Special grout required for effective sealing of old nuclear reactors

September 25 2012, by Will Callicott

The correct grout is key to closing SRNL's 60-year-old reactors.

When Savannah River Nuclear Solutions Area Completions Projects personnel sealed the site's massive P and R reactors, a suite of technologies and services from DOE's Savannah River National Laboratory (SRNL) was critical to a closure that DOE Site Manager Dave Moody called "a precedent-setting activity in the nuclear industry."

The two reactors were decommissioned in situ, avoiding the potential hazards and costs associated with generating and disposing of an estimated 137,000 tons of contaminated debris per reactor. In situ decommissioning (ISD) entails a combination of modeling to ensure protectiveness of the end state; demolishing or dismantling unstable structures; filling spaces, vessels, and equipment with special grout; sealing the openings, and monitoring the facility.

SRNL, with its extensive track record in environmental management technology application, contributed a combination of grout development and expertise and facility modeling that may show the way for nuclear decommissioning around the globe.

The process involved four different kinds of grout, including a "specialty grout" developed at SRNL, and based on earlier research at Argonne National Laboratory. The special grout was necessary because of a forest of aluminum tubing which remained in the reactors after their final defueling.

"Traditional grout with a higher pH would have caused these aluminum housings to corrode," said Dr. Christine Langton, an advisory scientist at SRNL. Such corrosion reaction could have led to a buildup of hydrogen gas. "We had to develop a grout that was chemically compatible with these hundreds of 20-foot-tall sleeve housings, so we developed a material with a pH of 9 1Ž2, which utilizes a calcium sulfoaluminate cement.

"It was equally important that the grout flow fluidly through the constrictive vessel configuration. We addressed the unique challenges of grouting a reactor vessel by designing the grout to be flowable, self-leveling, nonsegregating and compatible with the reactor vessel materials of construction."

Along with development of the grout material, SRNL's Mike Serrato explains, it helps to know how grout behaves "once the hose gets turned on."

"It is very important to have actual placement knowledge," says Serrato. "All over this site (SRS) we have cumulative operating experience with components in grout – the high level waste tanks, the low activity wastes in E area, the Saltstone vaults. That's the advantage of having a National

Lab integrated into a fully operational site, and having that understanding what the perceived end result needs to be."

Perhaps equally important was SRNL's rapid prototyping capability, a process that automated the translation of CAD drawings into three-dimensional models. With the creation of exact models of the underground portion of the reactor complexes, personnel were able to better understand the space, and to confirm or dismiss various placement approaches. As Serrato points out, the modeling capability helped to identify "hidden issues," such as construction features deep within the building that weren't obvious from drawings, or that had been long forgotten.

Provided by US Department of Energy