



Environmental Restoration

"Restoring the Environment Today for a Cleaner Tomorrow."

Environmental Restoration At the Savannah River Site

An Innovative Remediation Program

Setting the pace
for cost effective cleanup
and natural systems deployment

2001 Annual Performance Report

Our Mission

Remediate waste sites and groundwater units to reduce risk to the environment for future land use and to demonstrate capabilities to attract and succeed in new missions.

Our Vision

Continuously exceed the needs and expectations of our customers and become recognized as the best for Environmental Restoration (ER) through the application of innovative technologies, a strong commitment to teamwork, highly qualified personnel, and attention to continuous improvement.

Principles

- Safety is our first priority.
- People are our most important resource.
- High performance teams are created and sustained.
- Customer satisfaction is a continuous focus.
- Project management systems are rigorously used.
- Long-range strategic planning is valued.
- Achieving excellence is a commitment.

Fiscal Year 2001 Initiatives

Cost Efficiencies -- Accomplish $13M in cost savings while meeting all regulatory milestones.

Achieved $10.7M in FY01 hard dollar cost savings; achieved more than $2M in other FY01 savings; achieved $15M in out-year savings; met all regulatory milestones.

Technology -- Deploy innovative technologies resulting in at least $3M in baseline cost reductions from FY02 to FY06.

Deployed 32 innovative technologies; achieved savings resulting in greater than $3M of baseline cost reductions.

Safety -- Fully implement a Behavior-Based Safety (BBS) program.

Conducted 34 BBS workshops with ER management, staff and observers; local safety improvement teams began functioning at ER worksites; achieved zero lost workday cases in FY01.

Strategy -- Develop and communicate the plan to achieve the ER program strategy and vision.

Initiated an ER "Remediation to Stewardship" proposal that significantly accelerates remediation completion; conducted a two-part management retreat to strategically examine current and future plans for ER acceleration and completion.

Process Improvement -- Pursue efficiencies by integrating support services into ER projects and operations.

Piloted implementation of site's Six Sigma approach with initiatives streamlining ER support processes; pioneered use of graded approach in training ER personnel.

Radiological Control -- Develop a tailored approach to Radiological Control implementation commensurate with ER business needs.

Reduced unnecessary radiological requirements and optimized personnel resources; developed an ER-specific Radiological Controls Organization Procedures Manual.

Cynthia Anderson -- Director, ER Program, Department of Energy-Savannah River
Mike Sabbe -- Vice President and General Manager, ER Division, Westinghouse Savannah River Company

The first year of the new decade and millennium marked the continuation of outstanding performance for the SRS Environmental Restoration Program. In the past decade, we became known for our ability to successfully develop and implement innovative and cost effective approaches to remediation. The past year marked the continued implementation of this approach with new benchmarks for cost-effective performance.

Safety continues to be our first priority. By the end of the Fiscal Year (FY) 01 we had achieved over 1,453 days (over 3.4 Million hours) without a lost time accident. Monthly safety meetings, dedication to disciplined operations and the continued emphasis on the Safety Works Program are the foundation for our program of safety excellence. In the past year we applied our leadership approach for all SRS ER employees by implementing Behavior-Based Safety with introductory and observer training.

Our performance has been enhanced by disciplined project management and engineering coupled with close coordination with our regulatory partners. Trust is built on a foundation of making and meeting meaningful commitments, which allows the implementation of new and innovative approaches. Last year we deployed cleanup methods ranging from soil removal at the SRL seepage basins, soil solidification at C and K Reactor areas, and natural groundwater remediation using bioremediation and phytoremediation at multiple sites. The count of sites completed or in remediation reached 293 of 515 by the end of the fiscal year. Our continued emphasis on employing innovative technologies has saved over $250 million in life cycle costs.

Innovation does not end with our application of technology. We know that close coordination and liaison with state and federal regulators coupled with continuous community interaction through our proactive Citizen's Advisory Board (CAB) can make a difference. The continued participation of the regulators leads to early and innovative decision making. That translates into cost savings and improved efficiency.

We are not content with improving the operation of the SRS remediation program. Rather than look only inward we seek to export our innovations across the United States Department of Energy (US DOE) and United States Department of Defense (US DOD) remediation complex. Toward this end we actively support conferences including the annual Southeast Environmental Management Association, Waste Management and Technical Information Exchange with exhibits and presentations. We continued to host our own Annual Environmental Restoration Technology End User Conference (ER TEC) with our fourth meeting in July. This year we had over 240 attendees from 28 locations and concentrated on sharing information and technology deployment.

We will continue to strive for new and more cost effective approaches. Our efforts to involve all the stakeholders will not waiver, and we will seek to partner with the regulators to further accelerate the completion of our activities. We are proud of our accomplishments and welcome this chance to share some of our achievements with you. Take time to review this Annual Report. If you would like additional information please contact us at **803-952-6460**.

We appreciate your interest.

Cynthia V Anderson
Michael A Sabbe

Message to Stakeholders

Natural remediation combined with innovative technologies at the Savannah River Site is a cost effective solution to groundwater and soil cleanup.

Sharing Technologies

2001 represented a banner year for the implementation of new ER technologies with 14 first-time uses of technology. Examples of the new remediation technologies used in several locations include Dynamic Underground Stripping (DUS) for dense solvent cleanup and phytoremediation of solvent and tritium using trees as a natural process to remediate groundwater.

A successful benchscale was completed using a trademark micro-enfractionation process for enhancing in situ bioremediation of polychlorinated Biphenyls (PCBs) and pesticides. Eighteen uses of innovative technology were re-deployed at new waste sites.

To enable sharing of experience with new technologies, SRS hosted the fourth annual Environmental Restoration Technology End User Conference (ER TEC 2001) during July in Atlanta, GA. Over 240 participants from 28 states attended three days of ER TEC 2001 activities. Attendees represented federal and state agencies, universities, and private industry.

The focus of this year's conference was "green technology" for environmental cleanup. The conference agenda promoted deployment of innovative technologies and facilitated integration and teamwork among US DOE, US DOD, United States Environmental Protection Agency (US EPA), and state regulatory agencies. A special emphasis was placed on exchange of technology deployment experiences. Conference attendees shared cleanup success stories and technology innovations, and people who actually perform the cleanup work shared field experiences using new technologies.

A combination of technical presentations, interactive panel sessions, and vendor displays provided participants with many opportunities to exchange ideas on cost effective environmental cleanup. Thirty-two conference exhibitors from the private sector, state, and federal environmental agencies and academia held exhibits illustrating the latest innovations in environmental restoration technologies.

In addition to exhibits the conference also featured tours of the Lockheed Martin facility near Marietta, Ga., where extensive groundwater cleanup is in progress, and of the Plasma Application Research Facility at the Georgia Institute of Technology.

Dynamic Underground Stripping proved to be a promising technology for continued solvent removal in the A/M Area.

Upper Three Runs Projects




The Upper Three Runs project team completed remediation at four Savannah River Laboratory (SRL) seepage basins. This closure marks the last of the large surface unit remediation projects in the Upper Three Runs area of the site. These basins received low-level radioactive wastewater from the laboratories in the Savannah River Technology Center (SRTC — formerly the Savannah River Laboratory). The remedial action required removal of a 340-foot section of a process sewer line and 6,000 cubic yards of contaminated soil from the basins. After the contaminated soil was removed, the basins were backfilled to existing grade with clean soils and covered with selected plantings.

ERD completed operation of the DUS system in FY01. This system injects steam into the groundwater and unsaturated zone above it to mobilize the contaminants. The contaminants are removed through a central vapor extraction/groundwater recovery well with three vapor extraction wells around its perimeter. The DUS steam system heats the zone just outside the targeted area, driving contaminants inward to the extraction wells. Over time, the thermal front moves toward the central well until the saturated and unsaturated material in the target zone reaches the steam temperature.

At the first M-Area location where the DUS system was installed, over 70,000 pounds of contaminants (solvents) were removed. The removal rate is 15 times more efficient than conventional soil vapor extraction and 60 times more efficient than the groundwater pump and treat system. Two additional DUS deployments are planned for M Area.

Two interim remedial actions in A/M Area were completed in FY 2001. Contaminated soil was removed at the Miscellaneous Chemical Basin and a soil vapor extraction unit and 11 recirculation wells were installed to clean solvents from groundwater. A soil cover, 10 air sparging wells, and 30 passive soil vapor extraction wells were installed at the A-Area Burning/Rubble Pit to remove solvents.

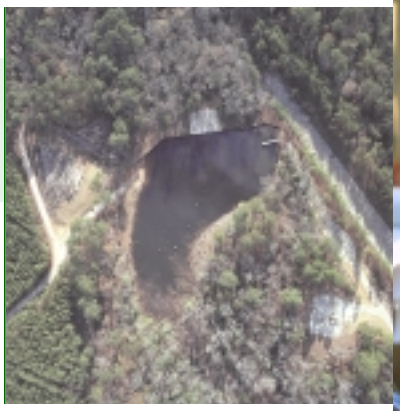
In addition, ERD completed Phase II of the soil and groundwater characterization at the D-Area Expanded Operable Unit. The characterization entailed collection of hundreds of soil and groundwater samples using an expedited site characterization approach. Evaluation of the collected data is in progress.

General Separations Projects

Natural remediation -- phytoremediation allows for the safe uptake and release of tritium to the air in extremely small doses. When the existing stand of trees is ready for harvesting, rainwater will replace the irrigation system as a means to flush the trees and restore them to their natural state.

The General Separations projects team completed production grouting activities in 2001 at the F-Area Retention Basin. The F-Area Retention Basin operated until 1973. The unlined basin received emergency releases of contaminated cooling water from the chemical separations process at the F-Area Canyon facilities as well as storm water drainage from the F-Area Tank Farm. Now contaminants that formerly posed a threat to groundwater have been stabilized in place by soil solidification with grout. A low permeability engineered soil cover has been placed over the basin area to further protect the groundwater.

The tritium phytoremediation project for the Southwest Plume began operations in 2001. A small sheet-pile dam impounds water from a seepline where the highest concentrations of tritium are found. When the dam became functional in spring 2001, monitoring stations in Fourmile Branch indicated an immediate and substantial drop in tritium concentrations. The water irrigates about 30 acres of adjacent natural forest. This irrigation results in transfer of extremely dilute tritiated water vapor to the air both from evaporation and from transpiration through the trees. This process, called phytoremediation, replaces the more conventional pump and treat system as a means of dispelling tritium. Phytoremediation allows safe uptake and release of tritium to the air



in extremely small doses. When the existing stand of trees is ready for harvesting, rainwater will replace the irrigation system to flush the trees and restore them to their natural state.

The Site Evaluations Program continued to make significant contributions to the assessment and closure of inactive waste sites at SRS.

Sampling activities were performed at 15 site evaluation areas, including early construction operational disposal sites, reactor cask car railroad tracks, a coal pile, a sandblast area, and the site of a mercury spill. Sixteen Site Evaluation Reports were submitted with recommendations for No Further Action at 15 sites (NFAs) and a limited removal action at one site. A substantial number of previously sampled sites were approved by regulators for no further action. In addition, sampling assistance was provided to other projects at the Burial Ground Complex, L-Area, and G-Area Oil Seepage Basin.




Reactor projects successfully completed remediation of the K-Area Reactor Seepage Basin (KRSB) during 2001. The KRSB, an unlined seepage basin, was used from 1957 to 1969 to receive low-level radioactive wastewater from operations at K-reactor. Site remediation entailed in-situ stabilization by grouting with a double-headed auger and installation of an engineered soil cover. A similar larger set of basins, with 579 soil columns each six feet in diameter, C-Area Reactor Seepage Basins (CRSBs), will be closed using the same methods in 2002. Grouting at these basins is a faster and more cost-effective cleanup method than shipping soil to a licensed disposal facility.

The subcontract for grouting KRSB and CRSB was awarded to a single contractor after a best value evaluation was performed on the submitted proposals to assure the greatest overall benefit to the site. This was the first use of the Basic Ordering Agreement for grouting.

The Air Sparging / Soil Vapor Extraction (AS/SVE) system continued to operate at the C-Area Burning Rubble Pit. The system has removed approximately 1,500 pounds of solvent since start of operations in the first quarter of FY 2000. During the year, monitoring well, soil, and soil-gas samples were collected, and zone of influence testing was conducted to assess the effectiveness of the AS/SVE system.

One of two SVE systems at the Chemicals, Metals, and Pesticides Pits (CMP Pits) was completed. The CMP Pits consist of seven unlined disposal pits that were used from 1971 to 1979 to dispose of chemicals, metals, and pesticides. The first SVE system was started at the end of the second quarter. Installation of the second system is nearly complete and the system will be operational by the first quarter of 2002. Approximately 900 pounds of VOCs were removed during testing and development of the extraction wells that will feed the second SVE system.

An enhanced bioremediation bench-scale treatability test was completed on the CMP Pits pesticide and PCB-contaminated soil. This test indicated that biological degradation of the contaminants was sufficiently promising to warrant an onsite pilot-scale treatability test. A treatment pad was constructed and the soil was excavated for treatment. The pilot-scale test on approximately 600 cubic yards of soil will begin during the first quarter of 2002 using an innovative tool, similar to a large compactor, called a microenfractionator.

Reactor projects continued to streamline regulatory documents saving time and money.

ER Operations sets the standard for non-nuclear operations at the Savannah River Site. Operations focused on safety during FY 2001 by training volunteers in Behavior-Based Safety, continuing the Job Hazards Analysis (JHA) program, and promoting the STAR (Stop, Think, Act, and Review) program.

ER facilities consistently maintained an operational state over 95% of the time. Over 1.1 billion gallons of groundwater were treated, over 3,450 cubic meters of waste were characterized and shipped for disposal, and over 95,000 pounds of solvents were extracted from the ground. Operators performed over 3,700 radiological surveys. The organization added two new operating facilities, reduced waste generation, and produced $800,000 in cost savings.

Roles and responsibilities for operators and mechanics were expanded through the Advanced Radiation Worker program and the assignment of multi-skilled technicians to the radiological facilities. A non-nuclear testing program was started that reduces new facility start-ups from months to days. This new program will provide the division with significant cost savings.

The Operations Drill Program was the first on site to respond to the Site Directive for drill improvement. Success of this program was reflected in the excellent response to actual severe weather and security events.

Most notable improvements were seen in material storage and shelf life. The program was formalized with the development and implementation of a new administrative procedure.

The Operations Department teamed up with Environmental Compliance personnel to develop and pilot a Permit Tracking System (PTS) to serve as a tool for ensuring compliance with operations-related regulatory requirements. The PTS is being considered as a site standard for tracking regulatory requirements.

ER Operations continued a rigorous self-assessment and a monitored evolution program consisting of over 100 documented assessments and a critique process. Events were analyzed and evaluated against Site Item Reportability and Issue Management (SIRIM) criteria. In every case, lessons learned were communicated to prevent re-currence. WSRC Senior Management conducted walk downs of the Operations facilities and provided positive feedback.

Future challenges and opportunities in the years to come include waste shipments to the Nevada Test Site and Phase II Operations of the F- and H-Groundwater Treatment Units.

On February 14, South Carolina Department of Health and Environmental Control Managers toured two ER waste sites: the tritium phytoremediation project (shown here) at the Burial Ground Complex Southwest Plume and Dynamic Underground Stripping (DUS) in M Area.

Stakeholders locally and nationally are kept informed of decisions involving the Environmental Restoration program at the SRS. Publishing in the academic/technical community is an important part of sharing cleanup experience. SRS ER encourages engineers and scientists to share their accomplishments by publishing their findings in trade journals. Two trade journals, *Pollution Engineering* and *Radwaste Solutions,* each featured the SRS Environmental Restoration Program. *Pollution Engineering* featured SRS on its front cover and included comprehensive coverage of four ER technologies. *Radwaste Solutions*, in addition to featuring SRS's ER program on its cover, discussed the overall evolution of the entire ER program, including technology development.

Stakeholder Involvement

SRS success stories are also shared with local community outreach programs and local news. The ER Program was included in multiple media events during the year and communicated cleanup plans with the local communities and stakeholders in news releases and site tours.

The Citizens Advisory Board (CAB) was informed of ER progress through site tours, and monthly and quarterly meetings. Area schools learned of SRS accomplishments and progress during the annual Technology Day, Safety Conferences, and Science Education Enrichment Day at the University of South Carolina at Aiken.

The CAB Environmental Restoration Committee held monthly meetings around the local area while the full Board met on a quarterly schedule. To enhance communication with the CAB Environmental Restoration Committee, a tour of ER waste sites was provided with presentations on science and technologies used for remediation.

To facilitate cleanup, ER communicates with US EPA and SC DHEC regulators on a daily basis and hosts many visits to inspect waste sites. In February, South Carolina regulatory managers toured two sites with special interest in technology: the tritium phytoremediation project at the Burial Ground Complex Southwest Plume and DUS in M Area.

The Annual Performance Report was widely distributed. The first ever ER Accomplishments CD-ROM was produced to replace the annual videotape. The CD-ROM presented a virtual tour of remediation activities on site, testimony to ER's progress and accomplishments, all of which represent significant cost savings. ER also updated all fact sheets to inform stakeholders of current cleanup progress and accomplishments. The fact sheets were posted on the SRS external web site and distributed to tour groups and news media personnel.

As of September 30, 2001, the ER program has worked four years (about 3.4 million hours) without a work-related lost time injury or illness. This is a demonstration of the ER program's dedication to safety.

Safety, Health and Security

ER continued its tradition of strengthening safety, health, and security during 2001, yielding the best ERD Safety Performance since its formation as an independent operating division in 1996. At year-end, ERD had completed 1,453 days, and over 3.4 million hours, without a worker missing a day of work due to an injury.

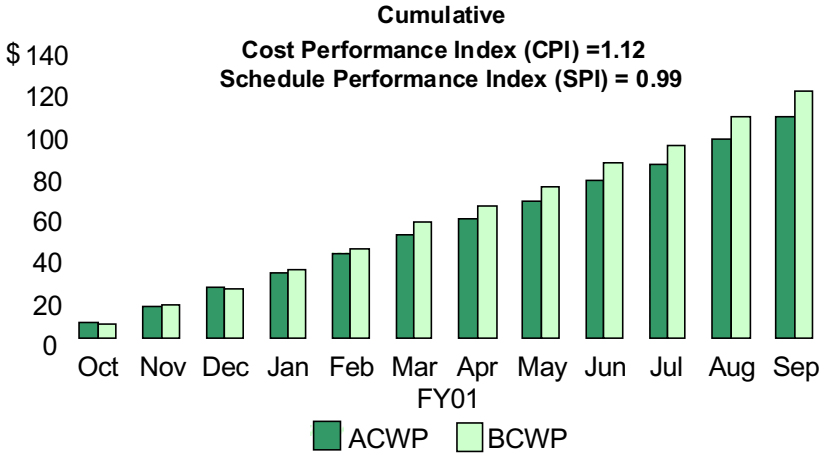
The focus on continuous improvement in worker protection strengthened the core programs of Integrated Safety Management Systems, Job Hazard Analysis, Emergency Preparedness, and Heat Stress Prevention. ER successfully developed and implemented the BBS process through team workshops for all personnel. The BBS process increases worker awareness of at-risk behaviors and develops skills they need to make the right choices for their safety and that of their co-workers. The BBS process is an integral part of the ER safety culture and represents a high standard of care for the safety of all ER personnel and their families.

During the year the ERD Safety Works Team developed focus initiatives to improve performance in the areas of chemical management, heat stress, and radiological control. In addition a special emphasis was placed on applying the STAR process — Stop – Think – Act – Respond — during the performance of tasks to prevent errors that contribute to injury.

Emergency preparedness was strengthened during the year through well-planned and executed drills and assessments to ensure that field communications, security, and accountability systems are fully functional.

ER continues to meet or exceed all site general security requirements. Through a program of continued education and awareness provided by the site in parallel with division emphasis, employees maintain their security focus. In the past year, self-assessments set the stage for the US DOE headquarters sitewide security evaluation. No discrepancies were noted for ER in this comprehensive assessment. Additionally, following the tragic events of September 11, a renewed emphasis on security has been implemented at the site. ER employees have rededicated their efforts toward compliance and vigilance, strictly adhering to sitewide security policies.

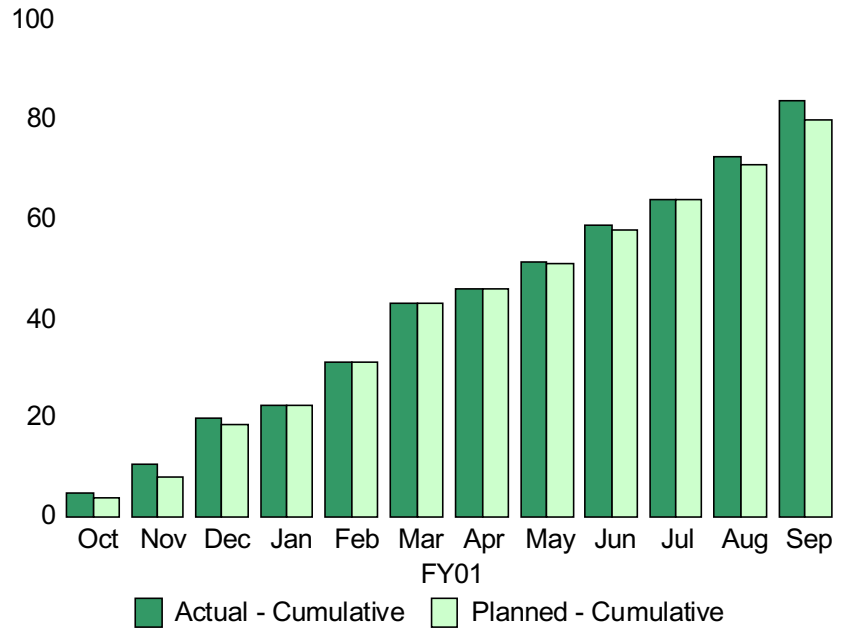
Program Performance



ER achieved cost efficiencies greater than 12.5 million dollars in FY01 and identified significant future savings impacting projects scheduled for remediation in FY02-06.

Actual Cost of Work Performed (ACWP)
Budget Cost of Work Performed (BCWP)

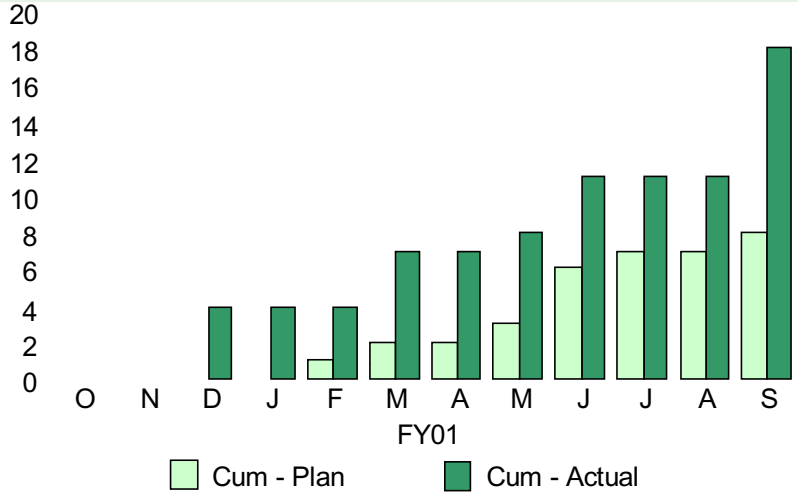
Enforceable Agreement Milestones



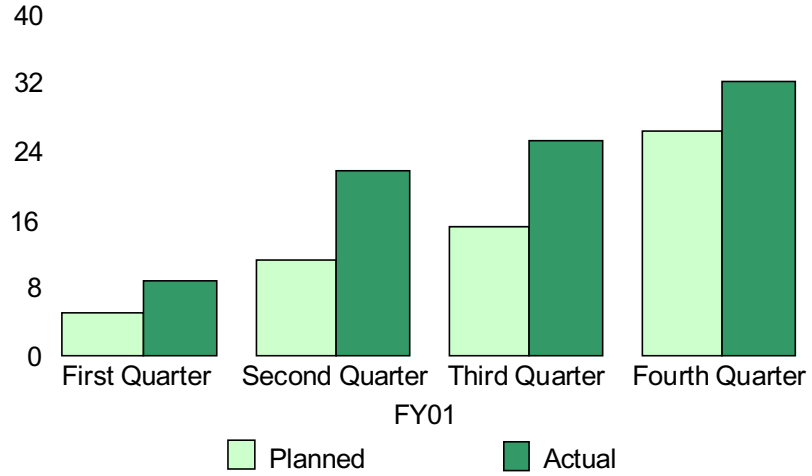
All regulatory milestones were met on or ahead of schedule. Effective teamwork with the Environmental Protection Agency and the South Carolina Department of Health and Environmental Control resolved strategic issues on several projects that will lead to cost and time savings in the coming years.

Performance-Based Management in 2001

Site Assessments

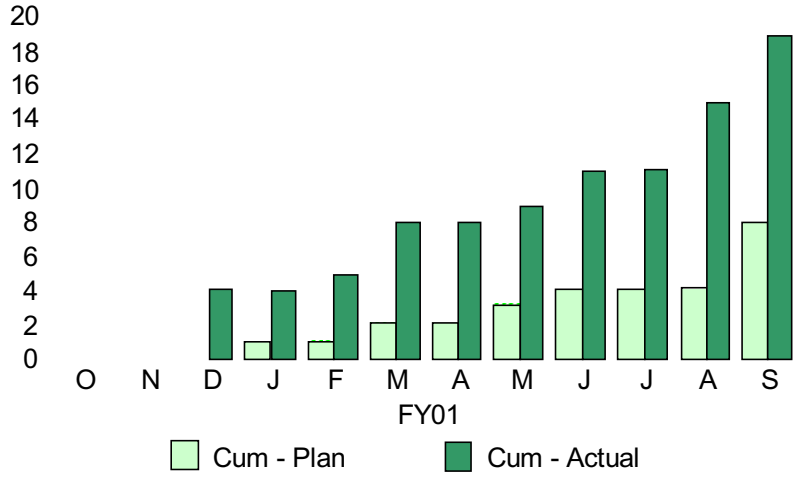


Technology Deployments

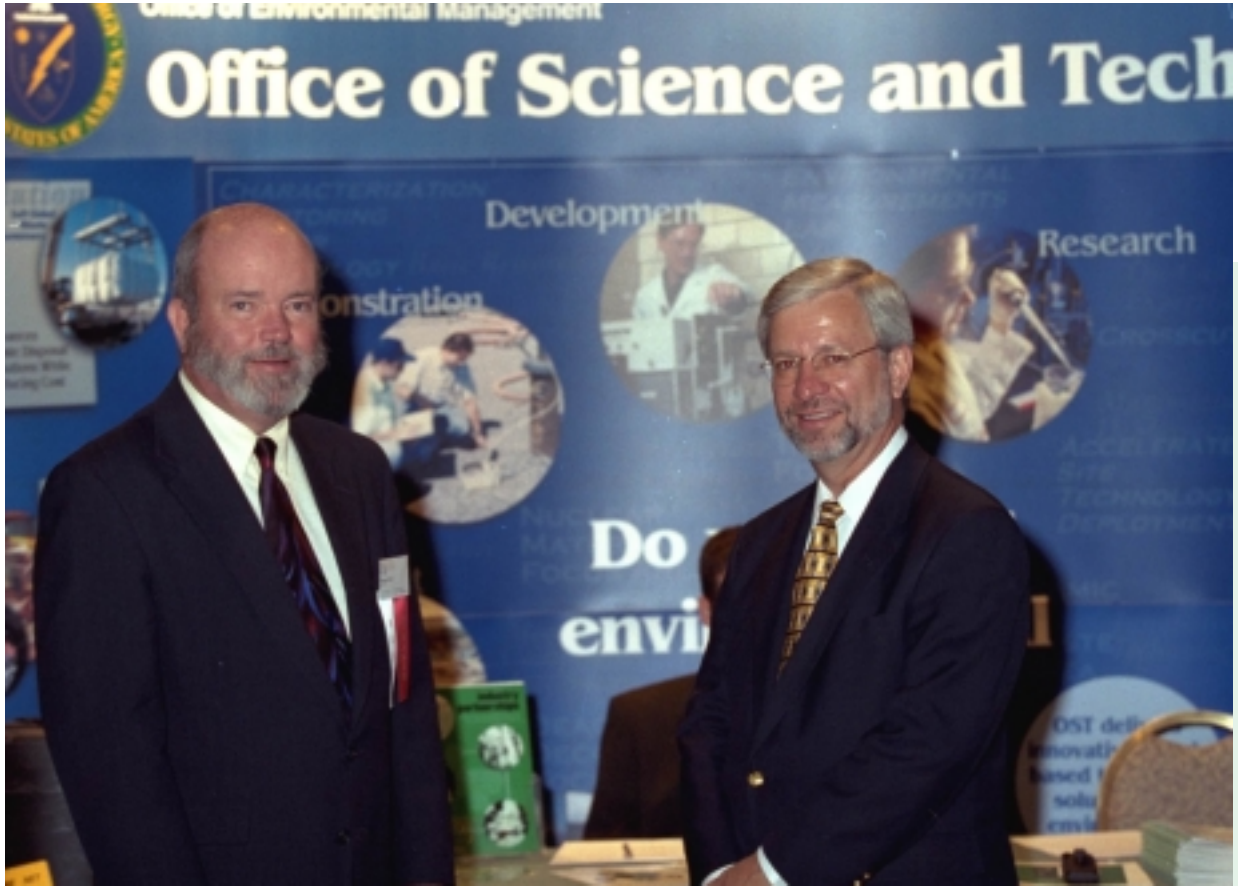


Deployment of 32 innovative technologies was accomplished in FY01. This significantly exceeded the FY01 plan and resulted in savings that exceeded three million dollars.

Site Completions



ER conducted site assessments and site completions well in advance of the cleanup plan. Eighteen assessments were conducted. This brings the total number of assessments to 290 out of the 515 sites. Nineteen sites were completed in FY01. Approximately 60 percent are now either completed or in the remediation phase. The number of fully completed sites now totals 263.



Tom Heenan, DOE-SR Assistant Manager for Environment, Science and Technology (left), and Gerald Boyd, DOE-HQ Deputy Assistant Secretary for Science and Technology-Environmental Mamagement (right), confer at the ER TEC Conference in July 2001.

ER management is not content with improving the operation of the SRS remediation program. Rather than look only inward we seek to export our innovations across the DOE and DOD remediation complex.

FY-02 COMMITMENTS

- Achieve closure on 13 waste sites.
- Complete 15 release site assessments.
- Complete construction and startup of phytoremediation plots for solvent removal in the southern sector of A/M area.
- Complete construction and startup of soil vapor extraction units for solvent removal at Miscellaneous Chemical Basin and the A-Burning Rubble Pit.
- Complete design and mobilize construction of dynamic underground stripping for solvent removal in the western sector of A/M.
- Complete construction and startup of field soil vapor extraction units at the CMP Pits.
- Complete K-Reactor Seepage Basin remediation with soil cap.
- Complete K-Burning Rubble Pit remediation with soil cover.
- Complete C-Reactor Seepage Basins grouting.
- Complete treatability study on microenfractionation technology for destruction of pesticides and PCBs.
- Complete grouting of 6 solvent tanks in the Old Radioactive Waste Burial Ground.
- Complete treatability report and install a new and more efficient ion exchange skid at the F-Area Groundwater Treatment Unit, moving toward scale-down of this system.
- Generate Records of Decision at the A-Miscellaneous Rubble Pile, L-Burning Rubble Pits, P-Burning Rubble Pits, Central Shops Burning Rubble Pits, (1,63G), Central Shops Sewage Sludge Lagoon, and the TNX Operable Unit.

Acronym Directory

AS/SVE	Air Sparging / Soil Vapor Extraction
BBS	Behavior-Based Safety
CMP	Chemicals, Metals, and Pesticides Pits
CAB	Citizen's Advisory Board
CRSB	C-Area Reactor Seepage Basin
DUS	Dynamic Underground Stripping
EPA	Environmental Protection Agency
ERD	Environmental Restoration Division
ERTEC	Environmental Restoration Technology End User Conference
FY	Fiscal Year
KRSB	K-Area Reactor Seepage Basin
NFAs	No Further Actions
PCB	Polychlorinated Biphenyl
SRL	Savannah River Laboratory
SRS	Savannah River Site
SCDHEC	South Carolina Department of Health and Environmental Control
STAR	Stop – Think – Act – Respond
TCE	Trichlorethylene
US DOD	United States Department of Defense
US DOE	United States Department of Energy
VOCs	Volatile Organic Compounds
WSRC	Westinghouse Savannah River Company