Putting the Stimulus to Work

By Fran Poda

The Savannah River Site (SRS) celebrated in April when it received $1.6 billion in funding under the American Recovery and Reinvestment Act. The money is being put to use to speed cleanup at the 310-square-mile U.S. Department of Energy nuclear complex.

Work to be performed under the direction of SRS's management and operations contractor, Savannah River Nuclear Solutions (SRNS), includes demolition of excess buildings, cleanup of old waste sites, and offsite shipment of transuranic waste. This accelerated work is scheduled to continue through September 2011, reducing SRS's operational footprint by 40 percent and creating or saving an estimated 3000 jobs.

To fill all of the personnel needs required under the Recovery Act project, SRNS is working with local union halls, the South Carolina Employment Security Commission, and multiple temporary agencies, while also conducting several job fairs in the surrounding communities. Hundreds of people have already been put to work, with the remainder expected to be in place later this year.

Some significant projects will begin and end by September 2011:

P Reactor before decommissioning.

On April 8, the U.S. Department of Energy's Savannah River Site received $1.6 billion to clean up remnants of the Cold War, employ locals, stimulate the economy, and restore hope.

- Two full-scale nuclear production reactors will be closed, becoming the DOE's first two reactors to achieve in-situ (or in-place) decommissioning.
- The high-hazard 235-F building will have the vast majority of its hazards removed.
- A 50-year-old test reactor whose rusted white dome has long been a landmark at SRS will be removed.
- A 450-foot-tall reactor cooling tower will be imploded, eliminating the cost of surveillance and maintenance and significantly reducing the site's footprint.
- The largest radiological incinerator east of the Mississippi will be torn down, marking the closure of a Resource Conservation and Recovery Act–permitted facility.
- The last remaining significant radiological building in the F Canyon complex, other than the canyon itself, will be demolished.

Considerable logistical and tactical challenges are being addressed to accommodate the hundreds of new employees and subcontractors who will be tackling the massive job ahead. These challenges include training, housing, and, most important, safety.

"One element of our mission is, and will continue to be, to safely deactivate and decommission [D&D] excess facilities and remediate soils, groundwater, and surface waters to protect our community and its people while also meeting all regulatory requirements," says Chuck Munns, SRNS president and chief executive officer. "In each of these projects we start with the notion of working safely. We want each employee to go home in a healthier condition and to carry with them a mindset of safety that extends beyond work conditions into their daily life. We want them to live by and propagate our incredible safety culture."

Setting the Stage for Future Reactor Closure

Two of SRS's nuclear production reactors reside in the P and R areas, where the reactors and their ancillary buildings covered nearly 600 000 ft^2. The reactor buildings are "cold and dark," meaning all historical power sources have been removed. Workers use temporary lighting and power to do the dismantling and removal work inside the reactor buildings.

The P Reactor had been shut down and unoccupied since the early 1990s, when the decision was made not to restart the reactor. R Reactor was shut down in the early 1960s because its production capacity was no longer needed for national security. Minimal surveillance and maintenance activities were conducted. Safety issues had to be resolved before others could occupy the facilities for deactivation work.

"The teamwork and leadership exhibited by the project management team to getting this job done, and done right, has been remarkable," said Mary Flora, director of SRNS' Area Completion Projects, the organization responsible for the lion's share of Recovery Act work. "These skilled individuals have analyzed the complex challenges of closing these reactors and have developed an innovative approach to not only achieve, but also accelerate these projects under the compressed Recovery Act schedule."

Deactivation of P Reactor is complete, and the facility is being prepared for removal of 4 million gallons of contaminated water in a disassembly basin whose depth ranges from 17 to 30 ft. The water will be removed using six industrial evaporators, leaving contaminants trapped in a sludge that will later be covered with grout. The disassembly basin structure will then be demolished and the area covered with an environmental cap.

The reactor tank will be filled with grout, and a concrete cover, called a monolith, will be placed over the tank. The below-grade areas of the building will be filled with grout.

At the top of the reactor building is a large steel structure that once served as the mechanism to raise and lower two massive steel doors into the reactor building. That structure will be removed, along with the 200-ft-high stack, and the building will be sealed, including air inlets, doors, and every other area where access could be gained. A roof will be placed over the area to prevent water intrusion.

Soil and groundwater cleanup work is done in tandem with D&D activities. For all cleanup projects, SRS works with the U.S. Environmental Protection Agency and South Carolina's Department of Health and Environmental Control to achieve the safest and most cost-effective end state for each area.

According to Reactors Project Manager Chris Bergren, decisions regarding closure of this area have progressed smoothly since the project was initiated in 2005. In 2006 comprehensive sampling of soil, surface water, and groundwater, covering a footprint nearly 100 acres in size, was performed to determine the nature and extent of contamination present in the area. The findings demonstrated that impacts to the environment from reactor operations were relatively benign.

Bergren noted the project is going well due largely to the ongoing open and candid dialogue with the regulators and the public. Because P Area is the first of the production reactor area cleanups at SRS, the project team recog-

A depiction of how P Reactor will look after decommissioning is complete.

nized the importance of establishing a solid approach that SRS, the regulators, and the public all support to set the stage for subsequent reactor area closures.

"This method sets the stage for the advancement in reactor closure," says Munns. "In-situ decommissioning has proven to be an environmentally friendly and cost-saving alternative to traditional remediation methods. Waste materials are stabilized and immobilized while radioactivity is allowed to naturally decay, preventing future exposure to the environment."

Stakeholders were actively involved in the decision-making process through numerous presentations to the SRS Citizens Advisory Board, and three separate workshops were held to discuss end state options. Work in R Area is following closely behind that at P Area, and both will be completed by the end of September 2011.

Removing Significant Hazards

The high-hazard 235-F building was part of original site construction in the early 1950s. It has had several production missions throughout its operational life, each of which has left a stamp on the robust old facility. Its operations have benefited the national defense, the National Aeronautics and Space Administration, and DOE–Environmental Management cleanup efforts.

The facility is a blast-resistant, windowless, two-story, reinforced concrete structure about 222 ft long, 109 ft wide, and 28 ft high. It is located in SRS's F Area, near F Canyon. The 235-F facility's most recent mission was receipt, storage, and disbursement of plutonium-bearing materials in support of SRS and the DOE complex. In 2006, the vaults were emptied, and the facility was placed in a reduced surveillance and maintenance state, in which the primary focus is operation and maintenance of systems. The facilities contain and provide ongoing monitoring of the residual nuclear materials that remain within the building. These materials are primarily plutonium-238 and neptunium-237, which are contained in various areas of the building. The major hazard is Pu-238, which requires extreme safety precautions and radiological preventive measures.

Facility decommissioning was in the planning stages in fiscal 2007, when funding was suspended. It was restarted with Recovery Act dollars. Project Manager Dell Simpson was instrumental in the successful Rocky Flats D&D and now brings his expertise to 235-F. Simpson compares 235-F to the situation in Building 776 at Rocky Flats, where a Pu-239 fire spread particulates of the isotope

The high-hazard 235-F plutonium facility is a major focus of Recovery Act workers.

throughout the building. The difference, he says, is that Pu-238, which is the hazard present at 235-F, is far more dangerous than Pu-239.

The first task is to reduce the height of one of the stacks so that in the unlikely event of a significant earthquake or tornado, it cannot fall and potentially rupture the ceiling of the facility, which could put employees at the nearby Mixed Oxide (MOX) Fuel Fabrication Facility at risk. The MOX facility, which is under construction, will convert legacy weapons-grade plutonium into commercial nuclear fuel. It is expected to begin operations in 2016.

Next is to remove the Pu-238 from specific cells in the Plutonium Fuel Form Facility (PuFF), one of the processes that once operated within 235-F. The PuFF cells and gloveboxes contain approximately 94 percent of the contamination in the entire facility, and five of the nine cells contain approximately 93 percent of that holdup. "This form of Pu-238 is very fine, so successful cleanup requires significant planning and engineering controls, coupled with diligent conduct of operations," said Simpson.

The project will use small crews experienced in this kind of job. The workers understand radiological material, how it behaves, how it moves, and how it can be controlled.

The job will employ specialized techniques and processes based on confinement and air flow. The crews will use multiple layers of protective clothing, including breathing-air suits. They will dress out, spend a limited time on the job, then come out of the area and be replaced by a second crew. A third group of workers will serve as a support crew.

Coming out of the work area will involve going through multiple doffing areas. Always aware that particles of Pu-238 can be anywhere, workers will be rolled with paint at the first doffing station to affix any particles, carefully remove their first layer of protective clothing, then be frisked. If a worker's suit is not clean, he or she will go to the second station, be rolled with paint again, and remove the second set of protective clothing. Another frisk will be conducted, and so forth until the monitoring shows the worker is clean.

Simpson and his team hope to decontaminate the cells to the point where they can be classified as low-level waste and then disposed of at SRS. This would save between $8 million and $10 million over the alternative, which is disposal at the Waste Isolation Pilot Plant.

The work at 235-F is also expected to be complete by the end of September 2011.

Demolishing One Facility without Disturbing Its Neighbor

The building known as 221-1F is the last facility behind the concrete giant known as F Canyon. All other structures in this area, which historically provided support to canyon operations, have been demolished.

The 221-1F facility includes miles of piping that contain uranyl nitrate. The building itself contains holdup of depleted uranium oxide (DUO), from nearly 40 years of operation.

The pipes must be drained and then removed, 70-ft-tall tanks must be cleaned and removed, DUO must be cleaned up and drummed, asbestos must be removed, the entire facility must be demolished, and a concrete cap must be put into place—all by August 2011.

Simpson is also the project manager at 221-1F. He has divided his work area into zones, using the approach—and some of the same people—that successfully complet-

The 221-F facility, part of the complex behind F Canyon known as FA Line, is the last remaining radiological facility to be demolished in F Area.

The HWCTR ran from 1961 to 1964 and has been welded shut since 1998.

ed similar D&D closure activities at the nearby 247-F complex. This complex and its ancillary buildings covered 100 000 ft^2 and operated from 1985 to 1989. The facility took uranium feed stock and converted it to a form suitable for use as fuel in U.S. Navy vessels. Its successful D&D was a significant accomplishment that was completed in 2006.

The 221-1F building has similar challenges and some unique ones, according to Simpson. The height of the process piping and tanks means a very tall crane and shear must be brought in. In close proximity are operating buildings as well as the MOX construction site. Nearby 292-F houses safety-class fans, which constitute the only operable system left in F Canyon. The fans are still necessary to keep the canyon habitable and to support transuranic waste repacking work that is still going on in one area of the canyon.

Taking 221-1F down safely without disturbing its neighbors will be a challenge, but it's one Simpson is comfortable with. "It is a challenge that we know we can meet," he says.

Heavy Water Components Test Reactor

Since the early 1960s, the Heavy Water Components Test Reactor (HWCTR—pronounced "Hector") has been a landmark in B Area. It has been welded shut since 1998.

The HWCTR was built in 1959 by a DOE predecessor agency, the U.S. Atomic Energy Commission (AEC), as a part of the power reactor development program. It extends more than 50 ft underground and includes a traditional containment dome above. Its mission was to test candidate fuel types for potential use in a heavy-water-moderated power reactor, which was one of the options under consideration at the time. It operated successfully

Before work could begin in HWCTR, workers had to cut their way into the facility.

At HWCTR, the team plans to dispose of the reactor vessel and steam generators, remove the dome, and grout the remaining structures in place. Then a concrete cover will be placed over the building footprint.

from October 1961 until December 1964, when the AEC discontinued development work on heavy-water power reactors.

When HWCTR and its support facilities were placed into a shutdown mode, fuel assemblies were removed; systems that contained heavy water were drained; fluid piping systems were drained, deenergized, and disconnected; and the spent fuel basin was drained and dried. Then a decision was made to retire the facilities in place. Ventilation systems were shut down, and facility doors were locked.

In the early 1990s, the DOE began planning to decommission HWCTR. In 1997, in the face of budget constraints, the DOE deferred dismantlement and placed HWCTR in an extended surveillance and maintenance mode. The facility was placed in a condition that protected workers, the public, and the environment from the exposure of residual radiological, chemical, or toxic hazards. All facets of the facility's construction and any potential future hazards were analyzed. All auxiliary buildings were demolished, and the entrance to the dome over the reactor itself was welded shut. This condition was designed to be effective for 60 years.

Now HWCTR has been identified as part of the Recovery Act scope, and Project Manager Tony Long's job is to take it down safely and efficiently. "The first thing we have to do is get in there and see what we're dealing with," he says. "We have to open it up, make it habitable, and verify the absence of hazards. Then we can perform the work necessary to officially declare it cold and dark."

Ultimately, the team plans to dispose of the reactor vessel and steam generators, remove the dome, and grout the remaining structures in place. Then a concrete cover will be placed over the building footprint.

K Area Cooling Tower

The cooling tower has stood near K Area since the early 1990s, when it was built to cool the water from K Reactor. Just as the tower was finished and tied in to the reactor, the Cold War ended and the reactor was shut down.

The 452-ft cooling tower, built on concrete stilts, has a honeycomb structure inside and a water-filled basin beneath. It has aviation lights at its top, which must be maintained and changed regularly, and its structure must also be kept in a safe state for workers who attend to the aviation lights. In the early part of this decade, the tower was on the D&D list but dropped off. Now, it's back on.

Long, who also serves as the project manager for this job, says he will award a contract to implode the structure. The contractor will dispose of approximately 18 000 cubic yards of rubble that will go to an SRS landfill. The pool underneath will be breached, drained, and left in place.

The 450-ft K Area cooling tower is built on concrete stilts and has a water-filled basin underneath

The CIF, which has been shut down since 2000 and will be demolished as part of Recovery Act work, is the largest radiological incinerator east of the Mississippi.

Consolidated Incineration Facility

Built in the 1990s to burn LLW and organics, the Consolidated Incineration Facility (CIF) has been shut down since March 2000. It is the last incinerator in South Carolina at a government site, and it is the largest radiological incinerator east of the Mississippi River. In its operational life, it disposed of LLWs such as lightly contaminated shoe covers, protective clothing, tools, and other items that had been used in radiological areas; solvents from the PUREX (plutonium and uranium extraction) operations in F and H canyons; and other site wastes.

The CIF is three stories high and covers about 100 000 ft^2, according to Steve Hayes, an engineer from Athens, Ga., who is one of the 3000 people hired to execute Recovery Act work. It has a rotary kiln and two secondary burners, all lined with fire brick. Solid waste arrived at the facility in boxes and was put on a conveyer belt that went through an X-ray machine to verify contents, then into the kiln. Liquid solvents were fed into the secondary burners. The resulting ash was disposed of at the SRS burial grounds.

The major challenges associated with CIF demolition, says Hayes, are the kiln, secondary burners, and a crossover pipe on the third level of the building. The challenge is how to get them out. "The kiln is 25 feet long, 12 feet wide, and weighs 250 000 pounds," says Hayes. "It's 14 feet up, made of steel, and lined with fire brick. The burners weigh about 60 000 pounds each. The pipe weighs about 100 000 pounds. There are cranes and heavy equipment that can do the job, but these are things we have to figure out."

Characterization is under way so that workers understand and can plan for the hazards they will be dealing with. The facility is scheduled to be demolished to grade by the end of September 2011.

Finishing the Job

In addition, workers will finish closure work in two other geographic areas—D Area and M Area. Both are near the site boundary. D Area was one of the first operational areas at SRS, with its tall heavy-water extraction towers making a distinctive skyline near the river. M Area was a reactor materials production area, where fuel and target assemblies were produced and sent to site reactors. Demolition of the heavy water and reactor materials production facilities is complete, and soil and groundwater cleanup work is being finished.

The next two years will be even busier than usual at SRS, as SRNS continues its core mission—safe operation of the facilities under its contract—and also executes Recovery Act work. The result will be a process footprint reduction of 40 percent and a site that is well positioned to accommodate new missions as a part of the DOE complex of the future. ■

Fran Poda works in Public and Employee Communications for SRNS. She can be reached by phone at 803/952-8671 or by e-mail at fran.poda@srs.gov.