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Innovations

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SRNL Fast Facts

- Located at the U.S. Department of Energy's Savannah River Site near Aiken, South Carolina
- Operated by Savannah River Nuclear Solutions
- "National Laboratory" for DOE Office of Environmental Management
- Applied research, development and deployment of practical, high-value and cost-effective nuclear materials management and technology solutions in the areas of national security, clean energy and environmental stewardship
- Supporting customers at SRS, DOE and other federal agencies nationally and internationally

SRNL Office of Communications
803.725.4396

Long-term Radionuclide Field Lysimeter Experiment

Previous research: Small scale and short term

Most knowledge related to radionuclide geochemistry has come from small-scale laboratory experiments, in which gram quantities of sediment are mixed with aqueous radionuclides for periods ranging from a few days to a few months. While such experiments are practical, they do not permit measurement of the many known reactions that occur over longer periods of time and on larger scales. These experiments also do not account for natural environmental variations, such as rainfall and temperature fluctuations. Long-term radionuclide field experiments are also rarely conducted due to the intense review and oversight associated with obtaining regulatory permission.

Impact

Helps scientists, stakeholders and regulators make informed science-based decisions about:

- waste tank closure
- low-level waste disposal
- radionuclide release from nuclear power plants and weapons of mass effect
- environmental stewardship of remediated lands

Taking past investigations a step further

SRNL has initiated a long-term radionuclide field lysimeter experiment (RadFLEx) to collect information that will permit up-scaling data from laboratory studies to expected real-life conditions. The experiment will operate for at least 10 years and will build on knowledge gained from smaller, bench-scale studies to simulate natural subsurface conditions. Some tests will run for two years, permitting the startup of new experiments as needs develop. Experiments involving dozens of radionuclides are under way to answer questions related to colloid transport, plant-enhanced transport, release rates from reducing versus non-reducing cementitious sources, and kinetics of radionuclide transport through sediment. Results from the lysimeters will provide important guidance for understanding natural complexity and heterogeneity in the environment.

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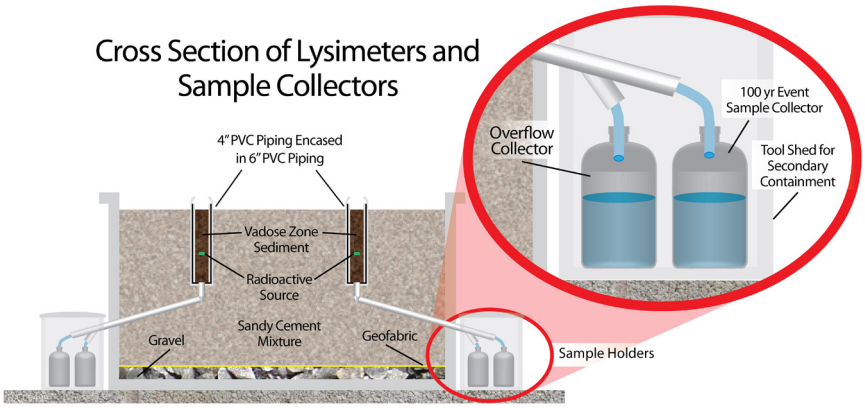

Out-of-the-Box Thinking: RadFLEx

RadFLEx is a one-of-a-kind facility that permits studying radionuclide movement through the subsurface environment under natural field conditions. In contrast with traditional laboratory experiments, the RadFLEx operates at meter-scale (not centimeter) spatial conditions, and over years-to-decade (not days or months) time periods. Longer and larger experiments are necessary to more accurately predict the long-term risk associated with radionuclides in the environment and to reduce the uncertainty (and therefore cost) associated with long-term radioactive waste disposal. No similar facilities have operated in the United States for over 30 years. Available lysimeter capacity currently exists at the RadFLEx to support new missions.

Innovation from science to successful deployment

- Identify long-term processes not evident through short-term laboratory studies
- Mechanistically interpret biogeochemical processes under controlled field-scale conditions
- Reproduce high-level and low-level waste disposal scenarios, including tank closure
- Develop environmental remediation and monitored natural attenuation strategies
- Measure waste form release
- Quantify radionuclide sorption to sediments (solubility and Kd values) and release from source terms

Partners in Success

SRNL collaborated with several groups to investigate long-term radionuclide geochemistry. Clemson University and the University of Georgia's Savannah River Ecology Laboratory assisted with RadFLEx design and installation; experimental results and data will provide subject matter for student dissertations and theses. SRNL continues to develop new collaborations. Funding for RadFLEx was provided by Savannah River Nuclear Solutions; DOE's Office of Science – Subsurface Biogeochemistry Research Program; and Savannah River Remediation.

Radiological field lysimeter facility

Leachate sample housing

In-line sediment probes measuring moisture and some chemical properties in "real time"

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