

Innovative Capping Technology to Prevent the Migration of Toxic Chemicals from Contaminated Sediments

Research Value:

Contaminated sediments is a problem in many U.S. waterways. Nearly 40% of the rivers and streams in the U.S. are too polluted for fishing and swimming. Contaminants in sediments involve both microorganisms and toxic chemicals. Many widespread persistent toxic chemicals are present in sediments, including polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and heavy metals. These chemicals can be released into the water above, and can bioaccumulate in the food web to levels in fish that pose a risk to the wildlife and humans that eat them. Fish advisories, warnings not to eat fish caught in our lakes and streams, have become increasingly common.

Capping is a common strategy for decreasing the risk associated with contaminated sediments in lakes and streams. Historically, caps have been designed to physically isolate contaminated sediments and prevent the transport of contaminants from sediments into the water above them, to aquatic organisms, and to wildlife and humans, with sand caps being common. Questions remain concerning the effectiveness of traditional sand capping. These questions include the vertical transport of

contaminants through the sand cap to the overlying surface water.

New innovative capping materials have been developed that may address some of the questions with traditional sand caps. One of these new materials, **Aquablok®** is a clay-based polymer composite, designed to swell and form a continuous and highly impermeable barrier. Other technologies involve the use of “active” material such as activated carbon or organoclays to retard or sequester the contaminants as they migrate vertically through the cap.



Applying capping materials with a clamshell bucket

Research Details:

EPA land risk management researchers are leading efforts to determine if these innovations can fulfill their promise to better protect human and wildlife health.

Goals in evaluating these innovative capping materials include:

- Evaluate how the performance of each capping technology is affected by gas generation below the cap.
- Develop improved methods for collecting and measuring sediment gas generation.
- Evaluate the degree to which aquatic organisms affect cap performance.
- Investigate how the presence of a cap affects the number and diversity of organisms in a contaminated area.
- Evaluate the physical stability of each type of cap, and the fate and transport of contaminants over time.

Joint Research with Academia: Anacostia River Capping Study

A field study at the Anacostia River in Washington, D.C. was conducted with EPA’s Southwest Hazardous Substance Research Center to evaluate the performance of an AquaBlok® cap compared to a sand cap and unaltered sediment. The study included an evaluation of the physical stability of the cap, the effect of the cap on the groundwater and sediment interface, the impacts of the cap on aquatic organisms, and the impact of these organisms on cap performance. Results of the study are available in the report,

*Demonstration of the AquaBlok®
Sediment Capping Technology.*



Studying sediment properties

**Joint Research with EPA
Region and State: Chattanooga
Creek Cap Monitoring Study**

EPA land risk management researchers are working with EPA Region IV and with the Department of Environmental Conservation in Tennessee to monitor an installed AquaBlok® cap in a section of Chattanooga Creek that has seen decades of industrial pollution from coal tar and creosote.

**Joint Research with EPA's
GLNPO and ACOE: Sorbent
Column Studies**

EPA is working in cooperation with the Great Lakes National Program Office (GLNPO) and the U.S. Army Corps of Engineers (ACOE) to evaluate various sorbents for possible use on contaminated sites in the

Great Lakes area. The ultimate goal of this research is to refine the design process for more effective caps.

**Joint Research with
Department of Defense (DOD):
Cap Evaluation Studies**

EPA is working in integrated collaborative efforts with the U.S. DOD (which has programs for environmental research and environmental security), the ACOE, and EPA's Regional Offices to improve cap designs and their cost effectiveness. In other DOD-related efforts, EPA has evaluated an innovative bauxite cap for containing mercury contaminated sediments, and is currently evaluating the impact of propeller wash on the stability of sediment caps.



Placing a reactive cap

Outcomes and Impacts:

Innovative capping technology research is helping to provide more options to reduce the risk to humans and benthic organisms from contaminated sediments. This research is providing new information and tools that are being used by EPA's Office of Superfund Remediation and Technology Innovation and EPA's regional staff to select the most environmentally and cost

effective remediation techniques at contaminated sediment sites.

Future research on capping and other sediment remediation projects will examine incorporation of tools such as Life Cycle Assessment (LCA) into efforts for sustainable sediment management.

LAND RESEARCH PROGRAM

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Demonstration of the AquaBlok Sediment Capping Technology (Innovative Technology Evaluation Report) EPA/540/R-07/008, Sept. 2007.
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