Former P Reactor employees were invited to participate in the unveiling of a state historical marker placed at the area entrance.

SRS's P Area Closure Work Reaches Milestones

Area Cold and Dark, Moderator Removed, Demolition Complete

The Savannah River Site's P Area has a history of leading the way at the DOE site. As the first reactor area at SRS to undergo area closure, it's still doing so.

By Fran Poda

The P Area has a history of leading the way at the U.S. Department of Energy's Savannah River Site (SRS). As the first reactor area at SRS to undergo area closure, it's still doing so.

In this integrated approach to closure, adopted by SRS in 2003 and endorsed by state and federal regulators, an entire area is addressed as one waste unit, rather than each small waste unit in the area being addressed separately. Under this strategy, SRS uses an area operable unit concept, which integrates decontamination and decommissioning (D&D) activities and soil and groundwater characterization, assessment, and remediation activities in each of SRS's 14 industrial areas. The money saved, in avoided costs associated with paperwork and person-hours alone, is significant. The first area closure at SRS was in T Area in 2006, at a cost savings of more than $37 million.

Yesterday

In February 1954, P Reactor was the second reactor at SRS to achieve criticality. Until it was shut down in 1988,

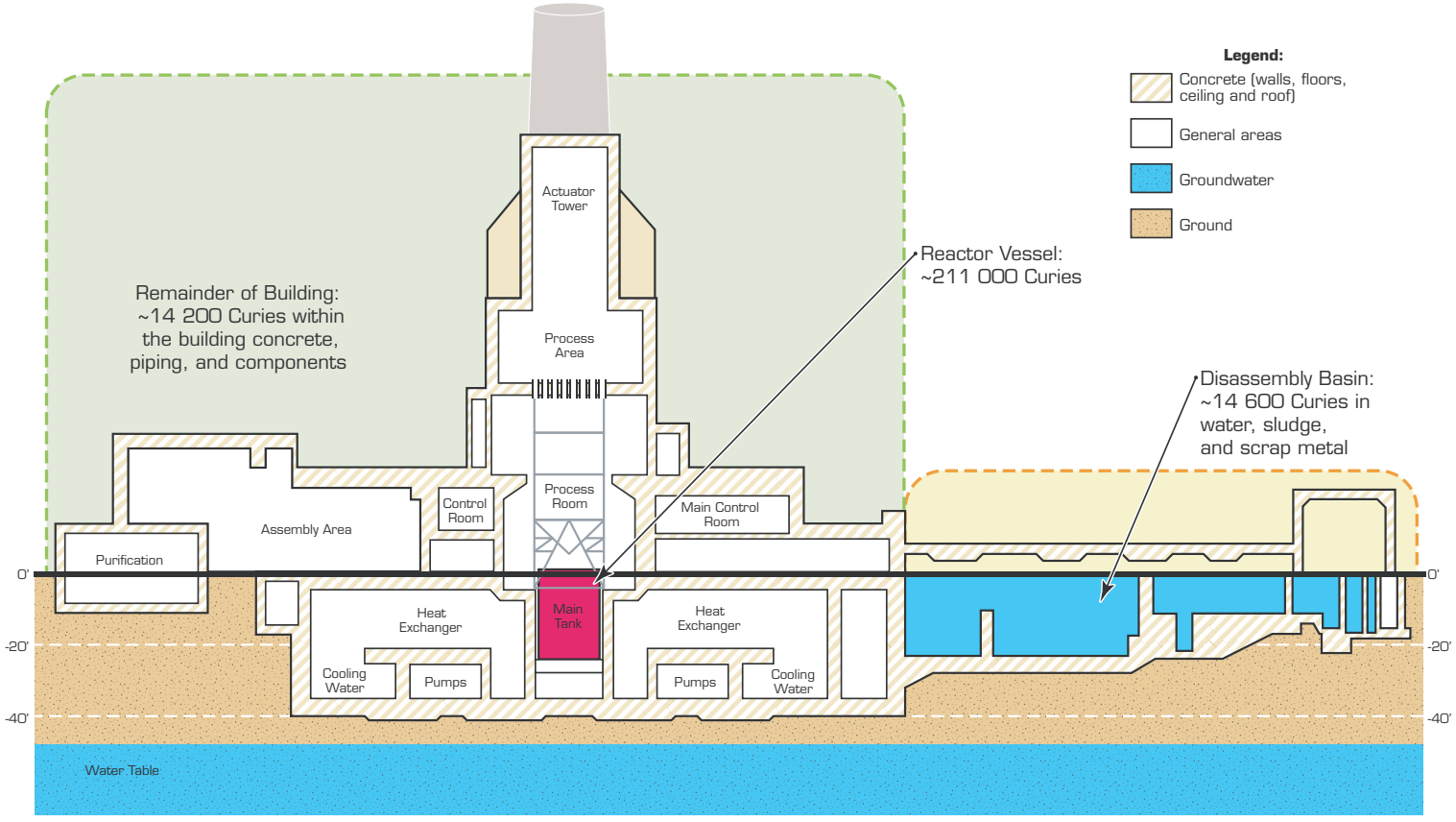
it never had a lost-time injury, which is why historical pictures of P Area show a sign claiming it to be the safest reactor in the world. This was where the subatomic neutrino particle was discovered, and subsequent research was conducted.

It's a place of pride and accomplishment, and the workers there still operate that way. "These workers have done an incredible job," says Tony Long, Washington Savannah River Co. (WSRC) project manager for deactivation and decommissioning of the buildings in P Area. (WSRC operates SRS for the DOE.) "They've dealt with hazards where one drop of liquid on their skin would have meant an uptake of radioactive material, and all their work has been safe and without any kind of event whatsoever."

Today

Now, a total of 19 buildings—covering 286 756 square feet—in the area have been removed, leaving only the reactor building and its ancillary structures. The entire area is "cold and dark," which means all historical power sources have been taken away. Workers are using temporary lighting and power to do dismantling and removal work inside the reactor building. "This is the first area where we've actually attempted and completed an area-wide cold and dark," says Long. "Before this, we drew a box around a building and cut the power, water, and sources of hazardous energy into the building itself. In P Area, we drew that box at the perimeter fence, which was

P Area as it looked in 2002, before deactivation and demolition work began in the area.



P Reactor building, 2008.

a very different thing. When we say P Area is cold and dark, we mean the whole area."

The area had been shut down and basically unoccupied since the early 1990s, when the decision was made not to restart the reactor. Minimal surveillance and maintenance activities had been conducted. Safety issues had to be resolved before people could come in and do deactivation work. "We had to work our way in," Long says. "The reactor building had previously sustained a complete power failure, so the building had absolutely no power and no lighting. We did all initial tours with flashlights, and we had to write specific safety plans to do the work we did. There were mold issues and significant water intrusion. We actually made some repairs to allow us to occupy the facility safely."

Hazards

Part of deactivation is removing hazards, and a major one was removing heavy water—which once served as a moderator for reactor operations—from the facility's massive systems. Although the systems had been drained, small amounts of tritium-containing moderator (i.e., moderator material, D_2O) remained in tanks, transducers, pressure switches, and pipes throughout the building. Workers had to manually drain hundreds of locations in the facility that could potentially hold leftover water. Each location presented a potential risk for uptake. All it would have taken would be for one worker to get a drop of water on his or her skin.

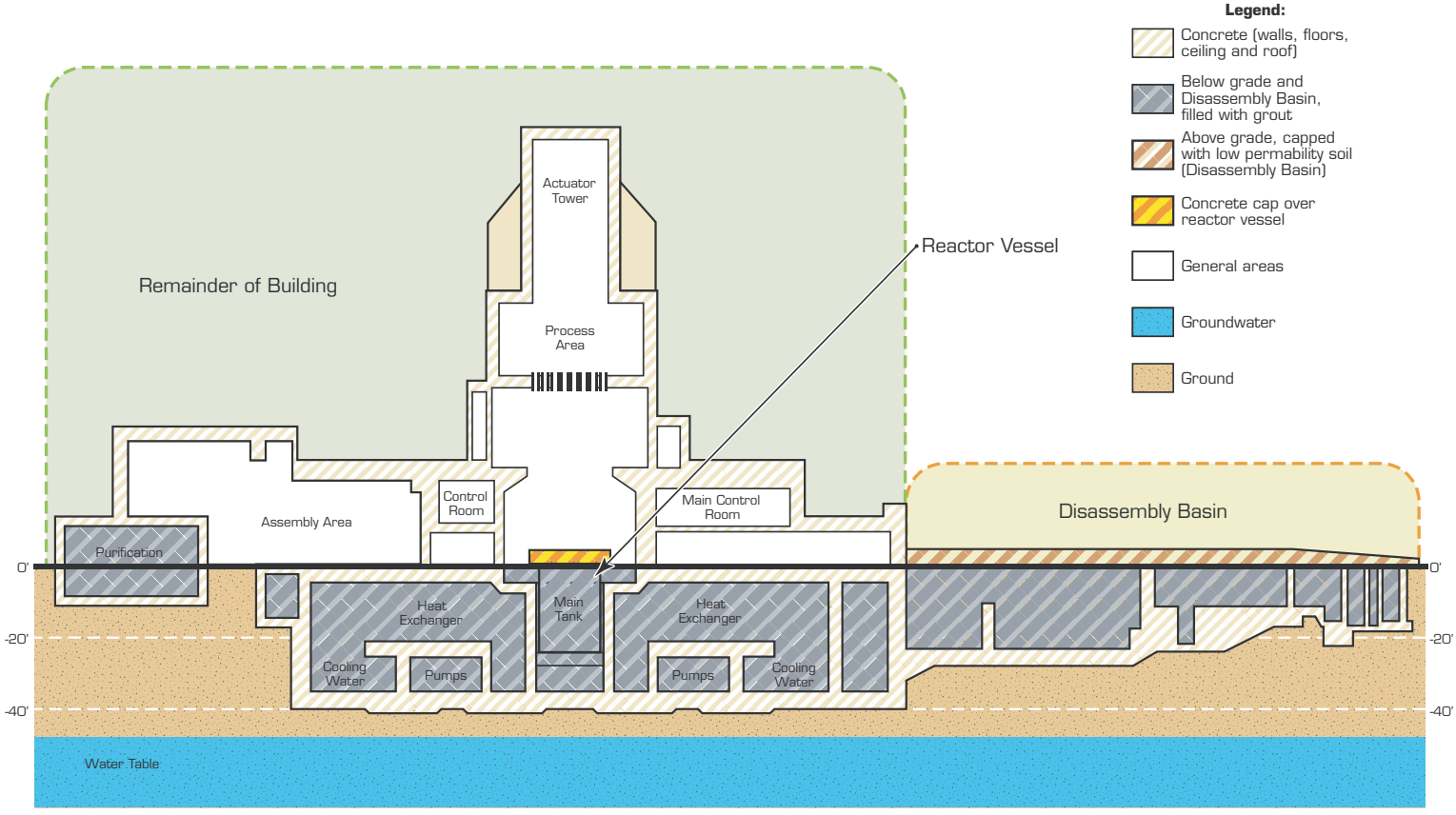
"Besides working safely, our people were also very resourceful," says Long. "With the help of other groups on site, they found plastic suits in other areas of the site that would have otherwise not been used because they were about to go out of date, and they used those suits for this work."

Removing moderator required an operational ventilation system, so the team started up one of the huge fans, which had not been used since the early 1990s. They made necessary repairs, connected temporary power, set up a set of temporary controls, and the fan worked well throughout the process.

In July 2007, P Area achieved cold-and-dark status. In September 2007—nine months early—the workers finished removing moderator from P Area, about 90 gallons in all. They drummed the water and transferred custodianship to the Spent Fuel Project, which is responsible for all heavy water on site. Part of the cold-and-dark work involved taking down 115-kilovolt lines going into the area. This was done with the help of DOE's Savannah River Operations Office (DOE-SR), their contract with SCANA, and WSRC's electrical operations group. After the lines were gone, the last substation that the 115-kV lines fed into was demolished. This was done in September 2007, and it marked the end of the demolition work for all buildings except the reactor building itself and its ancillary structures.

Memories

One intangible challenge was the history that some members of the team have with P Area—and the history of P Area itself. P Reactor is one of only 10 historically significant buildings at SRS, and its history had to be care-



P Reactor in-situ decommissioning.

fully preserved to comply with state and federal laws. "We brought in historians who did interviews with old reactor folks, took extensive photographs, and removed artifacts to be curated for future use," says Long.

Long himself has some personal feelings about P Area. His first job at SRS was in the reactor building as a project engineer. His first office was in P Area's administration building, which crews demolished last year. The reactor building has lots of memories for him. "Every time I walk through there, I think of specific things and people who helped me along when I was new on site," he says. "It's really amazing, all the capabilities that came together to make this an operating facility. I talk to some of the retired guys now, and they can't believe we're taking it all apart. But once you decide it's no longer needed, it's important to make it safe for future generations."

Currently, workers are preparing to remove contaminated equipment in above-grade areas of the building. For a 50-year-old, 100 000-ft^2 nuclear facility that extends from 40 ft underground to more than 150 ft high, that's not a small undertaking. "It's a significant task," says Long. And each portion of the overall task is fraught with the same hazards as those that have been faced before, requiring the same deliberate, safety-conscious, take-care-of-your-brother approach.

The End State

The things that are being done now will have to be done no matter what end state is chosen, says Long. The proposed end state for P Reactor is in-situ disposal, which would mean that the majority of the reactor building itself would remain. If the proposed end state is approved, then all the below-grade areas will be grouted in place. The reactor vessel will be filled with grout, including a concrete "monolith" placed over the top of the tank itself to completely encase the vessel. The elevations of the building at 20 and 40 ft below grade—which account for a significant portion of the overall structure—will be filled with grout. As the grout placement proceeds, workers will strip out the temporary lighting, power, and communications network that has been installed. Some areas above grade will also have to be grouted because of levels of contamination, Long explains.

At the top of the building is a metal structure that once served as the mechanism to raise and lower two massive steel doors into the reactor building. That structure, known as the shield door gantries, will be removed and a roof placed over the area to minimize water intrusion.

The disassembly basin, a large water-filled pool where spent nuclear fuel once cooled before being sent by rail to the site's chemical separations areas several miles away, will be grouted. The basin has pool depths of 17–30 ft and contained about 5 million gal of water. That water will be disposed of, the disassembly basin structure demolished, and the area capped.

The 100-ft stack will be removed from the building, so that it cannot fall on the remaining structure. Finally, the building will be sealed, including air inlets, doors, and every other area where access could be gained.

Environmental Remediation

While D&D crews are working on the reactor building itself, other remediation workers are cleaning up the soil and groundwater in P Area. Environmental restoration at SRS continues to be a challenging and dynamic process as new cleanup technologies and approaches are adopted for large industrial areas such as P Area with multiple contamination areas and types of contaminants. For all clean-

If the recommendation for in-situ P Area closure is approved through the regulatory process, the reactor building will look similar to this when work is completed.

Phil Carter cuts through one of two 8-inch-thick carbon steel doors that shielded reactor workers from the reactor during operation. The door was cut to gain access to equipment that had to be removed.

up projects, SRS works with the U.S. Environmental Protection Agency (EPA) and the state of South Carolina to achieve the safest and most cost-effective end state for each area.

According to the Soil and Groundwater Closure P Area 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. "There are only three areas, totaling less than 1.5 acres, where low levels of cesium-contaminated soil are present," says Bergren. "Geologists conducting the characterization efforts discovered only minor amounts of solvents in small, defined areas totaling less than 1 acre where maintenance and degreasing operations took place."

Stakeholders Involved

Bergren noted the project is proceeding well due largely to the open and candid dialogue with the regulators and public that has been ongoing since the start of this project. Since P Area is the first of five reactor area cleanups at SRS, the project team recognized 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. Stakeholders were actively involved in the decision-making process through numerous presentations to the SRS Citizens Advisory Board (CAB) and three separate workshops held to discuss end state options for the reactor facility and the 100-acre P Area.

"The need to be so rigorous," said Bergren, "was to make sure we had up-front involvement and agreement as the project evolved. If issues were raised, we did our best to address them. Today we are proud of the progress we have made, especially with various groups that have been engaged. I'm proud to say that everyone who has participated in this project supports the remedial approach."

Public Endorsement, Regulatory Agency Agreement

The SRS CAB and the public have endorsed the planned cleanup actions for P Area, including the proposed in-situ end state for the reactor. The regulatory agencies have agreed that excavating radiologically contaminated soil and consolidating it within the reactor building for final disposition is sound and protective. Two soil locations containing solvent contamination will be treated using soil vapor extraction, a technology used to remove organics from unsaturated soils. Removing the solvents from the P Area vadose zone will prevent the migration of contamination to the groundwater beneath.

A core team from the EPA, the S.C. Department of Health and Environmental Control, and DOE-SR meets regularly to review progress of P Area assessment and closure. It is anticipated that P Area cleanup will begin in early 2010 and will be completed within four years. The second SRS reactor area completion is currently under way in R Area and is utilizing the framework that was established in P Area. ■

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