

Hydraulic Fracturing: An Overview

Hydraulic fracturing technique

Hydraulic fracturing is an essential well completion technique that improves production of oil and natural gas that are otherwise trapped in low-permeability rock formations. The process involves pumping fluid through perforations in the wellbore that are located at target formation depths. Pressure exerted by the fluid creates small cracks, or fractures, in the rock that enable hydrocarbons to flow to the wellbore. The hydraulic fracturing process occurs over a three- to five-day period prior to bringing the well on to production for 20-30 years. To ensure well integrity, company experts closely monitor injection pressure and flow rates during hydraulic fracturing treatments through pressure gauges and flow meters.

At ConocoPhillips, we believe the risk associated with well operations, including those involving horizontal drilling and hydraulic fracturing, is very low and can be effectively managed. We are confident in our ability to responsibly develop oil and natural gas resources by using proven practices.

Importance of hydraulic fracturing

When used in conjunction with horizontal drilling, hydraulic fracturing has made it possible to develop our country's vast shale resources, positively impacting local economies and positioning the U.S. as the world's largest producer of natural gas. Since the late 1940s, over 1 million wells have been hydraulically fractured in the U.S. Without hydraulic fracturing, resources like tight sands, coal bed methane and shale gas would remain undeveloped. According to the U.S. Energy Information Administration, all of these resources combined accounted for 56 percent of U.S. natural gas production in 2009 and are projected to account for 75 percent of production by 2035.

Fracturing fluid – mostly water and sand

Water acts as the carrier fluid for the chemical additives and propping agents (typically sand) that are used to fracture the formation containing trapped natural gas or oil resources. While there have been concerns about the chemicals in fracturing fluid, water and sand comprise up to 99.5 percent of the mixture. Small amounts of chemical additives are necessary to reduce fluid friction, kill bacteria that are present in the formation and enhance the fluid's ability to transport the

propping agent. Many of these chemical additives are commonly used in everyday consumer products, such as toothpaste, ice cream, cosmetics, household cleaners, table salt substitutes and antiperspirant.

ConocoPhillips supports disclosure of the chemical ingredients used in hydraulic fracturing fluids in a way that informs the public and protects proprietary industry information. We are participating in the Ground Water Protection Council and Interstate Oil and Gas Compact Commission's voluntary chemical disclosure website, www.FracFocus.org. This landmark Web-based national registry was launched in April 2011 to provide the public with information about the hydraulic fracturing process and chemical additives on a well-by-well basis.

Hydraulic fracturing: A safe and proven technique

Hydraulic fracturing is a safe and proven technique that typically occurs thousands of feet below the earth's surface. Natural geologic barriers prevent upward migration of hydrocarbons and fracturing fluids into freshwater aquifers.

Many studies – and decades of history – indicate that hydraulic fracturing is safe when conducted properly and in accordance with regulatory requirements.

Roughly 90 percent of oil and natural gas wells drilled in the U.S. used hydraulic fracturing to enhance production.

– Interstate Oil and Gas Compact Commission

Multiple safeguards protect groundwater

A natural gas well is much more than a pipe in the ground. It is constructed to provide redundant barriers of steel and cement designed to protect underground sources of drinking water. Looking at a cross section of a well, the outermost structure typically includes a shallow conductor casing and always includes surface casing. The surface casing is set and cemented in place with the explicit intent of protecting the useable groundwater. Inside this structure, there may be one or more intermediate casings. The innermost structure is

continued on back

a production casing that extends to the bottom of the well. Typically, cement is pumped into the open space between each casing and the rock, forming a complete seal with multiple layers of protection. The casing and cement system is pressure tested to ensure its integrity.

Beyond these mechanical safeguards, groundwater is protected by physical factors, such as large vertical distances and the presence of natural geological barriers. These barriers consist of multiple layers of impermeable rock that separate the target hydrocarbon-bearing formations from freshwater aquifers by thousands of feet.

Multiple recent studies have found no substantiated connection between hydraulic fracturing and groundwater contamination:

- A 2009 study by the Ground Water Protection Council, an association of state regulators, reviewed 10,000 wells and found only one complaint, which proved to be unrelated to fracturing.
- A 2004 Environmental Protection Agency (EPA) study of fracturing of coalbed methane reservoirs found little or no threat to underground sources of drinking water. Hydraulic fracturing continues to be studied by the EPA.
- In 2010, the Interstate Oil & Gas Compact Commission, representing 30 state governments, affirmed that there have been no verified cases of drinking-water contamination resulting from hydraulic fracturing operations in states where shale gas is produced.

Water use

Hydraulic fracturing treatments typically require a one-time use of between 2 million to 5 million gallons of water, depending on the basin and reservoir characteristics, to create fractures in the formation. While these volumes may seem large, comparably, they are small relative to other continuous water uses, such as municipal consumption, power generation, industrial use and agriculture. ConocoPhillips understands that in some regions significant use of water for oil and natural gas production may affect the availability of water for other uses. We recognize that water management is an important worldwide issue and are committed to the development of responsible water-management practices that conserve and protect freshwater resources and enhance the efficiency of water usage during our operations.

Water disposal

Fluid that flows back up out of the well following hydraulic fracturing and water produced from the reservoir along with natural gas must be disposed of properly. After hydraulic fracturing is complete, fluids flow back to the surface where they are temporarily stored on-site in steel tanks or lined earthen pits. In addition, water is produced from the reservoir along with natural gas. ConocoPhillips follows a stringent management program to ensure flowback and produced water are managed in compliance with applicable regulations and company procedures. Flowback and produced water are typically disposed of in permitted injection wells in accordance with the Environmental Protection Agency's Underground Injection Control Program regulations.