Exploring the Hydraulic Fracturing Process

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How Does Hydraulic Fracturing Work?

Let’s explore the details of hydraulic fracturing - or “fracing” - and how Cabot Oil & Gas Corporation safely performs this procedure deep within Pennsylvania’s Marcellus Shale formation. What follows is a step-by-step overview of the process after the horizontal section of a well has been drilled and a protective barrier of cement and steel have been installed to separate the gas from surrounding structures and protect groundwater sources.

Hydraulic Fracturing Process

Hydraulic fracturing happens in small sections called stages. It starts at the end of the wellbore and moves toward the beginning.

Step 1 – Perforating the Casing
First, a perforating gun is lowered into a targeted position within the horizontal portion of the well. Then, an electrical current is sent down the well to set off a small explosive charge. This shoots tiny holes through the well casing and out a short, controlled distance into the shale formation. The holes created by the “perf” gun serve two purposes: they provide access for the fracturing fluid to enter the formation and subsequently allows natural gas to enter the wellbore.

Step 2 – Shale Fracturing
The fracturing of a well creates a complex network of cracks in the shale formation. This is achieved by pumping water, sand and a small amount of additives down the wellbore under high pressure. After these cracks are created the sand will remain in the formation propping open the shale to create a pathway for the gas to enter the wellbore and flow up the well.

Step 3 – Repeat in Stages
During each stage experts will monitor, adjust and record all of the stage parameters to ensure worker and public safety and to maximize the natural gas production from the shale. After each stage is completed, a plug will be set and new perforations created to direct the frac fluid to the next stage. By segmenting the well in stages, a greater amount of gas is produced from the lateral length of the well.
Step 4 – Safe Frac Fluid Removal
After hydraulic fracturing is completed, all of the plugs placed between frac stages are drilled out to remove the restrictions in the wellbore. The completed well is then opened up to safely remove the fracturing fluid so that natural gas can be harvested. The frac fluid that is recovered from each well is treated and reused in future frac jobs through Cabot’s closed-loop water recycling system.

Step 5 – Flaring
Toward the end of the frac fluid removal process, gas will start to travel up the well along with the fluid. Since the amount of gas increases as the water decreases, a flare is set up to make sure the gas is safely burned.

Step 6 – Harvesting the Natural Gas
After safely removing the fracturing fluid from the formation, the sand will remain in the shale to provide a pathway for the gas to flow into the wellbore and to the surface. Once at the surface, the gas will be processed and delivered to nearly 70 million homes and businesses across the country.

What’s in Hydraulic Fracturing Fluid?

Water and sand make up over 99% of the fluid used by Cabot during the fracking process. Less than 1% of everything pumped into a well is chemical additives. The primary function of these chemicals is to reduce friction, prevent corrosion and to control bacteria. These chemicals can generally be found in common household items. Without the use of these chemicals, our ability to effectively fracture the shale would be limited. The exact ratio of the few chemicals used varies depending on various characteristics of the rock being fractured.

As part of our commitment to openness and transparency, Cabot participates in Frac Focus – a chemical disclosure registry. By visiting FracFocus.org, you can search for wells by location or company to see the exact formula of hydraulic fracturing fluid in a specific well. Cabot has included all of its wells since 2011.

As part of Cabot’s closed-loop water system, all water used in operations will be trucked to the site and stored on a secondary pad (pictured on the front page).
Chad Gorman
Water Resource Engineer
North Region

While relatively new to the natural gas industry, Chad brings 12 years of Environmental Remediation and Water Treatment experience to the field as Cabot’s Water Resource Engineer.

The position is an important one, bringing with it the responsibility for the proper and safe management of water during all stages of the hydraulic fracturing process. This water “lifecycle” includes obtaining and transporting the water to the well site, followed by its storage and use in the hydraulic stimulation process during the “completions” phase of a well.

The job not only calls for cost analysis and cost control relating to the water management, but also demands keen organizational skills to juggle a full list of daily tasks while coordinating water storage and transfer set-ups to new locations that are changing weekly.

Raised in small communities not far from Susquehanna County, Chad thanks Cabot for giving him the opportunity to return and work in this region. “I like that you know your neighbors and I love experiencing the rolling hills, the winding roads and the fresh, crisp air out here,” says Chad. “It’s great to be back and working so close to home.”