Radioactivity from groundwater will be filtered for decades by volcanic rocks at Western New York nuclear waste site

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(PhysOrg.com) -- A massive treatment wall under construction this week at a Western New York nuclear waste cleanup site will stop radioactive contamination in its tracks for literally decades, according to University at Buffalo engineers who modeled and tested the wall's material.

While the treatment method was specifically designed for the West Valley Demonstration Project, located 30 miles south of Buffalo, it may eventually be applicable to other radioactive sites around the nation.

Extending up to 30 feet underground, the 850-foot-long wall is being constructed with 2,000 metric tons of clinoptilolite, a volcanic zeolite mineral similar to the material used in cat litter, horse stalls and waste-disposal.

It is believed to be the first time that this kind of full-scale, permeable treatment wall is being used to filter out radioactive material, in this case, strontium-90, which is found in spent fuel rods in nuclear reactors.

"It functions the way a kitchen water filter does," says Alan Rabideau, PhD, professor of civil, structural and environmental engineering in the UB School of Engineering and Applied Sciences, "only in this case, the filter is selectively removing strontium-90 in the ground.

"As it is held in place, the strontium-90 will decay right in this huge

'filter,'" he explains. "It removes the strontium-90 and lets other dissolved minerals go."

According to officials at the West Valley Demonstration Project, the installation of the treatment wall is an important first step toward eventually closing the facility.

Back in 1999, Rabideau's research team demonstrated that this form of clinoptilolite would be suitable for groundwater remediation at West Valley.

His original, experimental work demonstrated that a nonradioactive strontium, which behaves like strontium-90, is captured within the honeycomb structure of the zeolite mineral, leaving the groundwater essentially free of the contaminant.

For several years, larger-scale testing was deferred while stakeholders deliberated over plans involving how best to close the West Valley facility. Then, in 2007, the National Science Foundation awarded Rabideau and other environmental researchers at UB funding for an interdisciplinary program they called ERIE (Ecosystem Restoration through Interdisciplinary Exchange), which is designed to train a new generation of environmental scientists, using a nontraditional, interdisciplinary approach.

ERIE student Shannon Seneca, a Western New Yorker and Native American, was interested in groundwater remediation.

Rabideau and Seneca began conducting more extensive testing using a "simulated" nonradioactive groundwater in the lab; eventually, the tests were duplicated using radioactive groundwater at the West Valley laboratory facility.

With the data they collected from these experiments, which continued for two years -- an exceptionally long period for such studies -- they developed complicated mathematical models using supercomputers at UB's Center for Computational Research.

The goal was to find a way to predict just how long such a wall could continuously filter out the strontium-90.

The model accounted for the specific groundwater conditions at the West Valley site, such as the geochemical composition of the local groundwater, which contains unusually high levels of chemicals that compete with strontium-90 for storage sites within the zeolite crystals.

"We now have a computational tool that predicts for how long the wall will remain effective," says Rabideau. "Our analysis shows that between 10 and 20 years is the minimum performance that we can expect at West Valley and some plausible scenarios show the wall lasting much longer."

Monitoring points placed both within and outside the wall will provide data for an ongoing performance assessment.

The wall was designed by a team of geologists and engineers led by UB Department of Geology alumnus Rick Frappa at consulting firm AMEC-Geomatrix of Amherst, N.Y., in close collaboration with Rabideau, Seneca and West Valley technical staff. Additional expertise was provided by Douglas Bablitch and Scott Warner from the company's headquarters in Oakland, Calif.

Rabideau currently serves on a National Academy of Sciences panel that is exploring ways to improve hazardous waste management at thousands of sites where subsurface contaminants create problems for site closure, potentially threatening public water supplies.

While the groundwater plume at West Valley was not in danger of reaching drinking water sources, the parties involved have long agreed that the low-level radioactivity in the groundwater plume must be cleaned up.

Provided by University at Buffalo