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

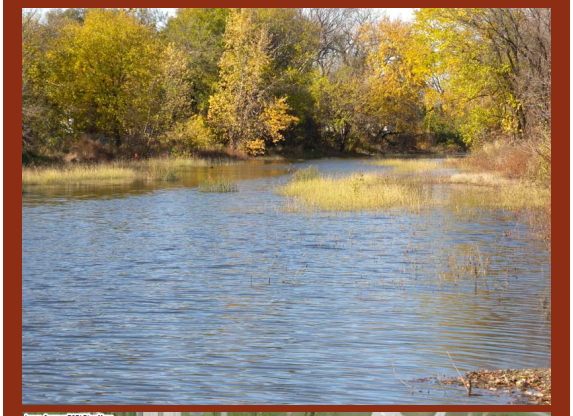
East Branch Grand Calumet River

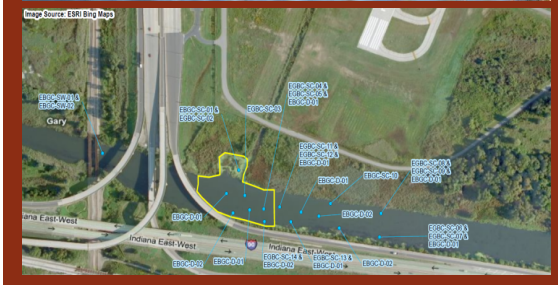
Introduction

This factsheet is one of a series of factsheets produced by the GLLA research effort with U.S. EPA Office of Research and Development (EPA ORD) and the USACE Engineer Research and Development Center (ERDC).

To help support remediation and restoration efforts at Great Lakes Areas of Concern, this report provides a brief summary of remedial actions suggested for the East Branch Grand Calumet 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 Grand Calumet River flows 13 miles from Gary, Indiana and drains into Lake Michigan through Indiana Harbor. The East Branch Grand Calumet River (EBGCR) is of concern because of the presence of legacy pollutants from point and non-point sources. The contaminants of concern at EBGCR are polyaromatic hydrocarbons (PAHs), with secondary pollutants, including polychlorinated biphenyls (PCBs) and heavy metals (e.g., mercury, chromium, cadmium, and lead).

In situ management of metals and hydrophobic organic compounds (HOCs) can be accomplished by reducing the availability or mobility of the contaminants. 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 absorb metal contaminants. HOCs sorb strongly to organic materials in sediment or cap materials, reducing their bioavailability and mobility. Amendments that achieve one or both goals could be introduced into surficial sediments or into sediment capping materials placed on top of the sediments. Potential amendments that can achieve one or both goals include granular activated carbon (GAC) and organoclay.

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, and natural organic matter may affect amendment performance. Natural organic matter and sediment biogeochemistry can also interfere with the measurement of contaminants in the interstitial water, and passive sampling is often required to accurately measure the mobile and available contaminants in the interstitial water. It is for these reasons that site-specific studies were undertaken.

Experimental Studies

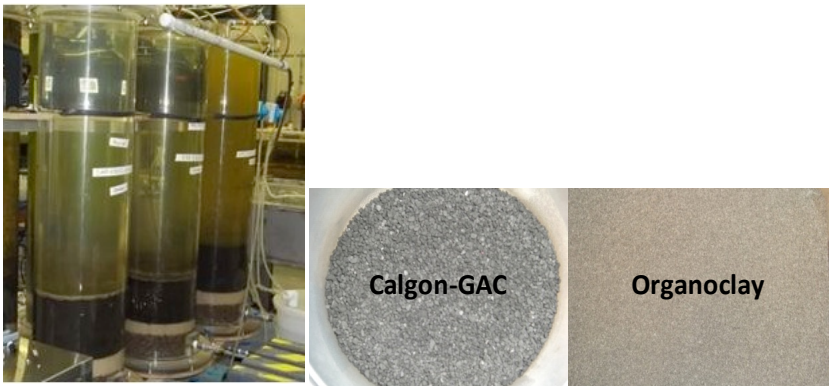


Figure 1. Column setup and amendments used for batch studies

- Experimental studies conducted for the EBGCR site were done using pore water generated from site sediment samples, granular activated carbon (GAC) and organophilic clay. These studies include the following:
  - Batch sorption tests for dosage needs
  - Static tests simulating *in situ* treatment
  - Column tests simulating active caps
- Results for all the tests showed GAC to be the preferred sorbent choice for both PAHs and PCBs.
- Organophilic clays would be preferred if there was a possibility of non-aqueous phase (NAPL) contamination, as it can provide significant sorption of oils under such conditions while GAC cannot. Some NAPL was present in the laboratory studies.

Remedy Evaluation

- Static tests showed a total PAHs removal percentage of 92% for 3% GAC and 100% for 10% GAC, and total PCBs removal percentage was smaller than 48% for both carbon dosages in the porewater discharge.
- Column tests show that a GAC amendment leads to a total PAH removal percentage of 70% after 2 months, whereas the organophilic clay leads to a 30% removal percentage in the porewater discharge. After 5 months, both lead to a total PAH removal percentage greater than 90% in the porewater discharge.
- Over a time period of 5 months, both amendments (organophilic clay and GAC) lead to a total PCB removal percentage ranging from 75% to 89% in the porewater discharge.
- A GAC mat or GAC amended cap could effectively eliminate HOC flux to surface.
- A two layer system consisting of a GAC amended cap over a thin layer of Organophilic clay (OC) will ensure that NAPL flux does not interfere with GAC sorption.

Potential Remedial Implementation based on Laboratory Studies

- An amended cap of GAC mixed with sand or sediments or placement in a thin layer mat would reduce the bioavailability of both PAHs and PCBs in the site.
- A combination (two layer cap) of an amended cap of GAC mixed with sand, with a lower layer of OC, will perform better in the presence of NAPL flux.

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