

# Liquid Waste Request for Proposals

## Savannah River Site Laboratory Facilities Tour

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Contracting Officer

October 23, 2007



# Special Notice

- The Laboratory Facilities Tour (the Tour) is for informational purposes only. All potential Offerors are cautioned that proposals must be based on the information provided in the Liquid Waste Request for Proposal ( LW RFP) and any amendments thereto
- In the event of any discrepancies between the information provided during this Tour and the LW RFP, the LW RFP shall take precedence



# Purpose

- The purpose of the Laboratory Facilities Tour is to familiarize potential Offerors with the unique capabilities of Savannah River Site (SRS) laboratory facilities available to support the Liquid Waste (LW) program and to the potential services available from these laboratories to the LW Contractor



# SRS Laboratory Facilities

- Some SRS laboratory facilities that support the LW program are included in the LW RFP scope
  - DWPF Laboratory
  - Liquid Waste Semiworks Tank Test Facility
- SRS Laboratory facilities not in the scope of the LW RFP are in the scope of the Site Management and Operating (M&O) RFP
  - Savannah River National Laboratory (SRNL)
  - F&H Analytical Laboratory
  - Regulatory Monitoring and Bioassay Laboratory



# SRS Laboratory Facilities

- Liquid Waste Contractor shall have responsibility and accountability over the laboratory facilities that are included in the scope of the LW RFP
- LW Contractor may enter into a business arrangement with the future Site M&O Contractor for any desired services and support from laboratory facilities not included in the scope of the LW RFP
  - Section J, Appendix N, of the LW RFP speaks to laboratory facilities services and support



# Laboratory Facilities Tour

- The Laboratory Facilities Tour consists of two parts:
  - An overview presentation of SRS laboratory facilities that support the LW program
  - A walking tour of a portion of SRNL facilities



# Laboratory Facilities Tour

## Protocol:

- No questions will be entertained during this overview presentation and the walking tour
- 3x5 cards will be available for the submission of written questions; any responses will be posted to the SR Acquisition Webpage
- The Tour will involve walking and climbing stairs. You will also be entering a Radiological Control Area during the tour. Please inform the tour guide of any physical or medical conditions (e.g., recent medical procedures involving the injection of a radiological tracer or dye) before the start of the Tour



# SRS Laboratory Facilities

## Savannah River Site Laboratory Facilities Overview

Robert Edwards, Director  
Nuclear Materials Programs Division  
Nuclear Materials Stabilization Project

October 23, 2007



# SRS Laboratory Facilities

## Overview

- Savannah River National Laboratory (SRNL)
- F&H Analytical Laboratory
- DWPF Laboratory
- Regulatory Monitoring and Bioassay Laboratory
- Liquid Waste Semiworks Tank Test Facility



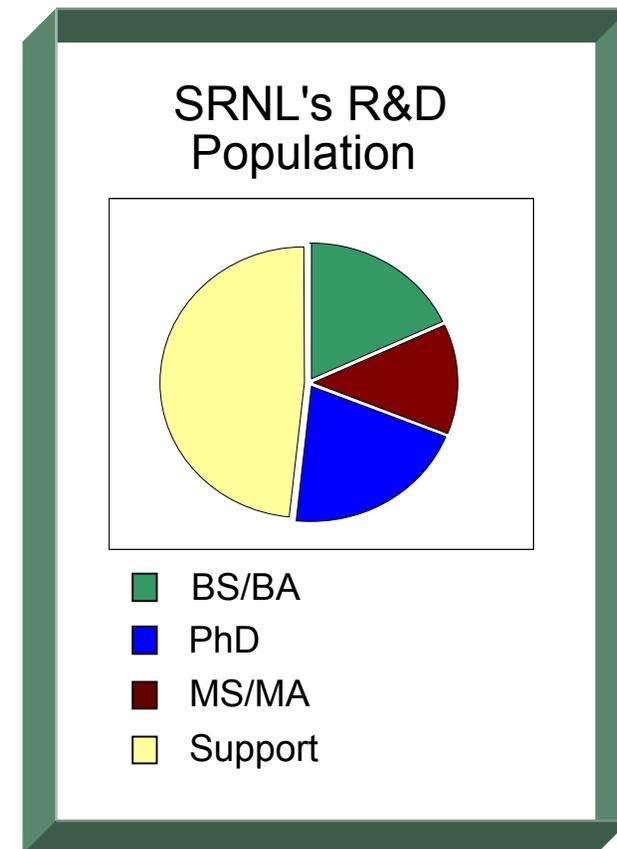
# SRNL Vision & Mission

- Vision
  - Continue to be the Laboratory of Choice for applied science in:
    - Environmental Management (EM)
    - National and Homeland Security
    - Energy Security
- Mission
  - As the DOE's EM Corporate Laboratory, address the challenges within the Department for:
    - Cleaning up environmental legacy from the Nation's weapons program
    - Promoting energy security through reliable, clean and affordable energy
    - Supporting America's nuclear security and nuclear non-proliferation initiatives

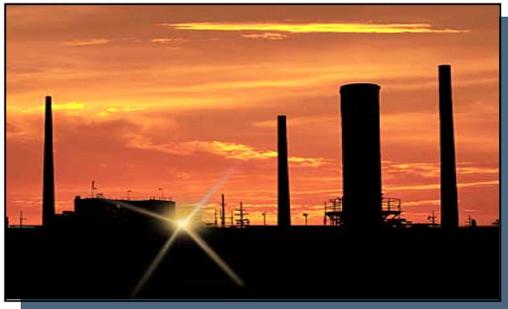


# SRNL Staffing / Staffing Disciplines

- Total staff ~ 940
- Research staff ~ 740
- 20% with PhDs
- Wide range of disciplines
  - Chemists
  - Mechanical Engineering
  - Chemical Engineering
  - Electrical Engineering
  - Metallurgical Engineering
  - Nuclear Engineering
  - Physicists
  - Biological Science
  - Math/Computational Science



# SRNL Emphasis Areas



## National Security

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



## Energy Security

- Hydrogen Technology
- Nuclear Energy Projects



## Environmental and Chemical Process Technology

- Materials Disposition
- Cleanup Technologies
- Interface Responsibility for Support to Liquid Waste Program



# SRNL Technical Capabilities

- Analytical chemistry
  - Radioactive, non-radioactive and hazardous samples analysis
  - Metallurgical analysis
  - Volatile and semi-volatile organics analysis
- Integrated chemical process development
  - Bench-scale testing using real and simulated waste
  - Research groups use analytical results to develop or refine chemical processes
- Materials development and analysis
  - Glass and grout formulation
  - Metallurgy and corrosion analysis
  - Failure analysis



# SRNL Technical Capabilities

- Computational modeling for process and engineering support
  - Process behavior modeling
  - Fluid flow modeling
  - Vapor space modeling
- Mechanical engineering, remote systems, and robotics
  - Development of sampling tools
  - Remote viewing systems
  - Robotic equipment
- Environmental transport and performance assessment modeling
  - Radioisotope modeling for air, soil and water migration
  - Integrated performance assessments



# SRNL Technical Capabilities

- **Computational modeling for process and engineering support**
  - Process behavior, fluid flow and vapor space modeling - modeling of zone-of-influence for waste removal pump installations in waste tanks as a function of installation sites and pump run protocols, and modeling hydrogen release mechanisms in waste tanks and benzene release in Saltstone vaults
- **Mechanical engineering, remote systems, and robotics**
  - Development of sampling tools - for special applications in waste tanks, tank annuli, piping, and other challenging environments
  - Remote viewing systems - for application in small spaces, difficult to access locations, and highly radioactive environments
  - Robotic equipment - for specialized jobs such as collecting waste glass pieces in the DWPF melter cell
- **Environmental transport and performance assessment modeling**
  - Modeling for radioisotope migration in air, soil and water pathways - Modeling results drive closure plans and materials (i.e., grouts, cap materials, other barriers)
  - Integrated performance assessments - to support tank closures and disposal of waste in Saltstone vaults



# SRNL Facilities



Intermediate-Level Cells



Gloveboxes



Shielded Cells



Radiochemistry and Analytical Laboratories



Aiken County Technical Laboratory



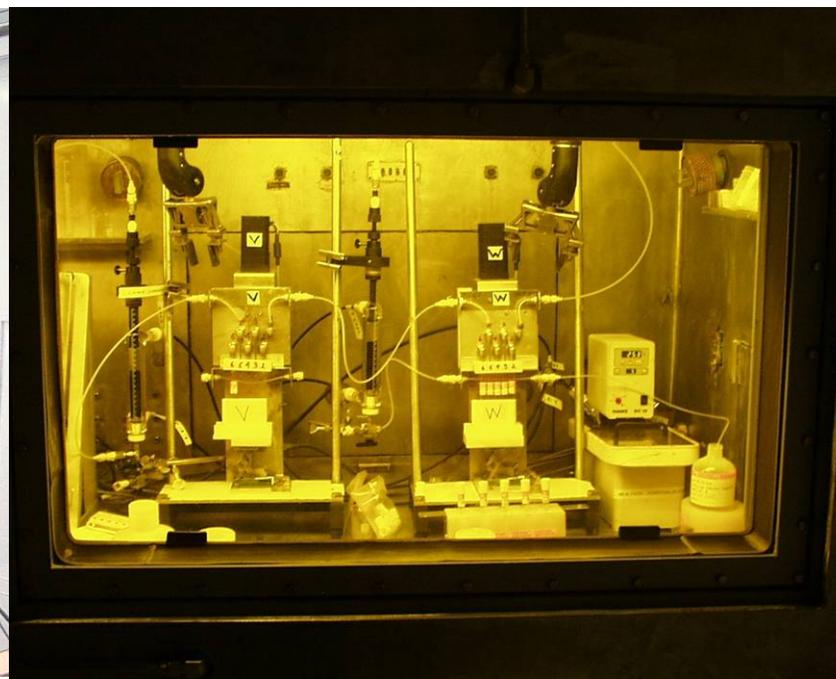
# SRNL Facilities

- SRNL Main Laboratory Building has over 300,000 square feet of multifunction laboratories, offices, and support space
- Facilities include:
  - Intermediate-Level Cells and Shielded Cells: Unique shielded containment facilities for the examination, analysis, and testing of highly radioactive materials
  - Gloveboxes: Sealed compartments with attached gloves that allow workers to handle radiological and hazardous materials safely
  - Radiochemistry and Analytical Laboratories: Analytical facilities with contained instruments, radio hoods and gloveboxes
  - Aiken County Technical Laboratory (ACTL) (currently under lease to SRNL): ACTL has 20,000 square feet of multifunction laboratories, offices, and support space



# SRNL Facilities

## Shielded Cells



# Shielded Cells

## Use:

- Receipt of highly radioactive or contaminated materials
- Repackaging of highly radioactive or contaminated materials – This includes dilution, subdivision, etc., for subsequent analysis in hoods or gloveboxes
- Process development testing using actual waste samples
- Analytical chemistry



# SRNL Facilities

## Intermediate Shielded Cells



**EM** Environmental Management  
safety ♦ performance ♦ cleanup ♦ closure



# Intermediate Shielded Cells

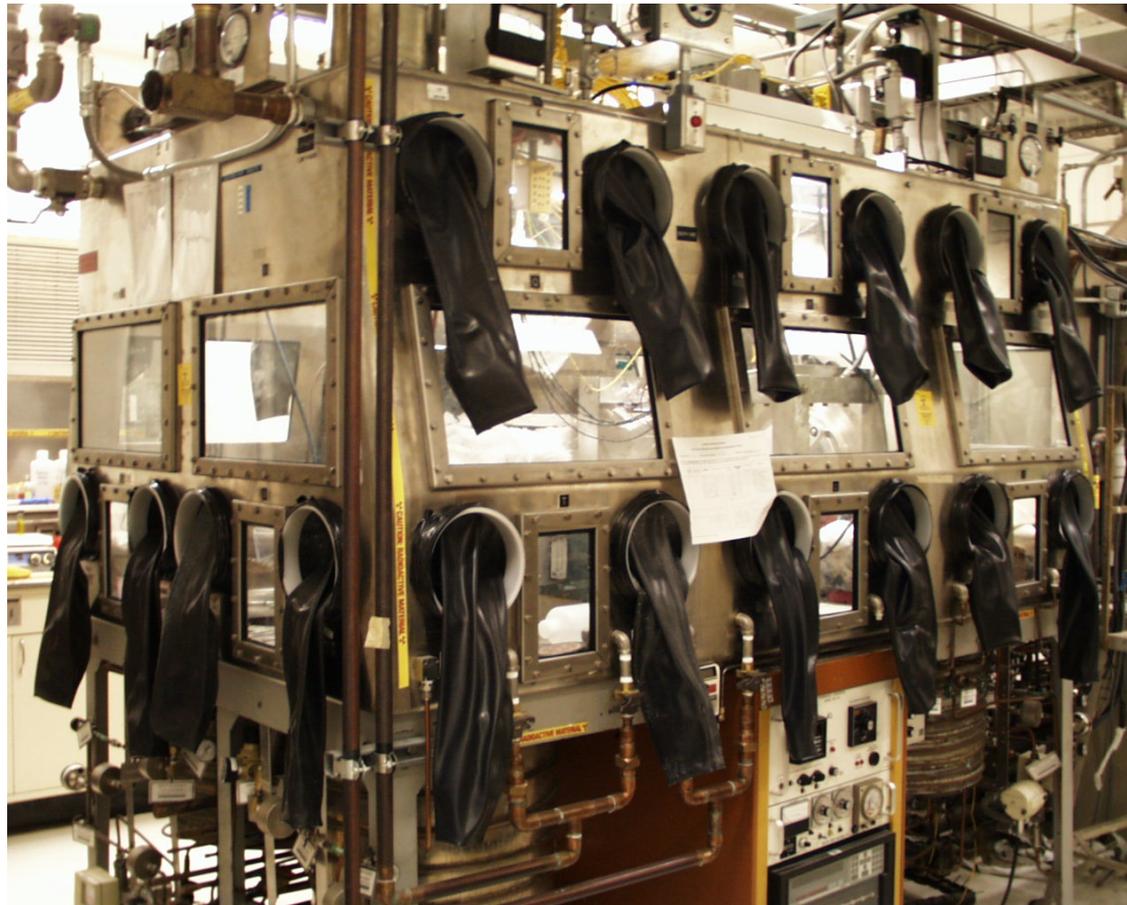
## Use:

- Lab-scale testing with actual waste
- Characterization testing of radioactive or contaminated materials



# SRNL Facilities

## Radiological Gloveboxes



# Radiological Gloveboxes

## Use:

- Analytical and materials characterization of highly contaminated samples
- Process development testing with actual waste



# SRNL Facilities

## Radiological Hoods



# Radiological Hoods

## Use:

- Sample characterization with contained analytical instruments
- Lab-scale testing and development



# SRNL Facilities

## Aiken County Technical Laboratory



# Aiken County Technical Laboratory

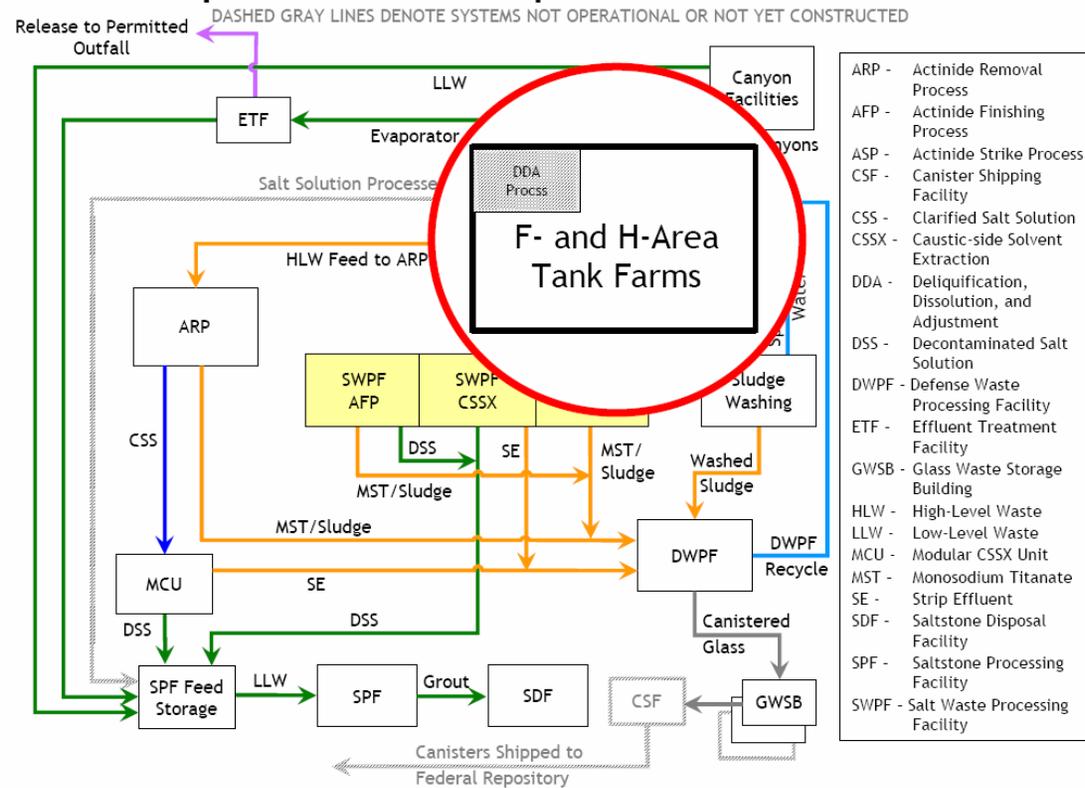
## Use:

- Bench-scale and pilot-scale testing with non-radioactive simulated waste for process development and improvement purposes
- Past work has included support to DWPF
  - Waste Treatment (sludge waste preparation)
  - Waste Processing (vitrification)



# SRNL Support to Tank Farms

## Liquid Waste Disposition - Contract



# SRNL Support to Tank Farms

- Process development & support
  - SRNL often develops and tests processes before they are put into use in the Tank Farms
  - Processes range from salt sampling tests to modeling for pump installations
- Equipment design, fabrication and installation
  - SRNL has experts in many mechanical and chemical engineering areas, plus fabrication facilities
  - Areas of expertise include development of designs/modifications for pumps, tank sampling equipment, monitoring instrumentation, etc., for specific applications and the fabrication of special equipment
- Routine operations
  - SRNL performs routine analyses to support Tank Farm operations such as overhead samples analyses and corrosion chemistry



# SRNL Support to Tank Farms

- Flowsheet development & testing (lab, bench-scale, pilot scale)
  - Uranium/Plutonium solubility studies
  - Evaporator cleaning flowsheet development and demonstration
  - Chemical cleaning testing
  - Engineering support and oversight for vendor demonstrations
- Materials analysis/corrosion testing
  - Integrity inspections of tanks and equipment
  - Corrosion testing – corrosion control program
  - Failure analysis
- Sample collection & analysis
  - Development, fabrication and deployment of specialized sampling devices
  - Analysis of salt samples
    - Full characterization (radiolytic, chemical, physical properties)
    - Dissolution properties
  - Routine evaporator overhead samples
  - Identification of unknown solids, etc.



Lab-Scale Benzene Retention and Release Equipment

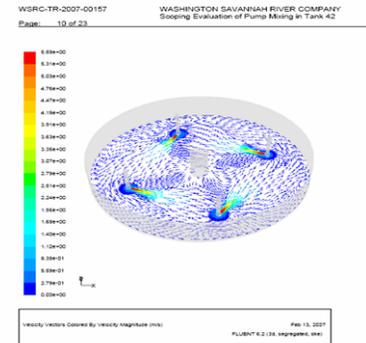


Salt Sampling Rig

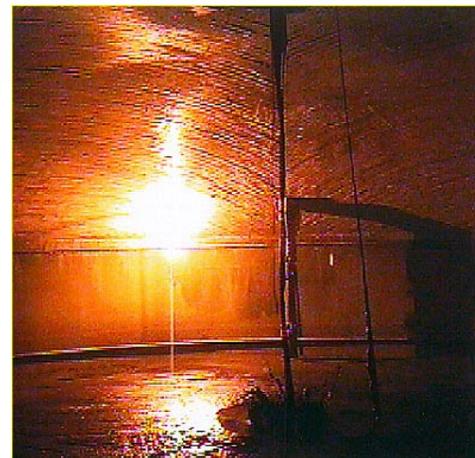


# SRNL Support to Tank Farms

- Computational modeling
  - Tank mixing studies
  - Gas generation, retention and release
  - Solids formation
- Equipment specification and testing
  - Demonstration/testing of pumps, filtration equipment and sampling tools
  - Equipment troubleshooting and failure analysis as needed
- Tank closure performance assessment (PA) modeling and analysis



Modeling Studies  
on Tank Mixing



Tank 20F zero-  
bleed, self  
leveling grout in  
1.3M gallon tank



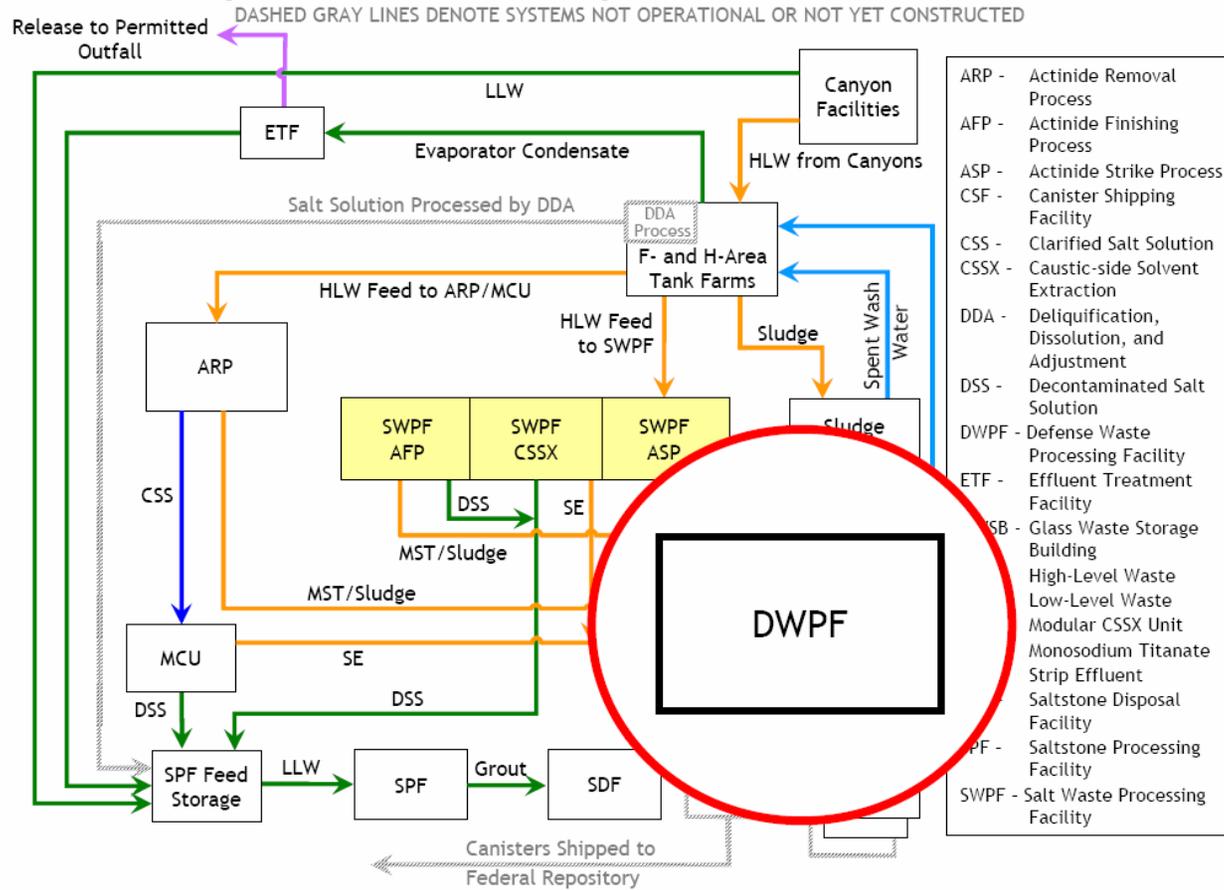
# SRNL Support to Tank Farms

- Computational modeling
  - Tank mixing studies – impact of pump location, pump speed, downcomer location, etc.
  - Gas generation, retention and release – hydrogen generation in waste tanks, vapor space mixing, etc.
  - Solids formation – evaporator modeling
- Equipment specification and testing
  - Demonstration/testing of pumps, filtration equipment and sampling tools – SRNL supported testing of, and revised design of, submersible mixing pumps used to conduct bulk waste removal
  - Equipment troubleshooting and failure analysis as needed
- Tank closure performance assessment (PA) modeling and analysis
  - SRNL actively involved in F Tank Farm Closure modeling for Tank Closure PA, including discussions with regulators on grout characteristics, radionuclide inventories, etc.



# SRNL Support to DWPF

## Liquid Waste Disposition - Contract



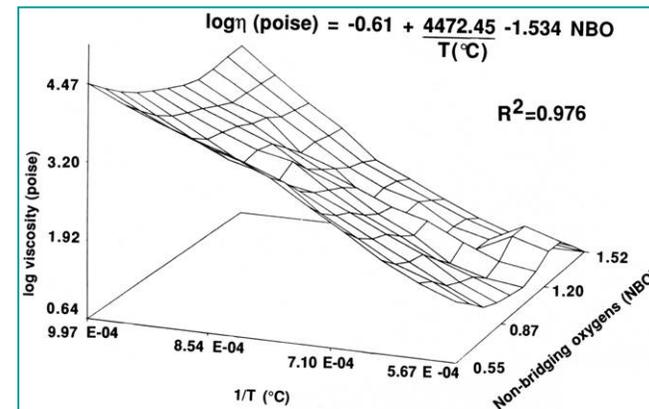
# SRNL Support to DWPF

- Responsible for original flowsheet design, development and testing, and equipment design
- Technical knowledge and expertise for developing and supporting process improvements
- Internationally recognized expertise in glass/ceramic immobilization
- Developed and tested all DWPF analytical methods and supported the transfer of these methodologies for application in the DWPF laboratory during the DWPF startup period
- Continues to play a vital role with considerable success in improving waste loading at DWPF



# SRNL Support to DWPF

- Sludge batch development
  - Sludge batch preparation strategy
  - Detailed tank sample characterization
  - Simulant development (used for initial cold testing)
- Sludge batch qualification and processing studies
  - Benchscale testing using simulants
  - Shielded cell runs with actual tank material
  - Analytical method verification
  - Issue resolution
- Process improvement and optimization
  - Melt rate studies
  - Frit development and testing
  - Optimization of feed properties
  - Operational parameter modeling and optimization of throughput
- Remote systems equipment support
  - Analytical lab enhancements
  - Equipment fabrication and upgrades
  - Instrument/equipment troubleshooting
  - Hardware improvements
- Materials analysis/corrosion studies



Advanced Waste Form Property Modeling  
to Optimize Immobilized Waste Processes



# SRNL Support to DWPF

- Sludge batch development
  - Develop sludge batch preparation strategy – SRNL supports development of initial sludge batch strategy, i.e., which tanks should be blended and what the washing strategy should be
  - Once the strategy is determined, SRNL obtains real waste samples and performs detailed analysis to see if strategy will result in acceptable feed to DWPF (from an elemental limit viewpoint)
  - Following analysis, SRNL makes up a nonradioactive simulant to allow bench-scale and some pilot scale testing at ACTL for an initial determination of the process parameters
- Sludge batch qualification and processing studies
  - ACTL performs bench-scale testing using simulants
  - Following runs with simulants, SRNL makes DWPF process runs using actual waste materials on a small-scale in SRNL Shielded Cells to allow process refinement and to reveal any unexpected issues (e.g., corrosion, flammability, etc.)
  - Verify that the analytical methods work for the sludge batch or develop new methods as necessary then transfer them to DWPF laboratory for application



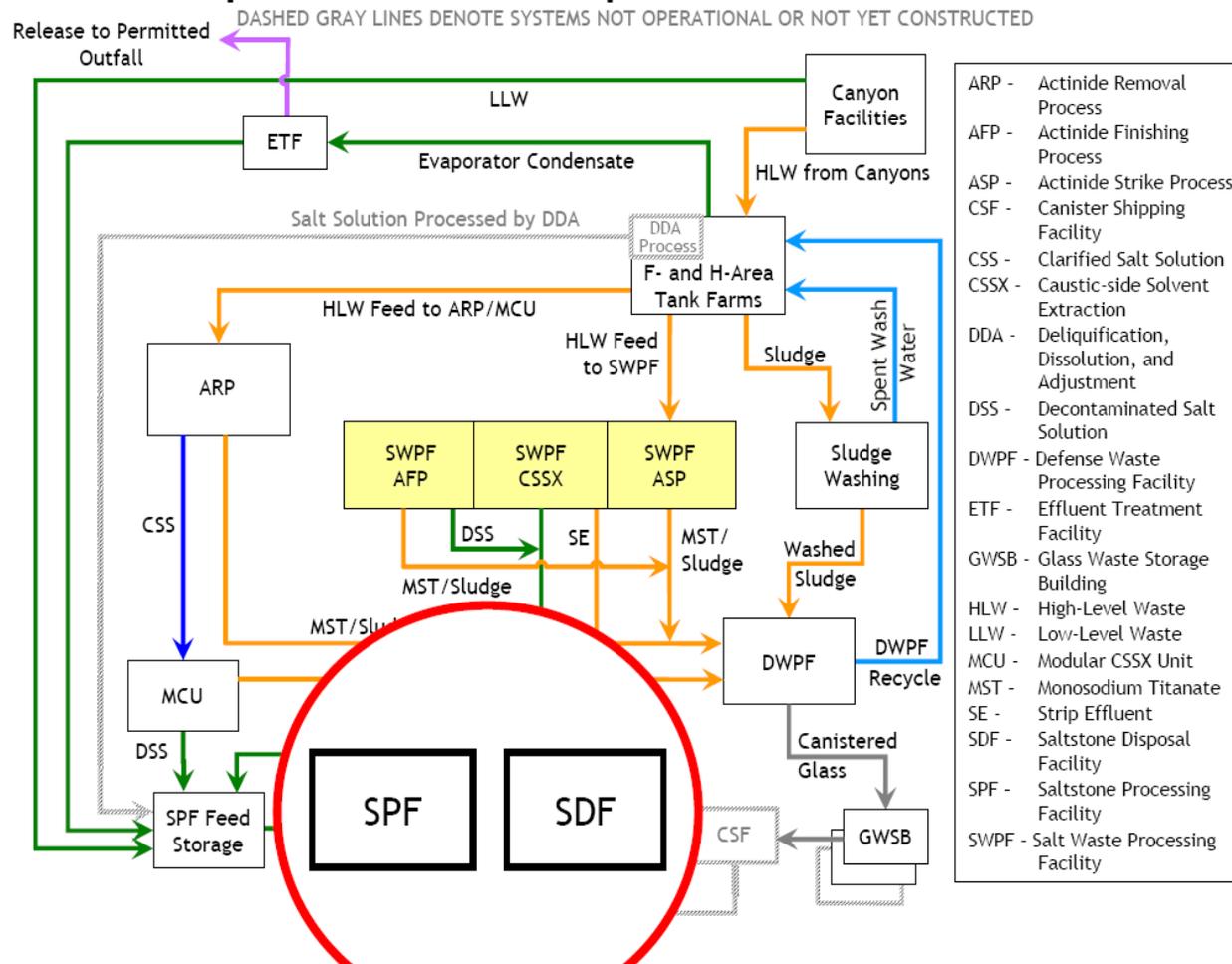
# SRNL Support to DWPF

- Process improvement and optimization
  - Continuous work to improve DWPF melt rate
  - Frit development and testing is performed in conjunction with sludge batch preparation and computer modeling is used to refine the frit selection
  - Optimization of feed properties
  - Operational parameter modeling and optimization of throughput
- Remote systems equipment support
  - Development of better ways to analyze process samples that can result in considerable time savings for the DWPF laboratory sample analysis
  - Equipment fabrication and upgrades
  - Instrument/equipment troubleshooting assistance – (Example: melter pour spout issues of a few years ago)
  - Hardware improvements
- Materials analysis/corrosion studies – as needed



# SRNL Support to Saltstone

## Liquid Waste Disposition - Contract



# SRNL Support to Saltstone

- Responsible for original flowsheet design, development and testing
- Technical knowledge and expertise for developing and supporting process improvements
- Internationally recognized for expertise in cementitious material
- Equipment design and testing
  - Support to efforts to improve pumps, mixers and flowpath
- Process improvements and troubleshooting
  - Resolution of mixer issues
  - Specified coatings for weeping vault walls



# SRNL Support to Saltstone

- Grout formulation
  - Batch formulation/testing
  - Component variability studies to expand operating window and improve performance
- Toxicity Characteristic Leaching Procedure (TCLP) testing and analysis
- Performance Assessment
  - Studies and testing to support maintenance and revision
- Facility support
  - Remote inspections
  - Equipment testing and upgrades



## Saltstone Facility

Saltstone Disposal Facility (vault) – foreground  
Saltstone Processing Facility – background



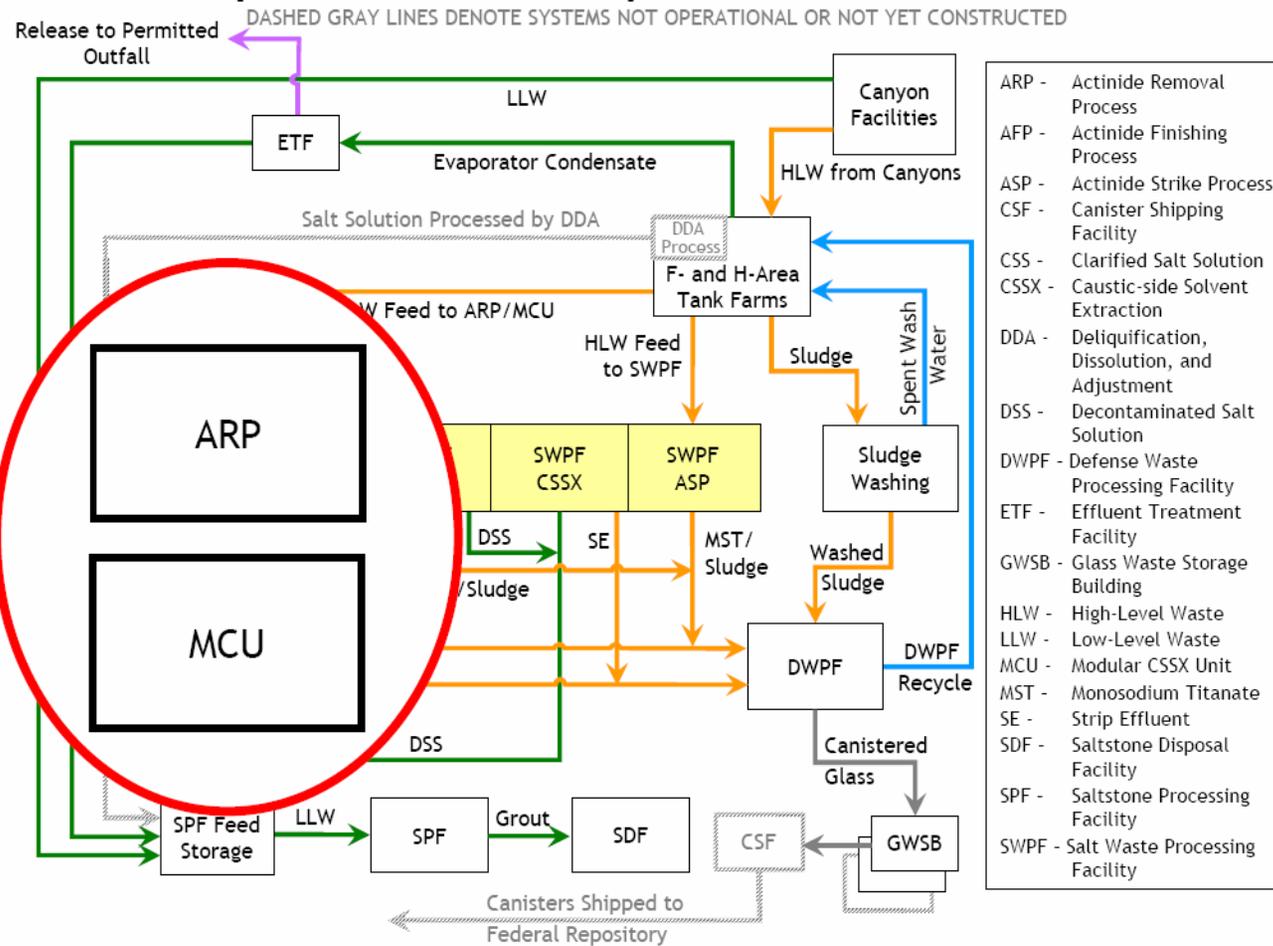
# SRNL Support to Saltstone

- Grout formulation
  - Work with actual tank materials to test resulting grout properties and to determine the proper amount of set retardant, etc. needed
  - Support development of alternative grout formulations to deal with process changes such as increased aluminum
- Toxicity Characteristic Leaching Procedure (TCLP)
  - Provide oversight of offsite lab analysis for grout performance verification
- Performance Assessment maintenance and revision
  - Perform studies of grout physical properties (i.e., resistance to cracking, etc.) as well as durability
- Facility support
  - Developed and fabricated a camera used for inspection of the feed hopper.
  - Evaluated and recommended improved vault waterproof coating
  - Recommended improvements to the salt feed tank pump



# SRNL Support to ARP & MCU

## Liquid Waste Disposition - Contract



# SRNL Support to ARP & MCU

- Process design and development
- Start-up test support/Issue resolution
  - Flowsheet testing
  - Equipment test support/troubleshooting
  - Materials analysis
  - Analytical support
- Analytical method development, verification and implementation
- Solvent make-up and qualification



# SRNL Support to ARP & MCU

- Process design and development
  - Involved in selection and testing of the solvent extraction process
  - Helped optimize the solvent used
- Start-up test support/Issue resolution
  - Conducted contactor tests to determine optimum operational parameters to ensure good aqueous/organic separation
  - Conducted tests and made recommendations for coalescer materials and design.
  - Analyzed and identified solids that were found in start-up testing and subsequently identified strategies for resolving the issue
  - Performed analyses that verified MCU test performance
- Analytical method development, verification and implementation
  - Developed key organic analysis methods used to support MCU, transferred such methods to Analytical Labs, and conducted some cross-check verifications with these methods
- Solvent make-up and qualification
  - Receives and verifies purity of solvent components and prepares final solvent for MCU



# F/H Analytical Laboratory



Shielded Cells



F/H Analytical Laboratory



Typical Glovebox



Typical Radio Bench



Inductively Coupled Plasma – Emission Spectroscopy



# F/H Analytical Laboratory Vision / Mission

- Vision
  - To be a world-class analytical laboratory
- Mission
  - To safely operate nuclear and environmental laboratories in providing the highest quality analytical services to customers



# F/H Analytical Laboratory

- Over 100,000 square feet of floor space including 20,000 square feet of laboratory space
- Analytical staffing consists of lab technicians, chemists, specialists and managers
- Accepts both radiological and non-radiological liquid and solid samples for analysis to support process control, product quality, accountability, regulatory compliance, and criticality safety analyses
- Provides analytical support to the following LW Facilities: F- and H-Tank Farms, DWPF, ETF, and MCU
- Included in the scope of the Site M&O Contract and the Site M&O RFP
- Liquid Waste Contractor may enter into a business agreement with the future Site M&O Contractor for provision of any desired laboratory services



# F/H Analytical Laboratory Capabilities

- Thermal Ionization Mass Spectrometry
- Nuclear Material Dissolution for Destructive Analysis Measurements
- Other analytical services include:
  - Non-Destructive Analysis
  - Spectrometry
  - Gas Chromatography
  - Classical Wet Chemistry
  - Radiochemistry



# F/H Analytical Laboratory Support to DWPF



DWPF Laboratory Radiobenches



DWPF Laboratory Shielded Cells



# F/H Analytical Laboratory Support to DWPF

F/H Analytical Laboratory currently supports DWPF Laboratory in:

- Performing measurements on both radioactive and cold feed samples
- Analyzing process samples taken at key points in the process to ensure that the vitrification facility produces high-quality glass
- Sampling, sample preparation and analysis (performed remotely using manipulators in shielded hot cells)
  - Vitrifying waste samples
  - Grinding vitrified samples into powder
  - Performing mixed acid dissolution and cold chemical dissolution
  - Sample filtration/separation by centrifuge or vacuum
  - Sample analysis to include ph analysis, weight percent solid analysis, and wet chemistry – ph titrations



# Regulatory Monitoring and Bioassay Laboratory

- Environmental monitoring analyses
- Bioassay sample analyses
- Personnel dosimetry



# Liquid Waste Semiworks Tank Test Facility

- Facility is included in Liquid Waste RFP workscope
- Located in T-Area



# Liquid Waste Semiworks Tank Test Facility

- Key facility features
  - 85 foot diameter open tank with 8 foot high carbon steel walls set on a concrete base
  - Steel superstructure above the tank has working platforms to simulate standard SRS tank heights and is designed with enough space for placement of 6 pumps
  - Supplied with 750 KVA power
  - Enclosed storage space used to store pump parts (seals, bearings, etc.) and a concrete pad that serves as a pump laydown area
- Past applications
  - Testing and refurbishing transfer pumps and slurry pumps for use in the tank farms
  - Technology demonstrations of various designs of slurry pumps, tank heel retrieval pumps, hardened waste removal tools, specialized tools associated with tank closure work, etc.

