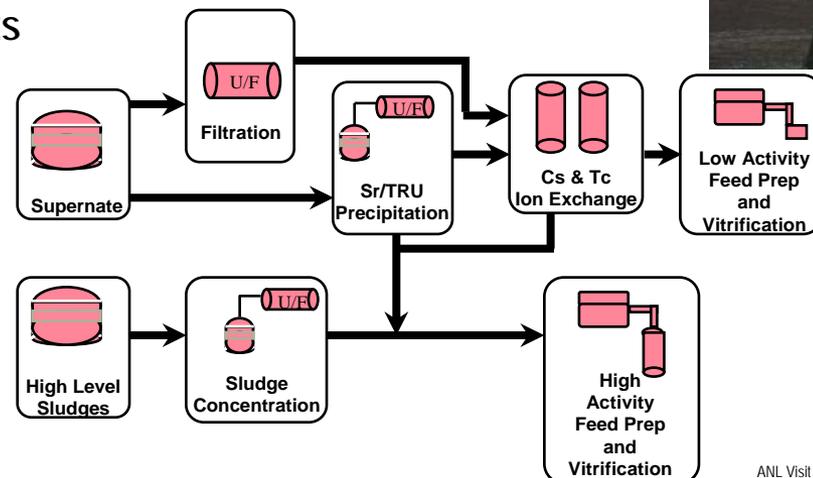
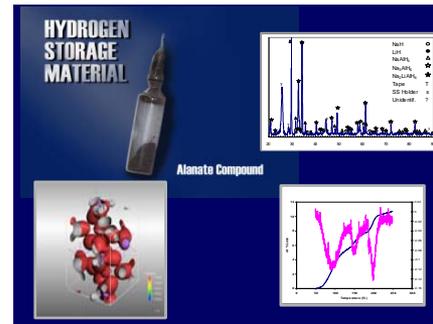


Pilot Plant Research Provides Real-World Solutions



Technology Transfer and Commercialization

- SRNL is a leader in applied science/technology solutions for the US Government
- Technical Leadership Areas:
 - Hydrogen technology – 12 patents
 - Nuclear sensors and detectors – 25 patents
 - Environmental remediation – 20 patents
 - Specialty equipment (robotics/samplers) – 62 patents
 - Chemical processing/ Material science – 27 patents





Savannah River National Laboratory

Environmental Management's *Corporate Laboratory* applies its unique technical capabilities to reduce technical uncertainties in order to assist sites in meeting cleanup requirements by providing applied research and development in the areas of:

Characterizing, processing, and stabilizing high-level radioactive waste



Closing high-level radioactive waste storage tanks

Characterizing and cleaning up groundwater and soil

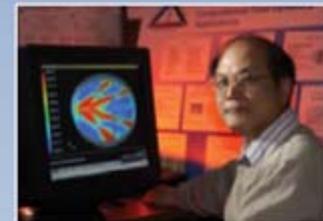


Managing, storing, and processing spent nuclear fuel

Managing surveillance and packaging of nuclear material



Processing, packaging and transporting, and disposing of legacy nuclear materials



Supporting waste stabilization through modeling and flowsheet development

SRNL also serves the nation with applied research and development in the areas of:

National and Homeland Security



Energy Security

