

Facts About Fracking

By Marc Lallanilla, Assistant Editor | January 23, 2015

Hydraulic fracturing, commonly called fracking, is a drilling technique used for extracting oil or **natural gas** from deep underground.



Fracking is a hotly debated environmental and political issue. Advocates insist it is a safe and economical source of clean energy; critics, however, claim fracking can destroy drinking water supplies, pollute the air and contribute to the **greenhouse** gases that cause global warming.

How fracking works

Most fracking wells in use today rely on two technologies: hydraulic fracturing, which has been in use since the 1940s, and horizontal drilling, a technique that first became widespread in the 1990s.

In simplified terms, the fracking process starts with a well that is drilled vertically or at an angle from the surface to a depth of 1 to 2 miles (1.6 to 3.2 kilometers) or more, according to the U.S. [Environmental Protection Agency](#) (EPA). The vertical well is then encased in steel and/or cement to ensure the well doesn't run the risk of leaking into any groundwater.

Once the vertical well reaches the deep layer of rock where **natural gas** or oil exists, the well curves about 90 degrees and begins drilling horizontally along that rock layer. Horizontal drilling can extend more than 1 mile (1.6 km) from the vertical well bore.

After the fracking well is fully drilled and encased, fracking fluid is pumped down into the well at extremely high pressure, in some cases exceeding 9,000 pounds per square inch (62,050 kilopascals). The pressure is powerful enough to fracture the surrounding rock, creating fissures and cracks through which oil and gas can flow.

The fluid that is pumped into the well to fracture the rock is called slickwater. It is mostly water, though it also can contain a wide range of additives and chemicals that serve an engineering purpose. Additives can include detergents, salts, acids, alcohols, lubricants and disinfectants. These chemical additives usually make up 0.5 to 2 percent of the slickwater, with the remaining 98 to 99.5

percent consisting of plain water, according to a report called Modern Shale Gas Development in the United States by the [U.S. Department of Energy](#).

In addition to the water and chemical additives, "proppants" such as sand and ceramic particles are also pumped into the fracking well. These proppants are added to prop open the fractures that form under pressure, thereby ensuring that gas and oil can continue to flow freely out of rock fractures even after pumping pressure is released, according to the [EPA](#).

Once the underground rock is shattered and proppants are pumped into place, trapped reservoirs of [gas](#) and oil are released and pumped back to the surface, along with millions of gallons of "flowback" liquid, according to the EPA.

The flowback liquid contains [water](#) and a number of contaminants, including radioactive material, heavy metals, hydrocarbons and other toxins. This wastewater is stored on the fracking site in pits, injected into deep underground wells or disposed of off-site at a wastewater treatment facility.

"Formation water" is the briny water that was in the pore spaces of the rocks. "The formation water is usually very salty and can have high [levels](#) of radon, a radioactive gas that comes from the decay of uranium in the subsurface," Marcia Bjornerud, a structural geologist at Lawrence University in Appleton, Wisconsin, told Live Science. "Flowback water can be treated, but there are large volumes of it and so dealing with it is expensive, and beyond what many small-town water treatment plants can handle."

The fracking boom

Though fracking is used worldwide to extract gas and oil, a fracking boom has occurred recently in the United States, partly driven by concerns over energy security and the [costs](#) associated with imported oil and other fossil fuels.

In 2000, there were about 276,000 natural gas wells in the United States. But by 2010, that number had almost doubled to 510,000, according to the [U.S. Department of Energy](#) (DOE). And every year, about 13,000 new wells are drilled. According to a 2014 study, [at least 15.3 million Americans](#) have lived within a mile of a fracking well that has been drilled since 2000.

The areas where fracking is most profitable include the Great Plains from Canada south into Texas, the Great Lakes region and an area known as the Marcellus Shale, which reaches from central New York into Ohio and south to Virginia, according to the [U.S. Energy Information Administration](#) (EIA).

The Marcellus Shale region is particularly attractive to gas drillers because it's a rich supply of natural gas — some call it "the Saudi Arabia of natural gas" or "Frackistan" — and because many of the region's rural communities are economically depressed and eager to attract an energy industry that enjoys handsome profits.

How safe is fracking?

Proponents of fracking claim that the drilling technique is a safe and clean method of securing essential sources of power that will meet U.S. [energy](#) needs for decades.

"Fracking has unlocked massive new supplies of oil and clean-burning natural gas from dense deposits of shale — supplies that increase our country's energy security and improve our ability to generate electricity, heat [homes](#) and power vehicles for generations to come," according to [EnergyFromShale.org](#), an alliance of oil and gas industry groups.

But opponents say the industry is whitewashing fracking's real effects, a long list that includes air pollution, groundwater contamination, health problems and surface water pollution.

Recent history supports some of their claims: A fracking well in Bradford County, Pa., operated by Chesapeake Energy Corp., malfunctioned in April 2011, spewing thousands of gallons of contaminated fracking water for more than 12 hours.

And in 2012, Chesapeake was again cited for contaminating the drinking water of three families in Pennsylvania, resulting in a settlement of \$1.6 million, according to [NPR.org](#). "Many companies keep their specific 'recipes' for fracking fluids secret, arguing that this is intellectual property," Bjornerud said. "This lack of disclosure makes it difficult to tie any contamination of drinking water to a particular company or well."

Researchers from Duke University tested drinking water at 60 sites throughout Pennsylvania and New York; their research was published in 2011 in the Proceedings of the National Academy of Sciences.

The researchers found that drinking water near fracking wells had levels of methane that "fell squarely within a range that the U.S. Department of Interior says is dangerous and requires urgent 'hazard mitigation' [action](#)," [ProPublica](#) reports.

There may be more [cases](#) of water that has been contaminated by fracking, but legal settlements and nondisclosure agreements usually prevent access to any documentation of these incidents, [The New York Times](#) reports.

A federal study, released in July 2013 by the U.S. Department of Energy (DOE), found no evidence that chemicals from the fracking process had contaminated groundwater at one Pennsylvania drilling site, [The Hill](#) reports.

However, the DOE's National Energy Technology Laboratory was quick to issue a statement on the preliminary nature of the report by declaring that, although "nothing of concern has been found thus far, the results are far too preliminary to make any firm claims. We expect a final report on the results by the end of [2013]."

In addition to water quality issues, fracking wells release compounds into the air, such as benzene, ethylbenzene, toluene and n-hexane; long-term exposure to these has been linked to birth defects, neurological problems, blood disorders and cancer. The National Institute for Occupational Safety and Health (NIOSH) has found that workers may be exposed to dust with high levels of respirable silica during hydraulic fracturing. These findings were shared after [NIOSH studied](#) 116 full shift air samples at 11 hydraulic fracturing sites in five states.

Benzene, for example, is a known carcinogen, according to the [American Cancer Society](#). In 2012, researchers from the [Colorado School of Public Health](#) released a study showing that [air pollution](#) caused by fracking could contribute to immediate and long-term health problems for people living near fracking sites. [Research by over 150 studies](#) suggests that chemicals released during natural gas extraction may harm human reproduction and development.

Additionally, many areas of the United States not considered [earthquake](#)-prone, such as Ohio and Oklahoma, are now experiencing relatively strong seismic activity. Fracking is believed to be the cause of [Oklahoma's strongest recorded quake](#) in 2011 and [more than 180 tremors in Texas](#) between 2008 and 2009. To start off 2015, an area of [North Texas had nine confirmed earthquakes](#) in a 24-hour period. Fracking is being investigated as the cause.

According to a 2000 [study of the Orito Field in Colombia](#), only around 15 percent of proppants can be removed after the fracking is done. Does leaving these foreign substances in a place where they weren't originally harmful? "No, there are no long- or short-term problems with leaving frack proppants in the fractures (fissures)," Rick Chamberlain, managing director the Berkeley Research Group, told Live Science.

Bjornerud agrees, "Even with the sand propping open the cracks, the weight of the overlying rock will, over months and years, cause the cracks to close and the rock's permeability return to about what it was before the fracking." According to Bjornerud, this is a problem for oil and gas production since the process has to be done quickly, soon after the fracking fluids have opened up micro-cracks, or the amount of oil and gas that can be extracted rapidly decreases as the cracks progressively shut.

Fracking and the law

Across the United States, fracking is regulated by a patchwork of state and local legislation, according to the [National Conference of State Legislators](#).

At the federal [level](#), fracking is exempt from some of the requirements of the Safe Drinking Water Act, particularly the requirement to disclose the chemicals used in well injections.

Wyoming, Michigan and Texas, however, have regulations requiring full disclosure of the chemicals used in fracking. Dozens of other proposed regulations that control some portion of the fracking industry are now moving through the legislatures of states where fracking is a large and growing industry. Some cities are taking the matter into their own hands by [banning fracking mines](#).

But by most accounts, America's fracking boom — especially in areas of shale gas — isn't going to stop anytime soon: The Annual Energy Outlook 2012 predicts that the country's ample supply of shale gas will account for nearly half of the natural gas produced in the U.S. by 2035. [More current analysis](#) shows a much more modest outlook for fracking due to dropping gas prices and overproduction.

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