

A Citizen's Guide to Fracturing for Site Cleanup



What Is Fracturing For Site Cleanup?

Fracturing creates or enlarges openings in bedrock 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, underground) or removed for above-ground 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 most commonly used with several in situ cleanup methods. (See A Citizen's Guide to Bioremediation [EPA 542-F-12-003], In Situ Chemical Oxidation [EPA 542-F-12-011], In Situ Chemical Reduction [EPA 542-F-12-012]), and Soil Vapor Extraction and Air Sparging [EPA 542-F-12-018]).

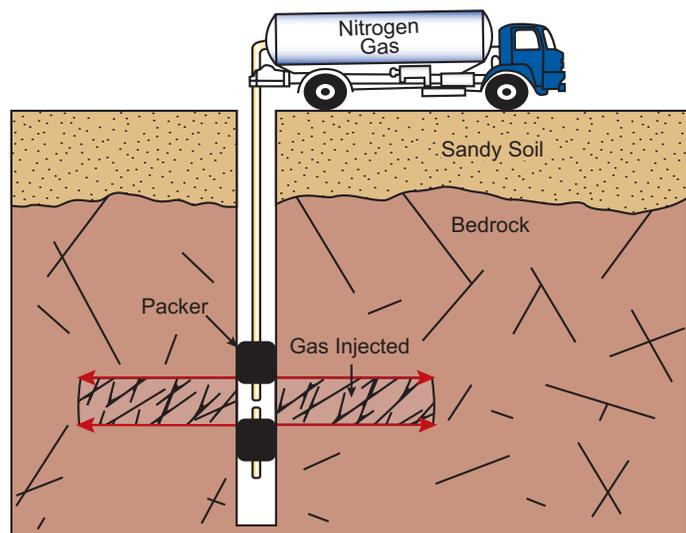
How Does It Work?

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

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.



Nitrogen gas is injected for pneumatic fracturing of bedrock.

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 that change to gases quickly when exposed to air. The gases may be captured and treated above ground.
- 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.

Both pneumatic and hydraulic fracturing can direct pressure to specific underground zones, but blast-enhanced fracturing cannot.

How Long Will It Take?

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

- The contaminated area is large or deep.
- Contaminant concentrations are higher.
- 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 bedrock, 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?

Residents near the site may see increased truck traffic when fracturing equipment and materials needed for cleanup are delivered to the site. Residents 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.



Pneumatic fracturing at the Hunters Point Naval Shipyard Superfund site

Fracturing has been used in cleanups at over 15 Superfund sites and many more sites throughout the country.

Example

Pneumatic fracturing was used to help clean up an area of the Hunters Point Naval Shipyard Superfund site in California. For years the site was used for ship building and maintenance, which contaminated groundwater with fuels, pesticides, heavy metals, industrial solvents, and other chemicals.

To clean up solvents from the groundwater, EPA needed to inject small particles of iron underground over an area larger than an acre to reach contaminants from 5 to 25 feet below ground. Pneumatic fracturing by high-pressure injection of nitrogen gas was used to create and widen fractures in soil. The fractures allowed the injected iron to spread more widely and evenly underground and treat more of the contaminated groundwater. After 12 weeks, solvent concentrations within the treatment areas decreased by an average of 87 to 99 percent. Additional monitoring is being conducted as part of the site-wide groundwater monitoring program.

For More Information

For more information about this and other technologies in the Citizen's Guide Series, visit:

www.cluin.org/remediation
www.cluin.org/products/citguide
www.cluin.org/techfocus/default.focus/sec/Fracturing/cat/Overview/

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