Community Guide to Solidification and Stabilization

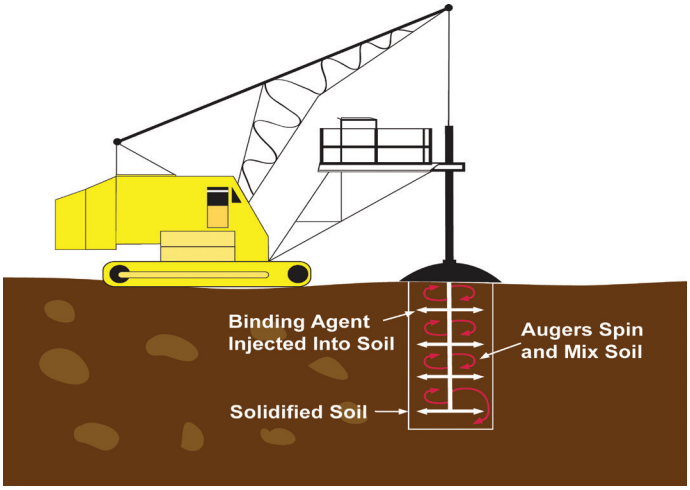
What Are Solidification and Stabilization?

Solidification and stabilization refer to a group of cleanup methods that prevent or slow the release of harmful chemicals from wastes, such as contaminated soil, sediment and sludge. These methods usually do not destroy the contaminants. Instead, they keep them from "leaching" above safe levels into the surrounding environment. Leaching occurs when water from rain or other sources dissolves contaminants and carries them downward into groundwater or over land into lakes, rivers and streams.

Solidification binds the waste in a solid block of material and traps it in place. The block also is less permeable, so water does not pass through it easily. Stabilization causes a chemical reaction that makes contaminants less likely to be leached into the environment. Solidification and stabilization are often used together to prevent people and wildlife from being exposed to metals, radioactive contaminants, and some types of organic contaminants, such as PCBs and pesticides.

How Do They Work?

Solidification involves mixing a waste with a binding agent, which is a substance that makes loose materials stick together. Common binding agents include cement, asphalt, fly ash and clay. Water must be added to most mixtures for binding to occur; then the mixture dries and hardens to form a solid block.



Binding agents can be injected into soil and mixed using augers.

Like solidification, stabilization also involves mixing wastes with binding agents. However, the binding agents cause a chemical reaction with contaminants to make them less likely to be released into the environment. For example, when soil contaminated with metals is mixed with water and lime — a white powder produced from limestone — a reaction changes the metals into a form that will not dissolve in water. The binding agents used to treat contaminated materials often both solidify and stabilize.

Additives can be mixed into the waste while still in the ground (often referred to as "in situ"). This usually involves drilling holes using cranes with large mixers or augers, which both inject the additives underground and mix them with the waste. The number of holes needed depends on the size of the augers and the contaminated area. Dozens of holes may need to be drilled. When the waste is shallow enough, it is excavated and mixed with additives aboveground (often referred to as "ex situ"). The waste is either mixed using backhoes and front end loaders or placed in machines called "pug mills." Pug mills can grind and mix materials at the same time.

Solidified or stabilized waste mixed aboveground is either used to fill in the excavation or transported to a landfill for disposal. Waste mixed in situ is usually covered with a "cap" to prevent water from contacting treated waste. (See *Community Guide to Capping*.)

How Long Will It Take?

Solidification and stabilization may take weeks or months to complete. The cleanup time will depend on several factors that vary from site to site. For example, they may take longer where:

- The contaminated area is large or deep.
- The soil is dense, rocky or contains debris, making it harder to mix with the binding agent.

- Mixing occurs aboveground, which requires excavation.
- Extreme cold or rainfall delays treatment.

Are Solidification and Stabilization Safe?

Large augers inject and mix binding agent with contaminated soil.

The additives used in solidification and stabilization often are materials used in construction and other activities. When properly handled, these materials do not pose a threat to workers or your community. Water or foam can be sprayed on the ground to make sure that dust and contaminants are not released to the air during excavation or mixing. If necessary, the waste can be mixed inside tanks, or the mixing area can be covered to minimize dust and vapors. The final solidified or stabilized product is tested to ensure that contaminants will not leach out. The strength and durability of the solidified materials also are tested.

How Might They Affect Me?

You may notice increased truck traffic as equipment and additives come to the site or as treated waste is transported to a landfill. You also might hear earth-moving equipment as waste is excavated or mixed. When cleanup is complete, the land often can be redeveloped.

Why Use Solidification or Stabilization?

Solidification and stabilization provide a relatively quick and lower-cost way to prevent exposure to contaminants, particularly metals and radioactive contaminants. Solidification and stabilization have been selected for use at hundreds of Superfund sites and other cleanup sites across the country.

Contaminated soil mixed with cement in a pug mill is spread on the ground as pavement.

Example

Solidification and stabilization were used to clean up contaminated sludge and soil at the South 8th Street Landfill Superfund site in Arkansas. From the 1960s to 1970s, municipal and industrial wastes were disposed at the site, including in a 2.5-acre pit of waste-oil sludge. In the 1980s, that area was found to be contaminated with oily wastes, PCBs, pesticides and lead.

In 1999, cranes with augers injected and mixed limestone, fly ash and Portland cement with 40,000 cubic yards of sludge and soil in the pit. These additives helped solidify the mixture, as well as stabilize the lead and other metals. The hardened material was left in place and covered with a soil cap. An evaluation in 2019 indicated that the cleanup approach is still protecting human health and the environment.

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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