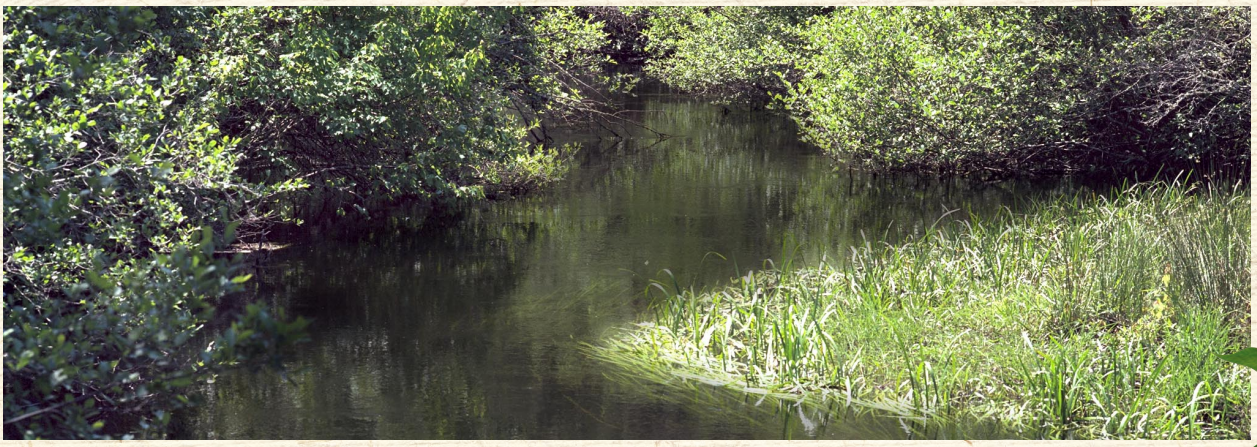
# Innovation. Acceleration. Completion.

SAVANNAH RIVER SITE

SOIL AND GROUNDWATER CLOSURE PROJECTS

2002 ANNUAL REPORT

# *How do we achieve success?*



WE WORK
*safely.*

WE WORK
*efficiently.*

WE GET
*results.*

***Cynthia Anderson, Director***
*Environmental Restoration Program*
*Department of Energy-Savannah River*

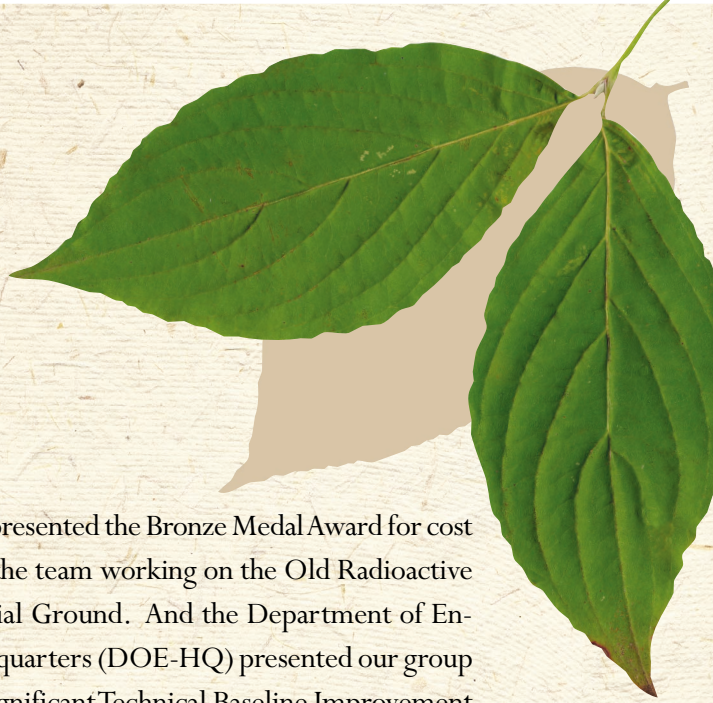
***Michael A. Sabbe, Manager***
*Soil and Groundwater Closure Projects*
*Westinghouse Savannah River Company*

# *A message to our stakeholders*

This fiscal year (FY02) was another exceptional year in the Soil and Groundwater Closure Projects. Our program continued its success of developing and implementing innovative and cost-effective approaches to risk reduction and remediation. We have now completed or moved into remediation 316 of the 515 waste units in our program.

This program deployed 22 new technologies and generated a total FY02 cost savings of $17 million while meeting every regulatory commitment. In addition, we reduced our out-year (FY03-FY07) estimated cost of remediation by $16.5 million through alternative technologies, expedited regulatory decisions, and improvements to our work processes from the Six Sigma Program.

However, our success goes beyond numbers and totals. Disciplined project management and engineering, coupled with close regulatory communications, drive our performance. Trust built on meeting com-



mitments allows the implementation of new and innovative approaches. Regular community interaction including the site Citizens Advisory Board (CAB) is essential. We share our success and lessons learned with other sites and, in turn, we learn from them.

Each employee's ownership and commitment to safety translates to our outstanding year-to-year work performance. In this fiscal year, we completed our fifth consecutive year without an employee missing a day of work due to a job-related injury or illness. Very few organizations achieve such an outstanding accomplishment in a work environment where potential hazardous conditions exist. We are very proud of our safety record.

Our key accomplishments were recognized. Westinghouse Savannah River Company president, Bob Pedde, presented a special Safety Achievement Award to our group. The Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response presented the Bronze Medal Award for cost savings to the team working on the Old Radioactive Waste Burial Ground. And the Department of Energy-Headquarters (DOE-HQ) presented our group with the Significant Technical Baseline Improvement Award for deployment of the Dynamic Underground Stripping technology. This award was one of two in the entire DOE Complex given by DOE-HQ.

As we document our accomplishments over the past year, we look forward to the challenges set forth in FY03 and beyond. We will strive for additional risk reduction and cost effective approaches to complete our mission. We are proud of our high standard of excellence and offer some of our key accomplishments in this year's annual report. Please take a few minutes to review our report. If you would like additional information, please contact us at (803) 952-6460. We appreciate your interest.

Cynthia V. Anderson

Michael A. Dello

# *How do we achieve results?*

*At the Savannah River Site, environmental results include completing soil and groundwater projects. Of the 515 waste units in the program, almost 300 are complete.*

*These results reduce risk to future populations and ensure adequate protection of human health and the environment.*

*Our project-based approach is cost efficient and operates in the regulatory framework of the Comprehensive Environmental Response, Compensation, and Liability Act, a Resource Conservation and Recovery Act Permit, and a negotiated Federal Facility Agreement.*

WE FOCUS ON *reducing risk.*

WE FOCUS ON *reducing costs.*

WE FOCUS ON *increasing understanding.*

WE FOCUS ON *valuing our people.*

# *How do we reduce risks?*

*By accelerating project completion.*

## Expedited Cleanup

The program adopted a plan to participate in the DOE's Environmental Management Expedited Cleanup Initiatives for implementing risk-based strategies, accelerating cleanup schedules, and reducing costs. The plan accelerates closure of the Old Radioactive Waste Burial Ground, reduces contaminant releases in Fourmile Branch, and continues deploying innovative technologies and improving regulatory processes.

## Consolidated Closure

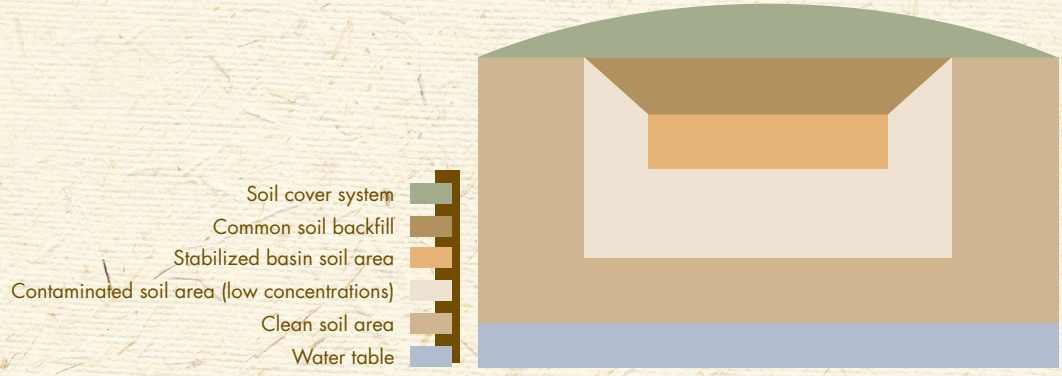
This initiative consolidates five high priority waste sites into one Record of Decision (ROD) for the General Separations Area Consolidation Unit. This project achieves a 99 percent risk reduction of radionuclides to the industrial worker and accelerates remediation of the program's highest risk waste site by two years. The plan removes contaminated soil material from the smaller nearby waste sites and incorporates it over the Burial Ground including 22 underground waste storage tanks currently being closed with grout. A synthetic clay cap will cover the contaminated soil followed by a layer of topsoil and vegetation to complete closure.

*The Old Radioactive Waste Burial Ground*

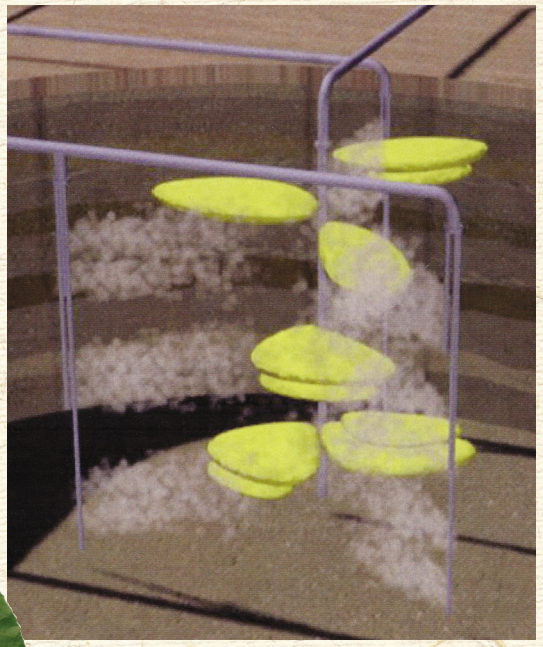
## Soil Stabilization Technology

Stabilization of soil in a high-risk open basin was completed for one of the three C-Area Reactor Seepage Basins. This project stabilized basin soil contaminated with radionuclides using an innovative dual auger to mix grout with the contaminated soil. Common soil was placed over the grouted area to backfill the open basin followed by a low permeable soil cover and vegetation to complete the closure. The two remaining basins were closed with common soil backfill and engineered protective soil covers. Grouting was not required for these two basins. C Area is one of four reactor locations to use one Plug-In ROD for closure. This approach presents a common remedy for high-risk reactor seepage basins with similar history of use, contaminants and risk.

*Dual auger grouting rig*




*Side view of a completed basin with grout*



*DUS uses steam (gray) to strip solvents (yellow) from subsurface soil*

## Dynamic Underground Stripping Project

Construction of the Dynamic Underground Stripping (DUS) project began for the A/M-Area Western Sector Groundwater cleanup effort. This innovative technology steam strips large quantities of concentrated cleaning solvents out of the groundwater and subsurface soil and significantly accelerates the cleanup schedule. The Western Sector Groundwater cleanup effort follows a successful one-year DUS operation of removing over 70,000 pounds of solvents in another A/M-Area location. The treatment area for this deployment is seven times larger than the area of its predecessor and has been estimated to contain more than one million pounds of subsurface solvents.

# *Phytoremediation of Groundwater*

Phytoremediation is an engineered use of trees and plants for consuming certain types of contamination in soil and water. Trees and plants have a natural process called transpiration that degrades, contains or releases these contaminants to the atmosphere in trace amounts. To control tritium-contaminated groundwater, the project includes an engineered pond to trap and contain contaminated groundwater seeps and a spray irrigation system for delivering it to a controlled, forested area of trees and sub-canopy plants. Phytoremediation of tritium-contaminated water is a safe technology. Dose studies indicate that releases to the atmosphere are in trace amounts and well below regulatory standards.

The program achieved an agreement to use phytoremediation to control releases of tritium-contaminated groundwater from closed waste units in F Area to Fourmile Branch. The agreement allows for expansion of the forested spray irrigation area at the already-constructed Phytoremediation Project. Estimates indicate an 80-plus percent reduction can be achieved by redirecting the contaminated water away from Fourmile Branch to the phytoremediation area. This natural technology also reduces the need to operate and maintain expensive mechanical groundwater treatment units.

*The constructed pond at the Tritium Phytoremediation Project*

# *How do we reduce costs?*

*By enhancing natural remediation.*

*The SRS Soil and Groundwater Closure organization uses its state-of-the-art technology to increase remediation effectiveness and efficiency. During this fiscal year, 22 new technologies were deployed at various waste sites to help achieve a total cost savings of $17 million. Avoiding the use of expensive mechanical treatment systems and adopting natural remediation systems produce significant cost efficiencies.*

## A/M Area Phytoremediation

*Poplar tree in A/M Area*

Phytoremediation was deployed to remediate solvent contamination in the A/M-Area Southern Sector. Phytoremediation is a rapidly developing technology that promises effective and safe removal of solvents from soils, sediments, and dilute/fringe portions of groundwater plumes. The phyto-irrigation system began operations on four quarter-acre plots of existing grasses and pine trees. Another four quarter-acre plots of poplar trees were planted and irrigated. The objective of the study is to determine the efficiency of various plants to bioremediate solvents in place under specific site conditions and to determine the maximum application of water without causing damage to the trees and grasses. A successful phytoremediation demonstration may eliminate the need to install additional systems.

*The Microenfractionator™ turns soil windrows during biochemical treatment.*

## Soil Bioremediation

Engineers completed the first phase of a soil bioremediation treatability study at the Chemicals, Metals and Pesticides (CMP) Pits. Approximately 600 cubic yards of soil contaminated with polychlorinated biphenyls (PCBs) and pesticides were distributed into four windrows for biochemical treatment. The soil windrows were amended with additives including manure and molasses and periodically turned by a machine called the "Microenfractionator™."

This natural remedy destroyed the dichlorodiphenyl-trichloroethane (DDT) pesticide and its by-products, and significantly reduced PCB concentrations. Results were reviewed by the regulatory agencies and approval was given to conduct a second phase of the treatability study.

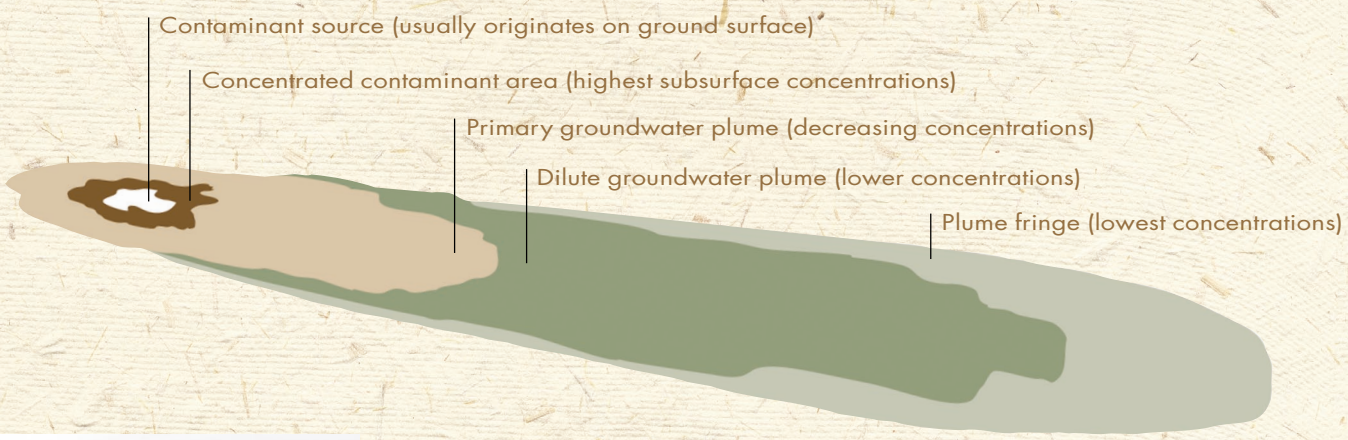
## Barometric Pressure

Project managers placed an air sparging soil vapor extraction (SVE) unit in stand-by at the CMP Pits and replaced it with Baroball™ technology. The SVE unit completed treatment of solvent hotspots in the subsurface soil known as the vadose zone area. Baroball™ technology was placed in operation to remove lower concentrations of solvents. The Baroball™ technology removes solvents from the soil by taking advantage of changes in barometric pressure above and below ground. When the subsurface pressure is higher, contaminants naturally move upward where they can be released or treated. Its design consists of a simple plastic sphere that seals a well from incoming air.

## Solar Microblower

Sampling at the A-Area Burning/Rubble Pits and Rubble Pile revealed elevated concentrations of solvent contamination which extended into the vadose zone beneath the trench to the groundwater table. Four wells were installed in this trench/pit area, each with a microblower connected to the head of the well to remove soil gas. The microblowers are powered by solar panels and operate during daylight hours when there is enough available solar energy. The microblower removes solvents from the subsurface much faster than Baroball™ technology because it does not rely on changing atmospheric conditions.

*Microblower and solar panel*




*SRS groundwater cleanup tailors technology to risk level.*

*Sampling water at a purge station*

## Monitored Natural Attenuation

Monitored natural attenuation was selected for the groundwater remedy at the K-Area Burning/Rubble Pit and Rubble Pile. This approach is based on the results of investigative sampling and a groundwater flow and contaminant transport model. The model indicated a clear trend of decreasing solvent concentrations and sample results indicated the plume is old and very low in concentration, and does not have active releases of source contamination. Groundwater monitoring wells were strategically located, and sampling implemented as a protective measure. Air sparging with soil vapor extraction is approved as the contingency measure if attenuation does not progress as modeled.

*How do we increase understanding?*

*Through stakeholder involvement.*

## *Tours and workshops*

The SRS Soil and Groundwater Closure organization is a model in the DOE Complex for stakeholder involvement. This year, the program offered a firsthand look at several SRS waste sites to Jessie Hill Roberson, DOE-HQ Assistant Secretary for Environmental Management, and to managers from the EPA and the South Carolina Department of Health and Environmental Control (SCDHEC).

*Jessie Roberson visited SRS in 2002.*

SRS was the host for two major workshops. The 2002 DOE Site Specific Advisory Board Groundwater Workshop was hosted by the SRS CAB. Approximately 50 participants came from 10 DOE sites across the United States to attend two days of workshop sessions and a tour of five waste sites.

*DOE Groundwater Workshop participants toured SRS.*

Our program also hosted a two-day Solvent Cleanup Workshop. Attendees included personnel from DOE sites such as Oak Ridge, Portsmouth, Paducah, and SRS, and the Department of Defense. Participants shared thoughts and opinions of technical presentations and participated in a field tour of seven waste sites.

## Citizens Advisory Board

The SRS CAB was informed of progress through site tours and monthly and quarterly meetings. The CAB was also instrumental in obtaining clean-up agreements on seven RODs with EPA and SCDHEC.

## Regulatory relationship

This organization has built strong relationships with the EPA and SCDHEC through open and frequent communications and negotiations. An existing core team consisting of DOE, EPA and SCDHEC is very effective in streamlining and combining decision documents. Cooperation during these processes translates into completing the fieldwork sooner and for less cost.

Seven RODs for 17 waste units were submitted to the EPA and SCHDEC for review and approval. Waste units completed included six with remedial actions plus an additional eight with no further action.

*Our employees provided a hands-on science experience at the 2002 SRS Technology Day.*

## School involvement

We provide science displays at area schools and opportunities for students to interact with our personnel during the annual Technology Day, Safety Conferences, and the Science Education Enrichment Day.

*How do we value our people?*

*With our commitment to safety.*

*The SRS Soil and Groundwater Closure organization operates safely and continues to reduce risk to the site worker, the public and the environment. The program is safely closing inactive waste sites and improving the water quality of site streams, the Savannah River and groundwater.*

*Hand protection at work*

*Extensive monitoring protects the environment as well as our employees*

## Safe hours record

The program continues to set worker safety records. By September 30, 2002, our program completed 4.3 million hours, totaling five consecutive years, without a worker missing a day of work due to an injury or illness.

## Behavior Based Safety

Behavior Based Safety (BBS) continues to be the key component for the success of worker safety. The BBS process increases workers' awareness of at-risk behaviors and teaches them skills to make right choices for personal safety and the safety of co-workers. Local Safety Improvement Teams were created for every project area.

## Operations Team

The Operations Team developed important safety initiatives including a Local Safety Improvement Team to increase the safe performance of tasks. Operations continued to set the site standard for managing environmental facilities. Crews drove groundwater remediation systems to over 95 percent efficiency in eight separate geographical areas.

*Personal protective equipment safeguards the health of site workers*

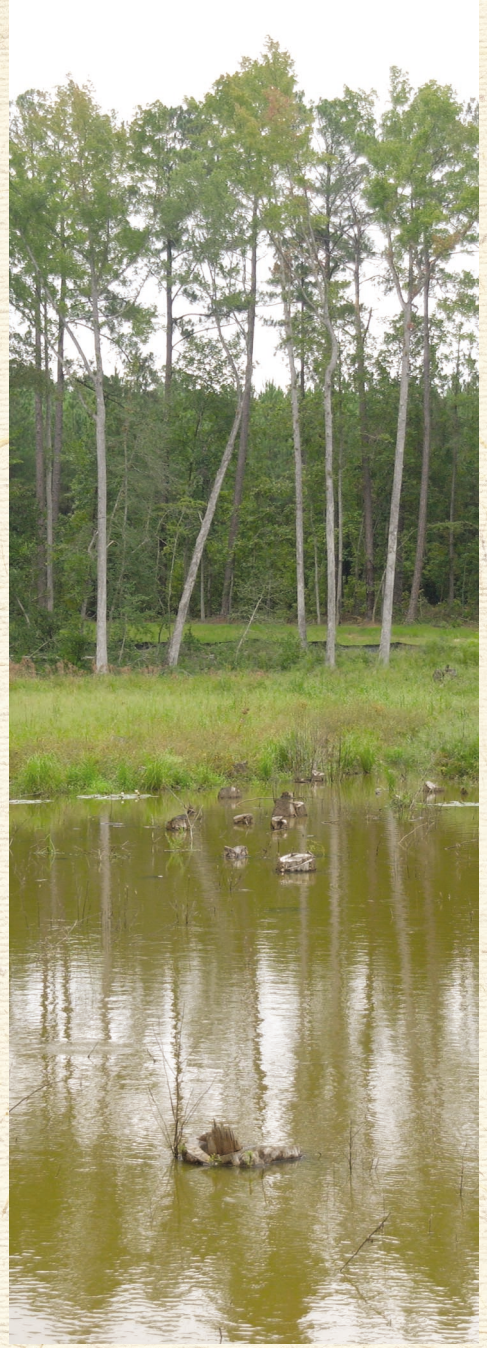
*How do we approach the future?*

*In fiscal year 2003, the SRS Soil and Groundwater Closure organization will apply 70 percent of its budget to high-risk sites. Key projects contributing to risk reduction include design to support accelerated closure of the Old Radioactive Waste Burial Ground and the remediation of solvent tanks at this highest risk unit.*

*Additional risk reduction projects include the installation of a dynamic steam stripping system in the A/M Area to control the source of a 1,600-acre solvent plume and protection of the Fourmile Branch watershed at the Mixed Waste Groundwater Unit. The Fourmile Branch initiative will also be supported with a caustic chemical injection into the F/H Groundwater Unit and additional phytoremediation to control tritium releases.*

## By completing our commitments.

*Innovative technologies such as bioremediation using microenfractionation to treat the remaining contaminated soil at the CMP Pits and sulfate reduction on metals in the D-Area groundwater are other key projects planned to produce risk reduction.*



*In 2002, the period covered by this report, the name of the Soil and Groundwater Closure organization was the Environmental Restoration Division.*

*The 2002 Soil and Groundwater Closure Projects Annual Report was produced by employees of the Closures organization and the Management Services Department at the Savannah River Site.*

*The Savannah River Site is owned by the U.S. Department of Energy and operated by Westinghouse Savannah River Company of Washington Group International and its partners - Bechtel Savannah River, Inc.; British Nuclear Fuels Limited, Savannah River Corporation; and BWXT Savannah River Company, Inc.*

SRS™

Soil and Groundwater Closure Projects
at the Savannah River Site

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