Community Guide to Fracturing for Site Cleanup

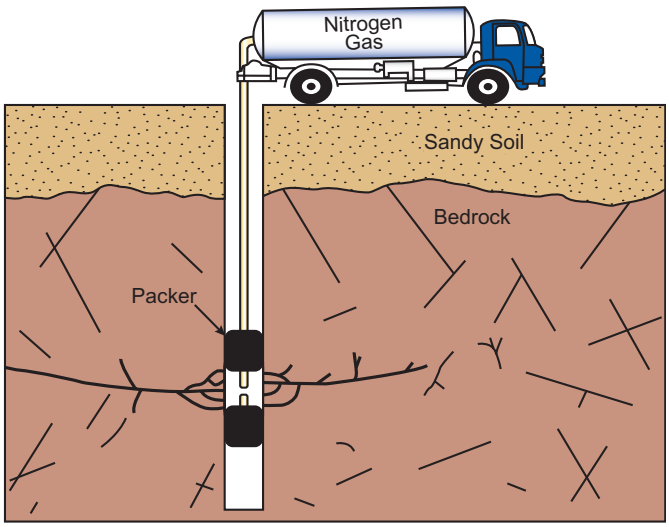
What Is Fracturing for Site Cleanup?

Fracturing creates or enlarges openings in rock or dense soil, such as clay, to help soil and groundwater cleanup methods work better. The openings, called "fractures," become pathways through which contaminants in soil and groundwater can be treated "in situ" (in place) by injection or pumped aboveground for treatment. Although fractures can occur naturally in soil and rock, they are not always wide or long enough to easily reach underground contamination using cleanup methods. Fracturing can enlarge the cracks and create new ones to improve the speed and effectiveness of the cleanup. Fracturing is commonly used with several in situ cleanup methods. (See the community guides to *Bioremediation*, *In Situ Chemical Oxidation*, *In Situ Chemical Reduction*, and *Soil Vapor Extraction and Air Sparging*.)

How Does It Work?

There are three ways to fracture soil or rock:

- Hydraulic fracturing pumps water or a water-based fluid under pressure into holes drilled in the ground. The force of the water causes soil (or sometimes rock) to fracture. The water or fluid can be pumped with sand or other "propping agents." Propping agents help keep the fractures open during cleanup.
- Pneumatic fracturing injects air or other gases into the holes to fracture dense soil. Air forced into the soil also can promote evaporation of chemicals. The gases may be captured and treated aboveground.
- Blast-enhanced fracturing uses explosives, such as dynamite, to fracture rock. The explosives are placed in holes and detonated. The main purpose is to create fractures for pump and treat cleanup. (See *Community Guide to Pump and Treat*.)



Nitrogen gas is injected for pneumatic fracturing of rock at a targeted depth.

Both pneumatic and hydraulic fracturing can direct pressure to specific underground zones by using packers to seal the hole, but blast-enhanced fracturing cannot.

How Is Fracturing for Environmental Cleanup Different from Fracturing to Recover Oil and Gas?

Oil and gas hydraulic fracturing is used to stimulate the recovery of oil or natural gas from underground geologic formations. Oil and gas hydraulic fracturing works by pumping a mixture of fluids and other substances into the target formation to create and enlarge fractures. Such operations are much larger, use different equipment and chemical additives, occur at greater depths, and use higher volumes of fluid than fracturing for site cleanup. Fracturing to clean up a contaminated site rarely exceeds a depth of 100 feet, and the affected area around the fracturing well usually is less than 100 feet in any direction. However, wells to extract oil and gas often are drilled hundreds or thousands of feet downward and sometimes horizontally into the oil- or gas-bearing rock. Fractures may extend over 500 feet from these wells.

How Long Will It Take?

Fracturing rock and soil does not take very long. It may take only a few days. However, even with the help of fracturing, actual cleanup may take months or years, depending on several factors that vary from site to site. For example, cleanup will take longer where:

- The contaminated area is large or deep.
- Contaminant concentrations are high.
- Groundwater flow is slow.

Is Fracturing Safe?

When properly used, fracturing is a safe way to make cleanup methods faster and more efficient. Because fracturing affects the soil and rock, it is not typically used where it can affect building foundations and underground utilities. To be sure fracturing does not damage nearby structures, special monitoring equipment is used to measure any movement of the ground. When fracturing is conducted at shallow depths, the ground surface around the holes may rise as much as an inch but will eventually settle back close to its original level if fractures are not propped open.

How Might It Affect Me?

You may see increased truck traffic when fracturing equipment and materials needed for cleanup are delivered to the site. You also may hear noise from the detonation of explosives and from machines used to inject water or air underground.

Why Use Fracturing for Site Cleanup?

Fracturing is used to help reach contaminants in rock and dense soil so that they can be cleaned up faster and more completely. It offers a way of reaching contamination deep in the ground where it would be difficult or costly to excavate. Fracturing can reduce the number of wells needed for certain cleanup methods, which can save time and reduce cleanup costs. Fracturing has been selected for use at a few Superfund sites and other cleanup sites across the country.

Pneumatic fracturing at the Hunters Point Naval Shipyard Superfund site.

Example

Hydraulic fracturing was used to improve cleanup at the Bountiful/Woods Cross Superfund site in Utah. Past maintenance of trailers and tank trucks at the site had contaminated the soil and groundwater with the degreaser trichloroethene (TCE).

The initial treatment technology chosen for the site was partially successful, but unable to reach TCE trapped within dense clay layers from 35 to 70 feet underground. In 2017, hydraulic fracturing was used to create fractures to reach and treat the clay soil. A slurry of sand and small iron particles was then injected into the fractures to help break down the TCE into harmless chemicals. After 18 months, TCE concentrations in groundwater had decreased by more than 99 percent. Samples are routinely collected to confirm treatment success.

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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