Effect of amendments on mercury fate in contaminated sediments

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In anoxic sediments, inorganic mercury can be transformed into methyl mercury, primarily by sulfate reducing bacteria. Capping and in-situ treatment, typically by treating the sediments or cap with sand or sorbing amendments, are discussed as an in-situ management strategy for the containment of mercury contaminated sediment. Recent research has shown that mercury methylation might increase or decrease under sediment caps in response to increasing anoxic conditions depending on the local geochemistry. It has also suggested that in-situ capping may accelerate methylation, at least at the initial stage, in a high organic environment while the effect is less dramatic in a low organic environment. A thorough understanding of all of these processes is essential to implementing an effective risk management strategy for contaminated sediments.

In this study, the ability of amendments to increase the effectiveness of conventional sand capping and in-situ treatment was evaluated for mercury contaminated sediments with different organic carbon levels. Proposed amendments are designed to enhance the binding of mercury to the solid phase or to encourage the formation of nonreactive Hg complexes.

First, baseline sediment batch slurry and mesocosm experiments with unamended sediments with different characteristics were performed to evaluate net mercury release and net methyl mercury production and identify key controlling factors.

Lab experiments and a pilot scale field study were performed to evaluate amendments including sorbents to reduce the amount of bioavailable mercury and chemical additives to control redox chemistry or interfere with the production of methyl mercury. Sorbents tested including activated carbon, biochars, organophilic clays while chemicals considered included FeS to help control redox conditions away from conditions that tend to maximize methyl mercury production. The performance of each of the tested materials in controlling mercury availability, redox conditions and net methylation will be presented.