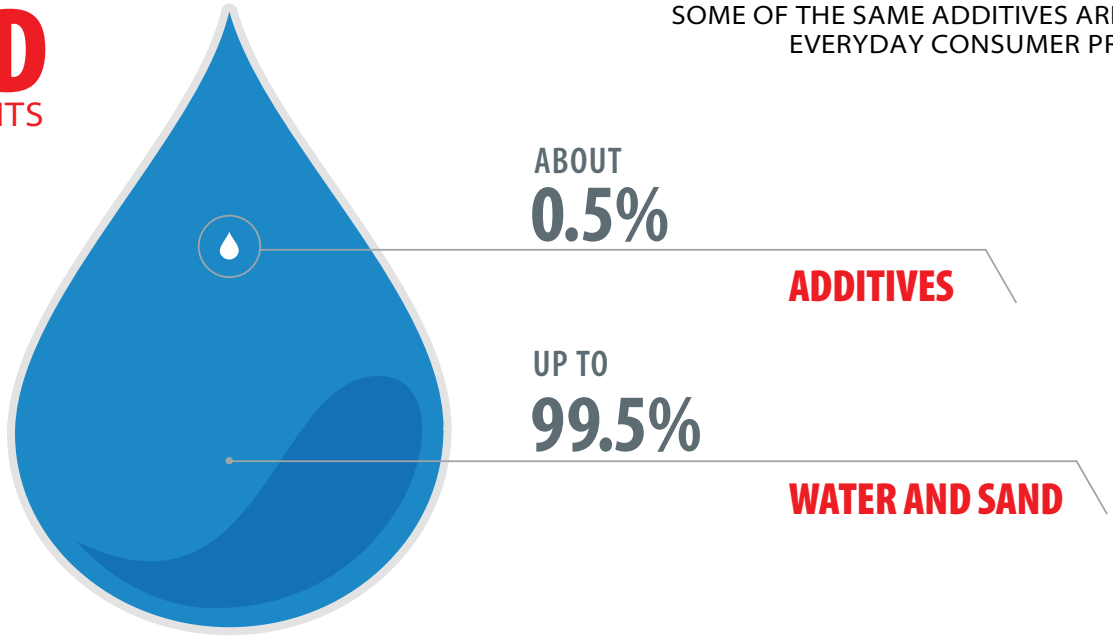
Hydraulic Fracturing Fluid

ConocoPhillips

2018

FLUID COMPONENTS

SOME OF THE SAME ADDITIVES ARE USED IN EVERYDAY CONSUMER PRODUCTS.



ADDITIVE TYPE	MAIN COMPONENT	PURPOSE	OTHER COMMON USES
Acid	Hydrochloric acid	Helps dissolve minerals and initiate fractures in the formation	Swimming pool chemical and cleaner
Biocide (antibacterial agent)	Glutaraldehyde	Eliminates bacteria in the water	Disinfectant (sterilizer for medical and dental equipment)
Breaker	Ammonium persulfate	Breaks down polymer chains to reduce viscosity of fracturing fluid	Disinfectant and hair coloring
Buffer	pH adjusting agent	Controls pH of fluids to maintain effectiveness of other components, such as crosslinkers	Detergent, soap and water softener
Corrosion inhibitor	N, n-dimethyl formamide	Prevents the corrosion of the well casing	Pharmaceuticals, acrylic fibers and plastics
Crosslinker	Borate salts	Maintains fluid viscosity as temperature increases	Laundry detergent, hand soap and cosmetics
Friction reducer	Mineral oil/polyacrylamide	Minimizes friction between the fluid and pipe	Water treatment, soil conditioner, makeup remover and candy
Gelling agent	Guar gum	Thickens the water to suspend the proppant	Cosmetics, toothpaste and ice cream
Iron control	Citric acid	Prevents precipitation of metal oxides	Food additive, food and beverage flavoring, and lemon juice
Potassium chloride	Potassium chloride	Creates a brine carrier fluid	Low sodium table salt substitute
Oxygen scavenger	Ammonium bisulfate	Removes oxygen from the water to protect the pipe from corrosion	Cosmetics, food and beverage processing, and water treatment
Scale inhibitor	Ethylene glycol	Prevents scale deposits in the pipe	De-icer, household cleansers and paints
Surfactant	Isopropanol	Reduces surface tension of fracturing fluids to improve the liquid recovery	Glass cleaner, deodorant and hair color

Source: Groundwater Protection Council, *Modern Shale Gas Development in the United States: A Primer*, April 2009

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Customized for Each Reservoir

Our engineers work with service company experts to tailor fracturing fluids to meet the specific needs of each well environment. Geologic and reservoir characteristics, such as mineralogy, rock strength, permeability, reservoir fluid composition, pressure and temperature, are just a few of the factors considered in selecting an appropriate fracturing fluid. Although the majority of the fracturing fluid is composed of water and sand (proppant), small amounts of chemical additives are necessary to achieve the fluid properties required to effectively stimulate the reservoir. Service companies develop a number of different hydraulic fracturing fluid recipes to more efficiently induce and maintain productive fractures. These solutions have unique characteristics, and therefore, the exact concentrations of some additives are protected as proprietary information.

Mostly Water and Sand

Water is used to fracture the formation containing trapped oil or natural gas resources and acts as the carrier fluid for the chemical additives and proppant (typically sand). Proppant allows fractures to remain open so hydrocarbons can flow more easily into the wellbore. 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 also commonly used in everyday consumer products, such as toothpaste, ice cream, cosmetics, household cleaners and deodorant.

One Time Water Use

The amount of water used for hydraulic fracturing can vary considerably, ranging from two to 20 million gallons per well depending on geographic location, producing formation characteristics, well design, lateral length, or other factors. According to the U.S. Geological Survey (USGS), natural resource extraction (minerals, oil and gas) consumes only about 1 percent of the total water used in the United States. Hydraulic fracturing water use is a fraction of this 1 percent.

Fracking operations generally occur over a three- to five-day period. The entire well construction process (including hydraulic fracturing) takes about two to three months, compared to the 20- to 30-year productive life of a typical well.

We have completed several pilot projects to test the compatibility of high-salinity produced water for reuse in hydraulic fracturing to reduce the amount of fresh water required.

Supporting Disclosure

We support disclosure of the chemical ingredients used in hydraulic fracturing fluids in a way that informs the public and protects proprietary industry information. In the U.S. we are participating in the Ground Water Protection Council and Interstate Oil and Gas Compact Commission's (IOGCC) voluntary chemical disclosure website, FracFocus. This landmark web-based national registry was launched in April 2011 to provide information about chemicals used to fracture oil and natural gas resources on a well-by-well basis. The website also provides educational information on hydraulic fracturing, the means by which groundwater is protected and links to state regulatory websites. Learn more at fracfocus.org. Many states now have statutes or regulations that require public disclosure of the chemicals used in hydraulic fracturing utilizing FracFocus.

FREQUENTLY ASKED QUESTIONS

Are fracturing fluids dangerous?

Additives used in fracturing fluids are chemicals commonly used in everyday life and are safe when properly handled and used appropriately. Fracturing fluids require safe work practices, which include storage, transportation, handling and disposal. Each step is regulated to ensure protection of the public, personnel at the well site and the environment. Chemicals used during the fracturing process must have a Material Safety Data Sheet (MSDS) available for all on-site personnel, medical staff and emergency responders. The MSDS outlines the hazards associated with well site chemicals and the appropriate steps to protect the user and the environment.

Where does the water come from?

Our company uses various water sources, depending on the region and availability of water near our drilling sites. The sources of water used in our fracturing fluids typically come from private and public lakes, ponds, rivers, groundwater, and municipal supplies.

For more information: www.powerincooperation.com