



# *Area Completion Projects* 2009

**accomplishments  
report**

A SUPPLEMENT TO THE 2009 SRS ENVIRONMENTAL REPORT

## Area Completion Projects

SRS's Area Completion Projects (ACP) is responsible for the safe deactivation and decommissioning of legacy facilities, as well as the remediation of SRS inactive waste sites and contaminated surface water and groundwater. The organization was formed from combining two pre-existing organizations: Soil and Groundwater Closure Projects and Site Deactivation and Decommissioning. Joining these two groups provides SRS with a comprehensive approach to cleaning up areas of the Site, sequencing decommissioning of legacy facilities with the environmental cleanup activities.

The cleanup program at SRS is regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA). Cleanup is accomplished through the RCRA Permit and the SRS Federal Facility Agreement (FFA), a tri-party agreement between the Environmental Protection Agency (EPA), the South Carolina Department

of Health and Environmental Control (SCDHEC), and the Department of Energy (DOE).

The FFA:

- ensures that SRS satisfies RCRA and CERCLA cleanup requirement to investigate and remediate waste units that may pose an unacceptable risk to human health and the environment;
- includes cleanup schedules for all SRS waste units;
- ensures facility decommissioning and activities are performed in an environmentally responsible manner.

At the close of 2009, ACP had completed **2,482** FFA milestones either on or ahead of schedule; **347** of those were achieved during Fiscal Year 2009. Moreover, the remediation of **368** of the **515** identified waste units at SRS have been completed, while **141** were in the assessment phase, and **6** were in the remediation phase.

## Facilitating RECOVERY

*The American Recovery and Reinvestment Act (ARRA) of 2009 provided SRS with an opportunity to accelerate its environmental management program. In April, the Department of Energy-Savannah River received a \$1.6 billion stimulus investment to create new jobs, remove Cold War legacy materials, and accelerate the closure of large legacy areas along the Site's boundaries.*

*A significant portion of that funding was targeted for environmental remediation, and facility deactivation and decommissioning activities. As a result, Area Completion Projects (ACP) personnel began a cleanup program, both in pace and volume, that was unlike any other in the Project's history. In some cases, ACP work was accelerated as much as a decade!*

*By the end of 2009, the Recovery Act at SRS provided for the creation or retention of more than 2,200 jobs at SRS, and invested more than \$96 million in local contracts, providing further chances to improve the local economy. Most telling though is the reaction of the majority of the ARRA new hires. These employees know they've provided SRNS and ACP with much needed support and in turn they have gained valuable skills and on-the-job training from working with the seasoned and knowledgeable ACP experts.*

*As always, while accomplishing our cleanup work*

*through the acceleration granted by ARRA is important, employee safety continues to be our top priority. To ensure the safety of our workforce, extensive training and mentoring programs were designed and implemented to fit the needs of ACP's increasing staff.*

*Under the ARRA, we will complete the cleanup of a significant portion of the SRS by 2012, which will allow DOE to consider these perimeter areas for redevelopment or other mission use.*

*I am proud to be a part of ACP during this unique time in SRS history. Moreover, I am honored to witness, first-hand, the dedication and commitment of ACP employees as they work to transform the Site for future generations.*

*I am excited to present the following supplement to the 2009 Environmental Report and I look forward to working with all ACP employees to achieve our Recovery Act goals over the next several years.*



**Mary Flora**  
Director  
Area Completion Projects

## Safety Culture

Since the beginning of SRS operations in the 1950s, employee safety has remained the top priority for operations contractors and the DOE. ACP continues this legacy through constant training, effective safety communications, workforce safety time-outs, pre-job briefings, monthly safety meetings, Behavior-Based Safety observations, and more. The safety procedures in place strive to ensure that each and every ACP employee returns home to their family in the same condition as when they arrived at work, each and every day.

The variety of mentoring and training programs available to ACP employees are designed to put workers in control of their own safety while always being mindful of potential hazards to themselves and their co-workers. One Site-wide program that supports this initiative is the Integrated Safety Management System (ISMS), which provides work-specific safety procedures and safety feedback once a job is completed. ISMS facilitated the Site's adoption of several safety programs such as the OSHA-supported Voluntary Protection Pro-

gram (VPP) and the corporate-sponsored Human Performance Improvement (HPI) tool.

VPP is a recognition program designed to award employers and employees who demonstrate an exemplary dedication to the prevention and control of hazards at the worksite. SRS is the only site in the DOE complex to receive the VPP Star of Excellence for seven consecutive years and two Legacy of Stars Awards.

In 2009, thanks to the safety culture at SRS, ACP employees achieved 11.9 years since the last "lost-time" injury involving a day or more of work missed due to a work-related injury.



*ACP employees achieved  
5 million safe hours  
worked in 2009.*



*ACP Director Mary Flora commends ACP employees for over five million hours worked without a lost-time injury.*

## Regulatory Milestones

In 2009, ACP achieved a remarkable milestone with the issuance of an Early Action Record of Decision (EAROD) for the in-situ closure of C, K, L, and R Reactor facilities. Supported by DOE, EPA, and SCDHEC, the in-situ closure of these four reactors is expected to yield \$900 million in cost savings over other closure methods.

ACP also received final approval from SCDHEC and EPA on the Federal Facility Agreement Rev. 1, Appendix E, Long-Term Projections for Fiscal Year 2009. This document sets the enforceable milestones for Fiscal Year 2010 and Fiscal Year 2011, and includes planning for milestones in Fiscal Year 2012 and after.

The American Recovery and Reinvestment Act (ARRA) was signed into law on February 17, 2009, by President Barack Obama to stimulate the American economy. The focus of the President's efforts lay heavily in the energy sector as America's dependence on foreign energy resources remains a challenge for the nation. Therefore, President Obama invested \$6 billion across the U.S. Department of Energy (DOE) Environmental Management (EM) program, including more than \$1.6 billion at the Savannah River Site (SRS) to create jobs, stimulate the economy, accelerate cleanup, and reduce the EM program footprint at SRS. This investment enables SRS to transform more expeditiously to address possible energy and research missions in the future.



Through the aggressive acceleration of the Area Completion Projects and waste disposition schedules, the plan achieves a significant operational footprint reduction by 2011.

Staffing plans were immediately devised and contracting activities were held throughout South Carolina and Georgia. This strategic community involvement plan resulted in the creation of thousands of jobs and on-the-job training for new employees. Moreover, hundreds of local, regional, and national small business contracts were awarded in the first few months of the Recovery Act, injecting millions of stimulus dollars right where it is needed — the American economy.

The ARRA project at SRS sets the stage for a renovation of government resources while creating or retaining an estimated 3,000 jobs across the Site.

*"What makes this recovery plan so important, is not just that it will create or save three-and-a-half million jobs over the next two years...it's that we're putting Americans to work doing the work that America needs done...in critical areas that have been neglected for too long."*

**-- President Barack Obama**

## Introduction

**Wednesday**  
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# Savannah River Site stimulus plan to bring \$1.6 Billion, 3,000 jobs

Plans speed waste removal, cleanup in preparation for new missions

- Reduce operational footprint by 40 percent or 79,000 acres by 2011
- Create and retain jobs at SRS with the Recovery Act funding
- Have all transuranic waste stored or ready to be disposed
- 2 low-level waste trenches closure
- Facilities deactivation and decommissioning
- Waste storage area closure
- Accelerate characterization

From 2009-2011

- Completed
- Completion by 2011
- Accelerated
- Infrastructure Consolidated

Map courtesy of the Department of Energy

## Area Completion Projects Recovery Act Scope

- Area-wide completion of D, M, P, and R areas, including in-situ decommissioning of P- and R- reactor buildings, demolition of K-Area Cooling Tower, and the Heavy Water Components Test Reactor, resulting in a 67% operational footprint reduction
- Acceleration of deactivation and decommissioning (D&D) work in Small Arms Training Area, B, N, and F areas
- Remediation of more than 50 contaminated areas, including approximately 500 acres of contaminated soil

### *P Area Operable Unit*

**P** Reactor, the second of SRS's reactor buildings, was operational from 1954 to 1991, when it was determined that national defense-related initiatives associated with the Cold War were no longer needed. The entire area, collectively referred to as P Area, comprises approximately 100 acres and includes 17 waste units, and at one time contained 42 buildings and ancillary structures. These facilities included the reactor building, maintenance buildings, the administrative building, cooling water basin, pump house, and a coal-fired powerhouse. The purpose of the reactor was to produce tritium, plutonium, and other special nuclear materials for national defense.

The reactor building and the cooling water basin are the only permanent structures in this area, and the reactor building has been approved for in-situ decommissioning, a precedent-setting closure method that allows most of the reactor building to remain in place. All below-grade areas within the reactor building will be filled with grout, fully entombing the reactor and thus preventing contamination from affecting the environment.

To achieve this objective, deactivation and de-

commissioning (D&D) crews removed all exterior metal and installed temporary lighting to facilitate the closure activities. Additionally, ten industrial evaporators were procured to remove approximately four-million gallons of water from the reactor's disassembly basin.

Plans are underway for the 2010 construction of a concrete batch plant that will provide the grout needed to fill the below-ground levels of the reactor. In preparation for the upcoming construction, a railroad spur was installed to support the future operations of the batch plant.

The cask car railroad tracks, one of the 17 waste units within P Area, were being remediated in 2009; these railroad tracks were used during reactor operations to transport materials from P Reactor to other Site facilities. Due to the resulting contamination from these operations, the contaminated sections of the railroad tracks were excavated and disposed of at an offsite facility.

Thanks to the federal American Reinvestment and Recovery Act investment at the Savannah River Site, P Area will be closed in September 2011.



**P**Area Groundwater (PAGW) is used to describe an area of contaminated groundwater plumes within the P Area Operable Unit. Historical waste disposal practices during reactor operations resulted in the release of tritium, trichloroethylene, and tetrachloroethylene (common degreasing solvents) to the environment.

Characterization of the PAGW began in 2009 in support of the P-Area closure funded by the American Reinvestment and Recovery Act. This work will include the use of direct push technology to obtain groundwater samples, define the lithology, assist in the installation of new groundwater monitoring wells, and perform the quarterly groundwater sampling and analysis.

During 2009, installation was completed on the monitoring well network for the enhanced bioremediation of the groundwater. The installation of the wells will allow ACP to conduct a treatability study, which will assess the performance of biostimulation and bioaugmentation in the removal of contaminants from the PAGW. Biostimulation and bioaugmentation are the use of edible oil (soybean or vegetable oil) to provide fuel to naturally occurring microbes found in the groundwater that

feed on the contaminants, resulting in the accelerated removal of groundwater contamination. The Emulsified Oil Substrate (EOS®) and the EOS

**“Area Completion Projects personnel are committed to staying abreast in the latest innovative tools and technologies in the field of Environmental Cleanup, resulting in cutting-edge scientific methods being put to work right here at SRS. The MicroCED™ study at P Groundwater is a perfect example of this commitment.”**

– Tom Gaughan, ACP Engineering Manager

AquaBupH™, Savannah River National Laboratory proprietary compounds, will be injected into the contaminated groundwater zone, and samples will be obtained from the monitoring wells to determine when the oil has completed the breakdown process.

After that, a specific dechlorinating enrichment culture, (Microorganism Chlorinated Ethane Destruction [MicroCED™]) will be used to complete the breakdown process, reducing the contaminants to ethene, a simple hydrocarbon molecule, and carbon dioxide. Once the process is complete, these chemical compounds can be safely released to the groundwater plume.



Left: Cone penetrometer rigs allow ACP crews access to the groundwater for analysis.

Below: ACP subcontractors use rotosonic drilling to get past hardened soils to access the groundwater.



**R** Area Operable Unit (RAOU) is located in the east central area of SRS, approximately seven miles from the P Area Operable Unit. The R Reactor facility, the largest of the five SRS reactors is situated within the R Area Operable Unit. R Reactor became operational on December 28, 1953, making it the first fully functional reactor at the Site. In 1964, it was shut down due to a reduced need for defense-related materials.

The R Reactor was one of four SRS legacy reactors to be addressed by the 2009 issuance of an Early Action Record of Decision for the In Situ Decommissioning of C, K, L, and R Reactor facilities. The in-situ decommissioning method follows the precedent setting in-situ closure of P Reactor.

This decommissioning process allows the concrete structure of the building to remain in place, minimizing hazards to human health and the environment.

Work began in 2009 to prepare the reactor for full closure activities. A contract was awarded to Bierlein Field Services, Inc. for the removal of the P- and R- Reactor Gantry Cranes, the 200-ton steel structures that sit atop both reactors. Temporary lighting was established along the exterior of the building to allow for around-the-clock closure operations, and two reactor support buildings, 108-1R and 108-2R, were permanently sealed.

Four contaminated large equipment disposition shipments at R Reactor were also completed in 2009. The equipment, which was part of the reactor's actuator system, was shipped to the slit trenches for disposal. The removal of this equipment allowed ACP to proceed with other reactor closure activities.

In December, ACP began pouring grout into the reactor's disassembly basin, marking the begin-

ning of the final chapter in R Reactor's history.

As crews were hard at work on the reactor facility, engineers began the removal of the contaminated Cask Car Railroad Tracks, which were once an integral part of material transport from one SRS area to another. Also, large dump trucks transported thousands of cubic yards of soil to the area to be used in the remediation of R Area's 12-acre Ash Basin. Meanwhile, an ACP subcontractor began



removing trees and vegetation from the basin so the remedial action could be performed.

Although the R Area Operable Unit is scheduled for completion in September 2011, the grouting of the below-grade reactor building areas is expected to be complete in 2010. The Gantry Crane will also be removed, all residual moderator within the system piping will be drained, the exhaust stack will be removed, and the remediation of the R Area Ash Basin will be completed by an ACP subcontractor.

**R**Area Groundwater (RAGW) is a term used to describe an area within R Area Operable Unit (RAOU) that contains the resultant groundwater plumes from historical operations at R Area. Four groundwater plumes and their associated contaminants have been identified.

The agreed-upon strategy by the EPA, SCD-HEC, and DOE for completion of remediation of RAGW calls for the implementation of monitored natural attenuation (MNA). In 2009, eight of up to 16 monitoring wells were installed to

complete the ongoing task of documenting the natural degradation of contaminants affecting the groundwater.

To best determine the locations of the monitoring wells, cone-penetrometer testing (CPT) pushes were performed in predetermined locations. CPT technology removes samples of soils and groundwater from various depths below the surface. These samples were sent to a laboratory for analysis. Based on those results, ACP engineers determined the placement of the monitoring well system.

In 2010, ACP will begin sampling surface waters surrounding the four RAGW plumes to determine the extent, if any, of contaminant migration from the affected groundwater.



**Left: Cone penetrometer as seen from underneath the truck. This is the portion that goes in the ground and retrieves samples.**



**Right: Samples are retrieved from the groundwater for laboratory analysis.**

# 770-U

, also known as the Heavy Water Components Test Reactor (HWCTR), or “Hector,” is the last remnant of the facility complex that was built at the Savannah River Site (SRS) to test fuel designs for use in boiling water and pressurized heavy water moderated reactors. The construction was completed in 1961, and the test reactor was operational for two years. The HWCTR was never used for national defense-related research or production.

Due to funding limitations, two previous attempts to decommission the facility were stopped. After completing work that allowed it to be safely placed in a state that required minimum maintenance, the building was welded shut and placed in a safe condition to allow the internal radiological constituents to decay.

In 2009, the Department of Energy (DOE) issued a Removal Site Evaluation Report/Engineering

Evaluation/Cost Analysis for the in-situ decommissioning of the HWCTR. Supported by the Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC), the document details the demolition plans for the test reactor.

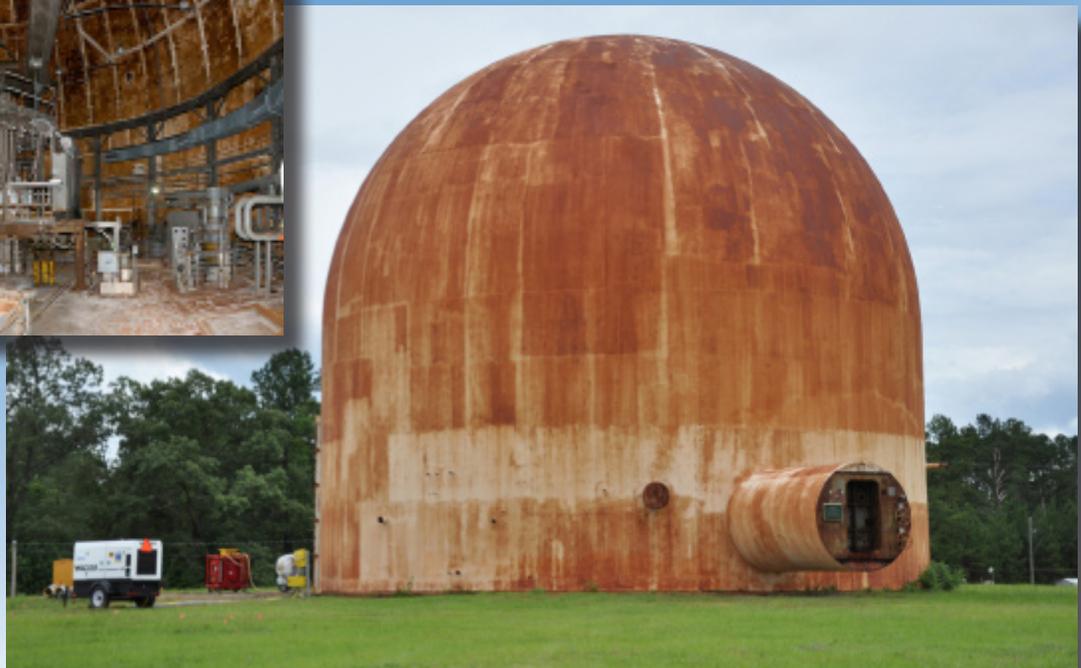
With American Reinvestment and Recovery Act funding, ACP began preparing the aged reactor and the surrounding area for upcoming demolition.

By September 2011, the HWCTR will no longer serve as a physical reminder of America’s birth of the nuclear age. The 75-foot dome and all interior equipment will be removed, the below-grade structures will be filled with grout, and a concrete cap placed over the reactor’s footprint will be the only remnant of what once was an iconic reactor situated among the Site’s executive offices.



**Left: The interior of HWCTR in a panoramic view.**

**Below: The dome structure of HWCTR, showing the door that was welded shut in 1996.**



The Savannah River Site's D Area consists of surface units and source areas that are potentially responsible for contaminating groundwater and soils. Past investigations have found relatively large, dilute, and depleting plumes with primary contamination caused by tritium. The tritium was released as a result of historical defense-related operations in the area.

ACP began researching treatment methods to address the tritium contamination and discovered a pioneering technology developed in France. Known at SRS as the Thermal Detritiation Treatability Study, ACP began work to construct a treatment cell in D Area and subsequently demonstrated that the technology was a viable treatment for tritium-laden soils and concrete. Thermal detritiation involves a simple concrete block structure, capped with an engineered roofing system, in which multiple heating elements are installed. The heating elements will heat the tritiated concrete contents to the target temperature of 1,500 degrees Fahrenheit to evaporate the water

from the concrete matrix. The soils will be heated to 212 degrees Fahrenheit to allow the tritiated water in the pore space to evaporate.

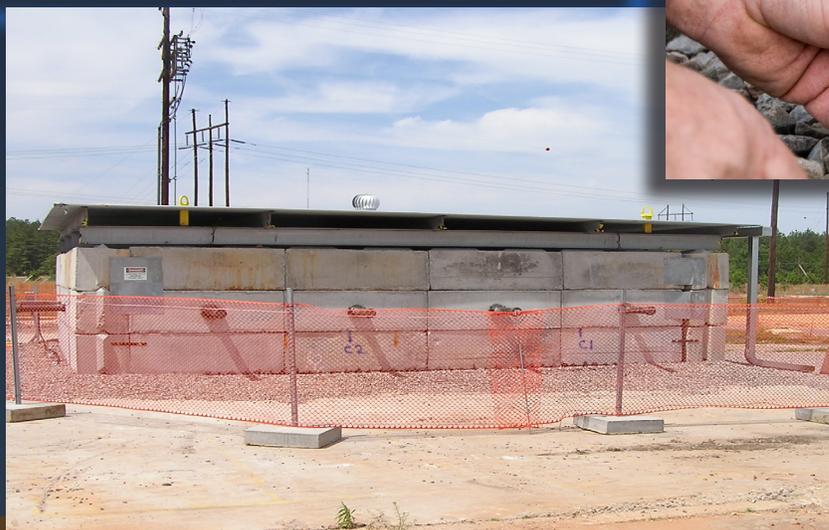
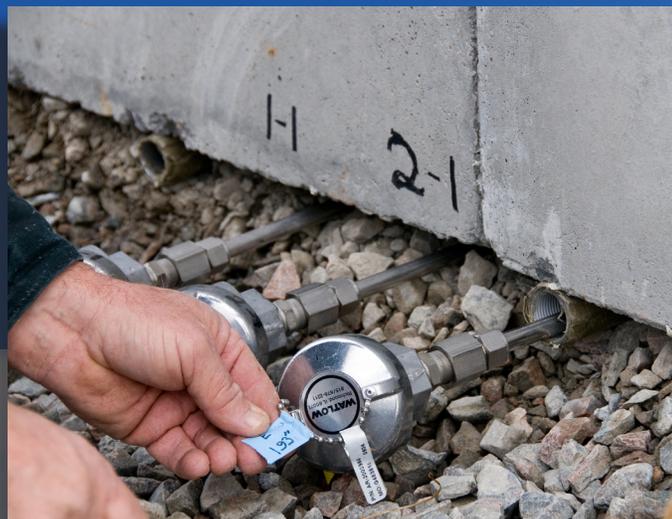
After the successful D-Area pilot study conducted in 2009, confirmation samples were collected and submitted for analysis. Four soil samples tested to an average tritium activity well below the contaminant migration level, while seven concrete samples analyzed by an offsite laboratory had undetectable amounts of tritium.

Thanks to this successful pilot study, and funding from the American Reinvestment and Recovery Act, three additional thermal treatment units will be constructed in D Area as part of the area's final remedial action.

The treated materials will then be safe to return to the environment rather than shipped off-Site for disposal. The project is scheduled for completion in September 2011.



Below: The Thermal Detritiation Treatability Unit in various stages of construction.



## 2009 Technologies

After more than four years, one of the Savannah River Site's most notable remedial technologies reached an operational milestone in September 2009, when steam injections were completed at the M-Area Dynamic Underground Stripping (DUS) system. Since its inception in August 2005, this technology has removed more than 433,000 pounds of volatile organic compounds (VOCs) from the three-acre treatment zone in M Area.

DUS is an innovative technology that injects steam into subsurface solvent plumes to vaporize the contaminants that reside within the soils. The resultant contaminant vapor is then extracted using Soil Vapor Extraction (SVE) units.

The primary contaminants of concern in M Area are trichloroethylene (TCE) and tetrachloroethylene (PCE), chemicals that are common commercial cleaning solvents and were once used to clean and degrease fuel assemblies during SRS's historic defense-related operations.

## Working towards Recovery

### *Dynamic Underground Stripping*

More than 340-million pounds of steam were injected into the treatment zone throughout its operations, which heated the subsurface soils to over 200 degrees Fahrenheit. Once heated, the contaminants became volatilized, which allowed the VOC vapor to be extracted from the soil. It has been estimated that the DUS system extracts material 15 times faster than SVE alone, and 75 times faster than pump-and-treat systems of the past.

ACP engineers estimate that the heat will be retained within the treatment zone for approximately three years, permitting continual vapor extraction to occur uninterrupted. As the soil cools, the treatment zone will be transitioned to a passive SVE technology, such as MicroBlowers™ or BaroBalls™, to remove the remaining contaminants from the area.



**Left:** Mary Brown, a Site Infrastructure employee, turns off the steam injection at the Dynamic Underground Stripping steam generation site.

**Right:** An aerial view of a portion of the DUS unit.



ACP remains focused on cutting-edge scientific research and new technologies in the areas of environmental cleanup and remediation. Recently, these efforts have been put to use at the M-Area Chemical Oxidation Project (MACO), where chemical oxidants will be injected into the subsurface to demonstrate the potential for groundwater remediation in M Area.

The treatability study focuses on source areas associated with a 1,600-acre plume that extends across SRS's A and M Areas, where trichloroethylene (TCE) and tetrachloroethylene (PCE) have been found in the groundwater.

Both solvents were used at SRS in cleaning and degreasing activities in many industrial areas. Scientists and engineers from Savannah River Nu-

clear Solutions (SRNS) and the Savannah River Ecology Lab (SREL) have teamed up to demonstrate alternative methods for source area remediation of solvent-contaminated groundwater.

Before the injection process could begin, monitoring wells were installed and samples of the subsurface soils and groundwater were collected to measure the contaminant levels in the treatment zone. At the close of 2009, ACP engineers had injected approximately 5,000 gallons of sodium persulfate (a type of salt) into the groundwater, where it chemically reacts with the PCE and TCE to create clean water.

At the conclusion of this demonstration, SRS hopes to identify a timely and cost-effective means of remediation to accelerate cleanup. The demonstration project is planned to be completed by September 2011.



**Above: ACP/ARRA employees Steven Ballesteros (left) and Matt Malin (right) sample groundwater from the MACO Project.**

Area Completion Projects attained another milestone in 2009 using an ingenious remediation strategy at a waste unit known as the Chemicals, Metals, and Pesticides Pits (CMP Pits).

The seven waste pits that comprise the CMP Pits were built in 1971 to dispose of chemicals, metals, pesticides, and lighting ballast components. In 1984, the pits were emptied and backfilled, and an infiltration cover was installed. Later, however, scientists discovered that solvents still existed in the soils below the pits, and these solvents had to be removed to prevent contamination from reaching the groundwater below. A remedial technology called soil vapor extraction (SVE) was deployed in 2001, which removed 9,300 pounds of solvents, but left behind small pockets of contamination.

A team was formed to determine the most effective cleanup technology for these pockets. The team, which included the U.S. Environmental Protection Agency (USEPA), the South Carolina Department for Health and Environmental Control (SCDHEC), the Department of Energy (DOE), and Area Completion Projects (ACP), selected a method called Electrical Resistance Heating (ERH).

In ERH, electrodes heat the soil to 200 degrees Fahrenheit, transforming the liquid solvents into a gaseous form. The contaminants are then removed using SVE systems. The rate of removal has proven to be over 80 percent faster than SVE alone, and the system facilitates quick and easy capture of solvent contamination, preventing further groundwater contamination and expediting SRS cleanup.

In 13 months, over 3,500 pounds of contaminants were removed using ERH and the system was dismantled in late 2009. Subsequent soil and groundwater samples were later collected to assess final completion. Groundwater testing will continue at regular intervals, in a process known as Monitored Natural Attenuation, to ensure that natural cleanup processes are proceeding as anticipated.



Above: An aerial view of the CMP Pits showing the extent of the ERH technology.



Left: The Electrical Resistance Heating technology shown in more detail.

**Area Completion Projects:**

- ▶ Achieved 11.9 Safe Years worked since the last lost-time injury
- ▶ Completed 347 FFA Milestones on or ahead of schedule (71% program completion)
- ▶ Initiated in-situ closure of P Reactor
- ▶ Received Early Action Record of Decision for the in-situ closure of C, K, L, and R Reactor facilities

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**Savannah River Site:**

- ▶ Awarded \$115,100,184 million in contracts to local businesses to support Recovery Act closure projects
- ▶ Hired 2,212 people in the first eight months of the Recovery Act



ACP Recovery Act employee, Matt Malin, records data from core samples taken in R Area.



ACP Recovery Act New Hire employees attend safety training prior to reporting to the field for work.

# 2009 Area Completion Projects Environmental Report

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