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www.epa.gov/superfund/sites
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A Citizen's Guide to Chemical Dehalogenation

The Citizen's Guide Series

EPA uses many methods to clean up pollution at Superfund and other sites. Some, like chemical dehalogenation, are considered new or *innovative*. Such methods can be quicker and cheaper than more common methods. If you live, work, or go to school near a Superfund site, you may want to learn more about cleanup methods. Perhaps they are being used or proposed for use at your site. How do they work? Are they safe? This Citizen's Guide is one in a series to help answer your questions.

What is chemical dehalogenation?

Chemical dehalogenation removes *halogens* from harmful chemicals, making them less toxic. Halogens are a class of chemical elements that includes chlorine, bromine, iodine, and fluorine. Many harmful chemicals contain halogens. The presence of halogens can be one of the main reasons such chemicals are toxic. Chemical dehalogenation is most often used to remove chlorine from PCBs and dioxins contained in polluted soil, sludge, or sediment.

How does it work?

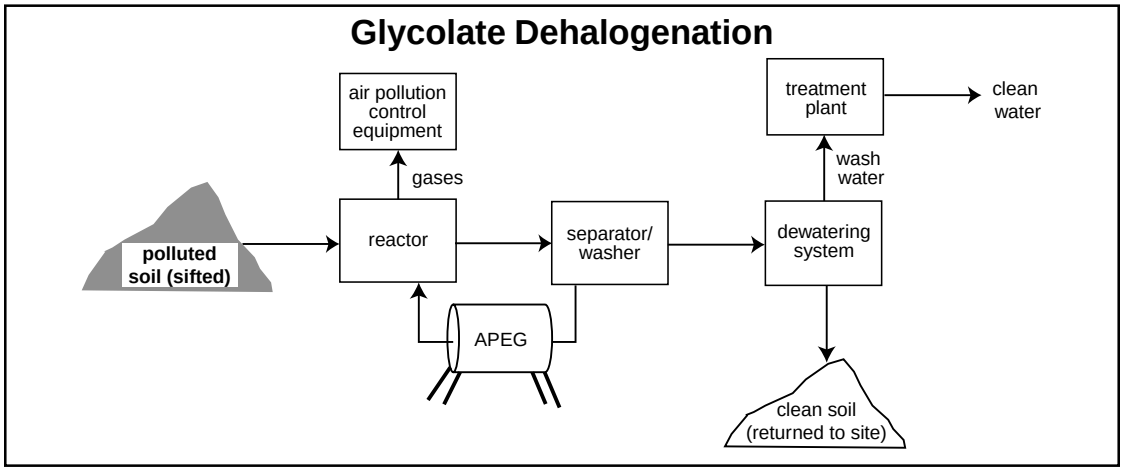
Before using chemical dehalogenation the soil must be dug from the polluted area to be treated. The soil is sifted and crushed to remove large objects, like rocks and debris. The sifted soil is then mixed with chemicals and heated in a large container called a *reactor*. During mixing and heating, a chemical reaction occurs which changes the harmful chemical. The reaction involves removing the halogens and replacing them with less toxic chemicals. Chemical dehalogenation can also work by evaporating the harmful chemicals, which changes them to gases. The gases are then destroyed.

There are two common types of chemical dehalogenation: glycolate dehalogenation and base-catalyzed decomposition.

Glycolate dehalogenation adds a combination of two chemicals called "APEG" to soil in the reactor. During mixing and heating, one chemical combines with the halogens to form a non-toxic salt. The other replaces the halogens to form other non-toxic chemicals. The heat in the reactor can cause some of the chemicals in the soil to evaporate. The gases are treated by air pollution control equipment at the site.

The soil is then placed in a *separator/washer* where the excess APEG is removed from the soil. Any remaining APEG is removed from the soil with water. The APEG can be reused in the cleanup of more soil. The wash water is removed from the soil and treated. When the soil is clean, it can be placed back on the site. If the soil still contains chemicals in harmful amounts, it is placed back in the reactor to repeat the process.

Base-catalyzed decomposition adds a chemical called "sodium bicarbonate" to soil in the reactor. The sodium bicarbonate allows the harmful chemicals in the soil to evaporate at a low



temperature. Once the chemicals evaporate, the cleaned soil can be returned to the site. The gases produced during evaporation are changed into liquids. These liquids are then mixed with other chemicals, such as sodium hydroxide and heated again. A chemical reaction occurs that removes the halogens from some of the chemical and replaces them with hydrogen. This produces a non-toxic salt and a non-toxic chemical. The resulting mixture is then treated using other cleanup methods and recycled.

Is chemical dehalogenation safe?

Chemical dehalogenation can be quite safe to use, but there are potential hazards. Chemical reactions can result in flammable and even explosive conditions in the reactor. Proper design and operation must be followed to avoid these conditions. Some of the chemicals used are corrosive, which means they can wear away certain materials and burn the skin. Therefore, workers must wear protective clothing. During digging and cleanup, air pollution equipment must be used to control dust and gases. Chemicals are rarely released from the reactor, but EPA tests the air to make sure that chemicals are not released in harmful amounts. EPA also tests the soil to be sure it is clean before it is placed back on the site.

How long will it take ?

The time it takes to clean up a site using chemical dehalogenation depends on:

- the amount of polluted soil
- the condition of the soil (Is it wet or dry? Does it contain a lot of debris?)
- type and amounts of harmful chemicals present.

Cleanup can take just a few weeks at sites with small amounts of polluted soil.

Why use chemical dehalogenation?

Chemical dehalogenation has been used at several sites to remove halogens from PCBs, dioxins, and certain pesticides. It works best for small amounts of polluted soil or polluted soil that has small amounts of harmful chemicals. Chemical dehalogenation can be conducted at the site, which avoids the costly transport of soil to a cleanup facility. It also can be cheaper to operate and maintain compared to other methods that cleanup similar harmful chemicals. And the cleanup time is relatively short.

For more information

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Further information also can be obtained at **www.cluin.org** or **www.epa.gov/superfund/sites**.

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