Biogeochemical Controls

SRNL researches long-term economic in-situ remediation of sites with mixed contaminants

Savannah River National Laboratory's research on novel ways to evaluate and utilize biogeochemical controls and gradients has made possible the development of new techniques for stabilizing and cleaning up sites that are contaminated with a mixture of radionuclides and other contaminants. The result is capping technologies that simultaneously immobilize and treat the contaminants.

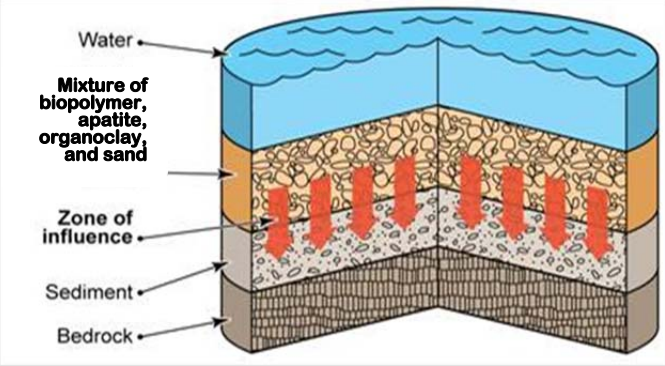
Why it Matters

Identifying sequestering agents that effectively remove troublesome contaminants can create new opportunities for the cleanup of contaminated sites at less cost and less collateral damage to the environment than more intrusive methods. This research addresses some of DOE's most challenging contaminants, including some of the most problematic radionuclides in the environment.

Methods

This research focuses on transforming environmental management practices and creating opportunities for contaminant stabilization and detoxification. The team is using state-of-the-art innovations in earth sciences, hydrology, engineering, and mathematics to select and develop novel sequestering materials that react with contaminants to reduce their toxicity, mobility, or bioavailability. The team is also evaluating the long-term performance of materials and mixtures of materials for overall benefits in the remediation of radionuclides, inorganic, and organic contaminants in contaminated soils and sediments.

Active caps can incorporate different sequestering agents such as phosphate materials (rock phosphate), organoclays, zeolite, biopolymers, and clay creating a versatile solution to a range of contaminants and contaminant mixtures. Phosphate based materials can stabilize radionuclides such as Sr and U, and zeolites can act as "molecular sieves" that filter radionuclides from water. Cs-137 and I-129 can be simultaneously removed from aqueous solution by a mixture of activated carbon and chabazite zeolite. The clay mineral illite can immobilize radioactive Cs. SRNL has also used combinations of biopolymers (e.g., guar gum, xanthan) mixed with sand to produce a viscous matrix for armoring active caps used to control the movement of contaminants. These materials could also be used to rapidly and cheaply produce retaining walls and plugs (of large size if required) to control and restrict the flow of contaminated water in and around reactors. These structures would have the advantage of being easily modified, demolished, or replaced with more permanent barriers as needed.



Active Cap – a layer of reactive amendments for a one-step field application resulting in reduced costs and more effective remediation. Image courtesy of Savannah River National Laboratory.

Adhesive product of sand coated with guar gum cross-linked by borax.

What's Next

Beyond their applicability to DOE, these results are of importance for contaminated Department of Defense (DoD) sites. For example, many DoD artillery firing ranges are contaminated with uranium, and many DoD installations have problems with contaminated sediments.

Publications

Knox AS, MH Paller, DD Reible, X Ma, and IG Petrisor. 2008. "Sequestering Agents for Active Caps – Remediation of Metals and Organics." *Soil and Sediment Contamination: An International Journal* 17(5):516-532.

Knox AS, I Petrisor, CE Turick, MH Paller, J Roberts, D Reible, and C Forrest. 2010. "Life Span of Biopolymer Sequestering Agents for Contaminant Removal and Erosion Resistance. In BIOPOLYMERS, Edited by Magdy M. Elnashar, SCIYO Press, Rijeka.

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