GREAT LAKES LEGACY ACT SEDIMENT REMEDIATION RESEARCH ON *IN SITU* TREATMENT

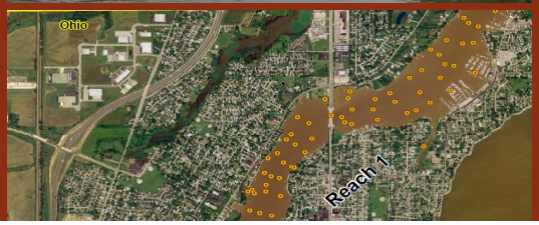
Ottawa River

Introduction

This fact sheet is one of a series of fact sheets produced by the Great Lakes Legacy Act (GLLA) research effort with U.S. EPA Office of Research and Development (EPA ORD) and USACE Engineer Research and Development Center (ERDC).

To support remediation and restoration efforts at Great Lakes Areas of Concern, this report provides a brief summary of remedial actions suggested for Ottawa River.

Great Lakes contaminated sediment sites contain elevated concentrations of contaminants of concern (COCs), such as metals and hydrophobic organic compounds. *In situ* management of the contaminants via containment or sediment treatment holds significant advantages over removal and *ex situ* treatment and disposal.



The Ottawa River, located in Toledo, Ohio, is part of the Maumee River Area of Concern (AOC). It is a short river that drains an area on the Ohio-Michigan border along the eastern and northern fringes of the city of Toledo, flows through Ottawa Hills, and discharges into the North Maumee Bay on Lake Erie. The site is contaminated due to historic discharges from landfills, industrial facilities, and combined sewer overflows. The COCs at this site are polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs) and secondary pollutants, including heavy metals.

In situ management of hydrophobic organic compounds (HOCs) and metals can be accomplished by reducing the availability or mobility of the contaminants. Amendments that achieve one or both goals could be introduced into surficial sediments or into sediment capping materials placed on top of the sediments. HOCs sorb strongly to organic materials in sediments or cap materials, reducing their bioavailability and mobility. Metals are often found in insoluble sulfides under strongly reducing conditions and also can complex with other constituents in sediments or cap materials to reduce availability and mobility. Organic materials in sediments or cap also tend to sorb or complex metal contaminants. Potential amendments that can achieve one or both goals include granular activated carbon (GAC) and organophilic clay.

The analysis of sediment *in situ* remediation options such as capping or *in situ* treatment with amendments depends upon accurately determining sediment pore water characteristics. Sediment biogeochemistry can affect contaminant speciation and fate. Natural organic matter may affect amendment performance. Natural organic matter and sediment biogeo-chemistry can also interfere with the measurement of contaminants in the interstitial water and passive sampling is often required to accurately measure mobile and available contaminants in the interstitial water. It is for these reasons that site-specific studies were undertaken.

Experimental Studies

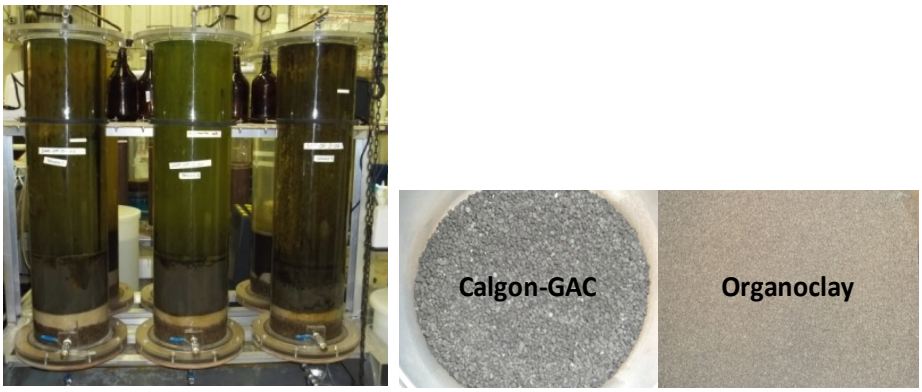


Figure 1. Column setup and amendments used for batch studies

- Experimental studies were conducted for the Ottawa River site using pore water generated from site sediment samples, granular activated carbon (GAC) and organophilic clay. The studies include the following:
  - Batch sorption tests for dosage
  - Static tests simulating *in situ* treatment
  - Column tests simulating active caps
- Total PAHs and total PCBs concentrations in the pore water were not detected for the majority of the field-representative tests conducted in the laboratory, suggesting that these compounds are strongly adsorbed by the materials used in these tests. For some contaminants, degradation may also occur. Passive sampling to concentrate contaminants in porewater and slurry test waters was often necessary to achieve detectable concentrations and estimate partitioning coefficients.
- Results for all sorption tests showed that either GAC or organophilic clay could be used as a sorbent for both PAHs and PCBs. However, GAC is the stronger sorbent (by a factor of 10-100 over organophilic clay). Organophilic clay would be preferred if there were a possibility of non-aqueous phase (oily) contamination. Organophilic clay can provide significant sorption under such conditions while GAC cannot.
- Capping would be expected to decrease the oxidation reduction potential of underlying sediments, leading to an increase in reduced species such as sulfides and therefore to an increase in relatively insoluble metal sulfides, reducing their availability and mobility.

Remedy Evaluation

- A total PCB congeners removal percentage of 65% was achieved for the porewater treated with 3% Calgon GAC and 100% removal was achieved for the sample treated with 10%.
- A GAC mat or GAC amended cap could be used to effectively eliminate the dissolved contaminant flux from the site.

Potential Remedial Implementation based on Laboratory Studies

- An amended cap of GAC mixed with sand or top soil, or placement in a thin layer mat would reduce the bioavailability of the COCs at this site.

For Further Information

- **http://epa.gov/greatlakes/aoc/torchlake/index.html**
- **http://www.erdc.usace.army.mil/**
- **http://www.epa.gov/nrmrl/**

Contacts

- Damarys Acevedo. USACE-ERDC-EL, Damarys.Acevedo-Acevedo@usace.army.mil, 601-634-4845
- Carlos E. Ruiz. USACE-ERDC-EL, Carlos.E.Ruiz@usace.army.mil, 601-634-3784