Community Guide to In Situ Sediment Amendments

What Are In Situ Sediment Amendments?

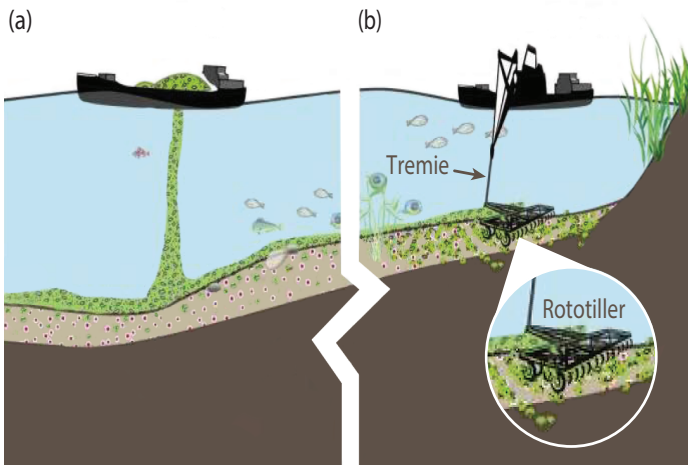
Sediment amendments are materials that can be mixed into the surface layer of sediment in rivers, streams, bays and lakes. The amendments help reduce the exposure of organisms living in sediment and surface water to contaminants found in porewater, the water between sediment grains. The technology occurs "in situ" (in place) which avoids removing sediment for treatment or disposal. In situ sediment amendments are used to treat a range of contaminants, including PCBs, petroleum products, solvents, pesticides and metals.

Sediment amendments also can be applied as a distinct layer of a sediment cap. These "amended caps" are discussed in *Community Guide to Amended Sediment Caps*.

How Do They Work?

Amendments can be poured or sprayed from a truck, boat or barge and allowed to settle through the water onto the contaminated sediment. Pouring an amendment down a pipe called a "tremie" helps place it more accurately, particularly in deep or fast-moving water. The amendments may also be mixed with sand or soil for better placement.

The most commonly used sediment amendments are activated carbon (See *Community Guide to Granular Activated Carbon Treatment*.) and organoclays, which are special types of clay that contain organic material that attracts oil and similar substances. Contaminants "sorb" (stick) to the surface of amendments so they are no longer "bioavailable" or free to be taken up by organisms. Some organoclays also expand in water to create a barrier that helps prevent contaminants from moving into the surface water. Other amendment materials may break down contaminants into less toxic or less mobile chemicals. For example, microbes (very small organisms), which use biological processes to convert contaminants to less toxic forms, can also be used as amendments or in combination



Amendments can mix with sediment naturally over time (a) or be mixed mechanically during application (b).

with other amendments. (See *Community Guide to Bioremediation*.) The type of amendment selected for a site depends on the contamination, sediment characteristics and site conditions.

Amendments may be mixed into the sediment naturally over time by burrowing worms, mollusks or other animals. Mechanical mixing with a rototiller or auger may be preferred where the water is deep or has a strong current that can sweep amendments away.

How Long Will It Take?

Placing sediment amendments can take a few days to several months depending on the size and depth of the contaminated area and the placement approach. It may take a few weeks to a few years to reduce bioavailable contaminants in the sediment and will depend on several factors that vary from site to site. For example, in situ sediment amendments will take longer where:

- Concentrations of contaminants are high.
- There is a continuing source of contamination entering the sediments.
- Natural mixing of the amendment is slow.

Amendments may become more effective over time as complete mixing occurs.

Are In Situ Sediment Amendments Safe?

The reactive amendment materials help prevent plants and animals living in the sediment and surface water from being exposed to contaminants. Materials used are naturally found in the environment and are safe to handle. Surface water, porewater, fish or other organisms are analyzed to make sure the amendments are working.

How Might They Affect Me?

You may see increased truck and boat traffic as equipment and amendment materials come to the site. Placement of the amendments may involve trucks, boats or barges in the contaminated area, so boat traffic and other activities must be coordinated and limited during that time. Following placement of the amendments, shipping or recreational activities may be limited in the area.

Barge pouring activated carbon onto lake sediments.

Why Use In Situ Sediment Amendments?

In situ sediment amendments may be used in a wide variety of contaminated sediment remediation approaches. They are often used where there is sensitive habitat that has been contaminated or where there is hard-to-reach contamination around bridges, piers or other structures in the water. In places where sediments are stable and water flow is low, the amendments may significantly reduce risk in a short time with few implementation challenges. Once amendments are in place, treatment requires little energy or maintenance. In situ sediment amendments have been selected for use at several Superfund sites and other cleanup sites across the country.

Example

Delaware's Mirror Lake sediments received PCBs and other contaminants over many years from sources throughout its watershed. In 2013, the Department of Natural Resources and Environmental Control (DNREC) spread 79 tons of pellets containing activated carbon, clay and sand from trucks and small boats across the 5-acre, 3-foot-deep lake and downstream channel. The pellets settled to the bottom and naturally mixed with the contaminated sediment.

After one year, samples of porewater and fish showed about a 60% reduction in PCBs. Sampling after 5 years showed 80% (porewater) and 70% (fish) PCB reductions. Following the success at Mirror Lake, DNREC began testing a similar, but enhanced, cleanup approach with microbes added to destroy the sorbed PCBs at a ditch that drains to the Christina River.

For More Information

- About this and other technologies in the Community Guide Series, visit: https://clu-in.org/cguides or https://clu-in.org/remediation/
- About use of cleanup technologies at a Superfund site in your community, contact the site's community involvement coordinator or remedial project manager. Select the site name from the list or map at http://www.epa.gov/superfund/sites to view their contact information.

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