

**Savannah River Site, Liquid Waste Program, Savannah River Remediation  
American Recovery and Reinvestment Act  
Benefits and Lessons Learned – 12559**

Mark A. Schmitz, Thomas N. Crouse  
Savannah River Remediation, Aiken, South Carolina 29808

**ABSTRACT**

Utilizing funding provided by the American Recovery and Reinvestment Act (ARRA), the Liquid Waste Program at Savannah River site successfully executed forty-one design, procurement, construction, and operating activities in the period from September 2009 through December 2011. Project Management of the program included noteworthy practices involving safety, integrated project teams, communication, and cost, schedule and risk management. Significant upgrades to plant capacity, progress toward waste tank closure and procurement of needed infrastructure were accomplished. Over 1.5 million hours were worked without a single lost work day case. Lessons Learned were continually identified and applied to enhance the program. Investment of Recovery Act monies into the Liquid Waste Program has ensured continued success in the disposition of radioactive wastes and the closure of high level waste tanks at SRS.

**OVERVIEW**

The Department of Energy's (DOE) Liquid Waste Program at Savannah River Site (SRS) was allocated \$200 million from the American Recovery and Reinvestment Act (ARRA) in September 2009. As the Liquid Waste Program contractor, Savannah River Remediation (SRR) is responsible for the management, storage, transfer, treatment, and disposal of the liquid radioactive waste that is stored in 49 underground tanks at SRS. SRR is a team of companies led by URS Corporation with partners Bechtel National, CH2M Hill and Babcock Wilcox and integrated subcontractors, AREVA, Energy Solutions and URS Safety Management Solutions. Operations include vitrification of high level waste into a glass form, interim treatment of salt waste until the Salt Waste Processing Facility (SWPF) project is completed, and final disposition of salt into a grout form after treatment. Monitoring, surveillance, and maintenance activities are performed to validate safe storage and maintain tank integrity and the overall tank farm infrastructure in preparation for waste removal, transfer, and treatment activities. Under the Recovery Act, a broad range of activities were funded. The 41 scopes of work were completed in the following mission areas:

- **Waste Treatment**—Designed and installed components to enhance Defense Waste Processing Facility (DWPF) and Saltstone operations.

- **Salt Disposition Integration**—Installed salt processing infrastructure to support SWPF.
- **Tank Closure Infrastructure**—Installed equipment and infrastructure modifications to support tank closure activities.
- **Facility Operations**—Designed and installed modifications to support enhanced salt and sludge waste removal.

SRR achieved physical completion of the 41 field activities in December 2011. SRR Recovery Act Workers successfully completed the ARRA activities with no lost time injuries, working over 1.5 million safe hours from project inception in September 2009 through completion in December 2011. The successful completion of the Recovery Act project allowed DOE and SRR to:

- Upgrade infrastructure to accelerate capabilities to close tanks and disposition waste,
- Enhance the overall risk reduction for the SRS Liquid Waste Program; and
- Create jobs and procure goods and services that benefitted the local economy.

## **BENEFITS**

The primary Liquid Waste Program ARRA objectives were to create and/or retain jobs and stimulate the local economy, while enabling critical near-term execution of activities to enhance the disposition of radioactive liquid wastes at SRS.

- The \$200 million of ARRA funding was used to perform critical Liquid Waste Operations work to maintain and enhance overall Liquid Waste program performance objectives.
- ARRA funding enabled SRR to both retain the jobs of its employees and hire additional people through subcontracting who may have otherwise been unemployed (project average of 360 full-time equivalents from September 2009 through September 2011).
- ARRA funding of critical Liquid Waste Program work mitigated adverse impact to the life-cycle schedule resulting in a cost avoidance of almost \$1 billion to the taxpayer and the ability to close old-style waste tanks.
- Over 1,500,000 safe hours worked through December 2011, without any lost workday injuries since project inception in September 2009
- \$83M in total procurements, with \$45M in procurements from small business and \$32M in procurements from the local area

- SRR ARRA workforce peaked at over 600 full-time equivalent workers, averaged 360 full time equivalent workers and more than 2,100 lives were touched

## RECOVERY ACT HIGHLIGHTS

### Waste Treatment

- Designed, built, and installed argon bubblers in the DWPF melter resulting in a significant increase in the glass melt rate and canister production. (Figure 1)

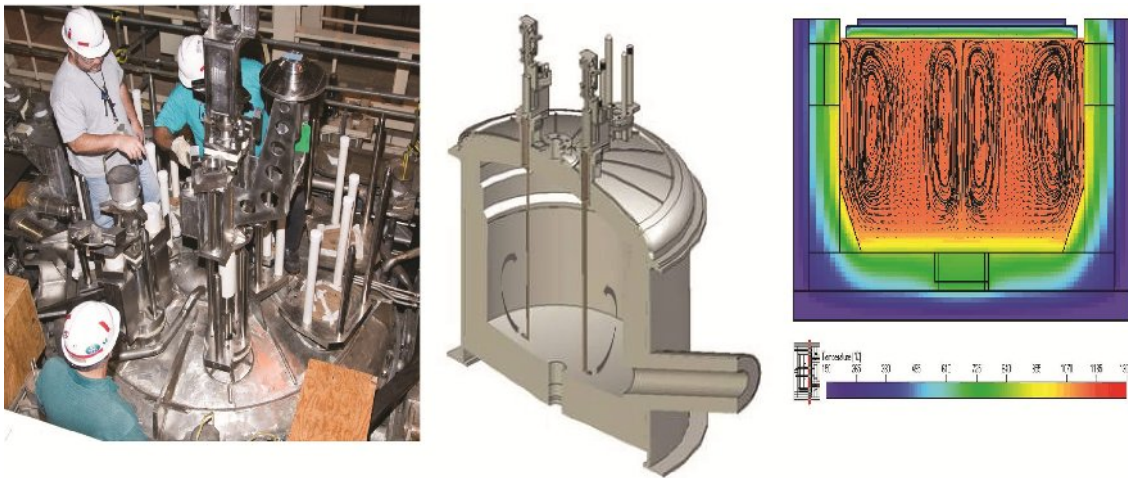


Fig 1. Bubbler technology significantly increased high level waste glass production at DWPF. Shown above is fit-up testing at Melter 3 and the simulated mixing pattern in the melter with the bubblers.

- Fabricated critical equipment and components for assembly of Melter 4, which is to be installed in DWPF in the future to support processing high level waste slurry into a solid glass material for disposal.
- Designed, fabricated, and placed a new argon tank into operation to support the increase in DWPF canister production by providing a larger capacity for melter bubbler operation.
- Designed and initiated construction on services and organic modifications to ventilation, power supply, leak detection, drain water return, and temperature monitoring systems for operation of Saltstone Disposal Unit (SDU) 2.
- Procured 2 Electromechanical Manipulators (EMMs) for high radiation work in the DWPF Shielded cells.

## Salt Disposition Integration

- Designed and built a shielded cell and a 114m<sup>3</sup> (30,000 gallon) waste concentrate hold tank for the Effluent Treatment Plant (ETP) to enable batch transfers of low-level waste directly to Saltstone and return Tank 50 to higher curie tank farm service, if needed. (Figure 2)



Fig 2. Waste Concentrate Hold Tank (WCHT) installed at ETP to collect low level waste.

- Designed and constructed two 227m<sup>3</sup> (60,000 gallon) salt solution receipt tanks and foundation/enclosure walls to support the processing of decontaminated salt solution at higher volumes at the the Saltstone Processing Facility and to support startup and uninterrupted SWPF operations. (Figure 3)



Fig 3. Salt Solution Receipt Tanks (SSRT) at Saltstone will collect Decontaminated Salt Solution (DSS) from interim salt treatment and the future SWPF

- Fabricated and installed a larger capacity nitrogen tank at DWPF to support receipt of SWPF feed containing organic materials.

### Tank Closure

- Installed infrastructure and equipment to prepare Tank 13 for bulk waste removal. Tank 13 will be the major source of material for future sludge batches and ultimately, a central tank for sludge batch preparation. (Figure 4)



Fig 4. Tank 13 – Recovery Act funding installed pumps, upgraded ventilation, hydrogen monitoring, electrical equipment and shielding to allow bulk sludge removal from the tank.

- Completed mechanical and electrical systems isolation of Tanks 18 and 19 as the next step towards permanent closure of the high level waste storage tanks.
- Designed and fabricated Enhanced Chemical Cleaning (ECC) testing equipment and initiated designs for Chemical Cleaning Infrastructure (CCI) to reduce the impact on tank space and downstream processes and accelerate tank closure with enhanced removal of residual waste.
- Invested in equipment and infrastructure improvements to reduce operational risk:
  - Replaced a failed submersible transfer pump in Tank 4.
  - Relocated and installed submersible mixer pumps in Tank 5 and refurbished the ventilation system.
  - Obtained samples of remaining materials from Tanks 5 and 6.
  - Performed annulus cleaning on Tanks 5 and 6.
  - Performed sampling and analysis and completed the first sludge transfer from Tank 12.

- Developed, designed, fabricated, and tested a robotic crawler to assist with cleanup efforts and obtain samples for testing. (Figure 5)

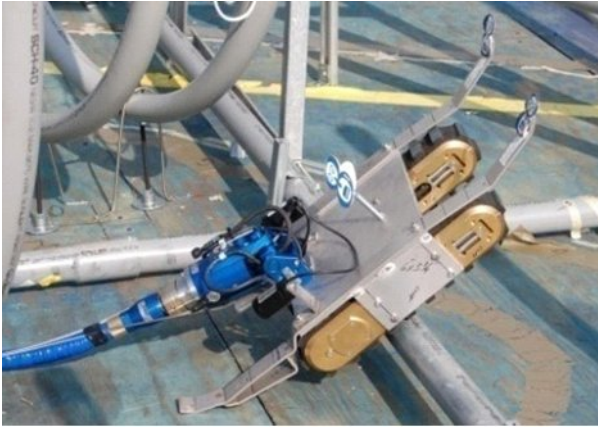


Fig 5. Robotic crawler in tank mockup.

- Designed and installed infrastructure modifications for Tanks 28, 37, and 42 to enhance salt removal capabilities and permit efficient removal of sludge from waste tanks.

### Facility Operations

Designed and procured fourteen (14) radiation hardened pumps each valued at over \$1M for the transfer of radioactive materials, the mixing of 3800m<sup>3</sup> (1 million gallon) waste tanks, and the blending of salt solutions. (Figure 6)



Fig 6. Pump testing. All pumps designed and procured for waste tank usage were rigorously tested in a full scale test facility.

- Fabricated and installed a chemical truck unloading station and a 38m<sup>3</sup> (10,000 gallon) storage tank for SWPF blend and feed tanks, which will reduce worker exposure and decrease the potential for chemical leaks.

## LESSONS LEARNED

### DOE Complex Level

Incorporation of lessons learned from the ARRA project can provide continuous improvement to future Liquid Waste projects, enabling SRR to more safely and cost-effectively execute its mission to close old-style waste tanks while reducing risks to employees, the public, and the environment. Five lessons learned were formally submitted to DOE-EM to be shared DOE Complex wide during the course of the Liquid Waste Recovery Act project:

- **PMLL-2010-SR-SRR-0001 (Scope Change Management):** Manage scope change through contract modifications and establish an Integrated Project Team (IPT) that includes contractor and DOE members to ensure communication and alignment of scope changes.
  - Used to achieve endorsement of scope changes to refine specific work activities for ARRA scopes of work.
- **PMLL-2010-SR-SRR-0002 (Safety Program):** Use qualified subcontractors and staff augmentation personnel to meet peak project resource demand. Assign work tasks that are appropriate to knowledge and experience levels of individual workers.
  - Used whenever ARRA work activities were planned and executed. Primarily, ARRA subcontracted and staff augmentation personnel were used to support lower hazard ARRA scope activities and were integrated into existing, experienced work teams to ensure safety.
- **PMLL-2010-SR-SRR-0003 (Equipment Procurement):** Clearly define the ARRA terms and conditions for equipment procurements to ensure qualified vendors are able to competitively bid and procurements are placed in a timely manner.
  - Used when initiating all ARRA procurements.
- **PMLL-2010-SR-SRR-0004 (Risk Management):** Conduct a Pre-mortem in the early stage of the project to proactively identify potential issues before formal risk identification is performed.
  - Used in the early stage of the project; the outcome was input to the standard risk management process. The issues were reviewed monthly to continually assess the risks and opportunities presented by the ARRA work scopes.
- **PMLL-2010-SR-SRR-0005 (Procurement):** Procurements required to meet Safety Class/Safety Significant (SC/SS) functions (such as commercial nitrogen

storage tanks) may be obtained through a Level 2 purchase that meets Commercial Grade Dedication (CGD) standards rather than a Level 1 procurement with NQA-1 requirements. This approach provides the best opportunity to meet program quality requirements as well as project cost and schedule objectives without compromising safety.

- Used to purchase an additional nitrogen tank for the Defense Waste Processing Facility. Procuring the tank directly from the tank manufacturer utilizing the Commercial Grade Dedication process ensured the tank would meet the necessary quality requirements to provide the defined safety class function and still meet project cost and schedule objectives.

### **SRR ARRA Project Level**

In addition to the formal lessons learned, SRR identified the following lessons learned at the SRR ARRA project level.

- SRR proactively managed the safety culture of all ARRA workers, whether they provided field operations or support.
- Target costs were established through Estimate at Completion (EAC) reviews for each project to ensure ongoing and accurate funds management.
- Developed spend plans and ensured all DOE-HQ metrics were tracked and reported to provide adequate focus on jobs and economic stimulus.
- SRR procured subcontracts with qualified staff augmentation resources to ramp up project support personnel quickly and effectively.
- Stakeholder alignment was ensured through open and clear communication including outreach to SRR employees as well as state and federal agencies, congressional offices, state legislature, city councils, county commissions, environmental organizations and labor unions.

SRR also determined the best practices to meet the demands of the diverse project portfolio encompassed by the Recovery Act included:

- Developing division of authority between Project Directors, ARRA Project Managers and the ARRA Program Manager,
- Involving Project Directors and facility personnel,
- Establishing an Integrated Project Team (IPT) and meeting weekly,
- Leveraging existing project teams,

- Leveraging the existing Contract Performance Baseline (CPB) process, DOE-Savannah River (SR) Programmatic Project Execution Plan (PPEP), and LW Generic Team Execution Plan (TEP), and
- Using DOE-EM Project Management Portfolio Guidance.

## **CONCLUSION**

The funding of a portion of the Liquid Waste Program at SRS by ARRA was a major success. Significant upgrades to plant capacity, progress toward waste tank closure and procurement of needed infrastructure was accomplished. Integrated Project Teams ensured quality products and services were provided to the Operations customers. Over 1.5 million hours were worked without a single lost work day case. Lessons Learned were continually reviewed and reapplied to enhance the program. Investment of Recovery Act monies into the Liquid Waste Program has ensured continued success in the disposition of radioactive wastes and the closure of high level waste tanks at SRS.

*(The authors would like to acknowledge the contributions of their staff for the quality of this paper. Special thanks are given to Melissa Kitchings and Gayl Hoel for their assistance with the WMS 2012 presentations.)*