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Hydraulic Fracturing in California: An Overview

Hydraulic fracturing (HF), also called hydro-fracturing, fracking or fracing, has been utilized in California for the past 60 years as a method of stimulating production of oil and natural gas wells. Central California sits above the Monterey Shale Formation, a 1,750-square-mile oil reserve stretching approximately from Modesto to Bakersfield. It holds an estimated 64 percent of all discovered national deep-rock resources in the United States, containing as much as 15.4 billion barrels of potential shale oil. This Short Subject provides an overview of HF in California and includes a summary of the federal and state regulatory environment for this enhanced method of shale oil and gas development.

Oil and Gas Recovery

The first oil wells in California were sunk in the 1860s. By the early part of the 20th century, many of the easily-accessible oil reserves were depleted. Petroleum companies throughout the United States were trying various experiments to develop new methods that would allow further extraction of oil and gas. HF was one such method.

In HF, water is first mixed with chemicals to form a gel-like substance. This gel is then mixed with sand, silica or other proppants, which serve to "prop" open cracks in shale. This mixture of fluid and proppant is then pumped into a wellbore at pressures high enough to force the mixture into oil-laden shale deep underground.

Once in the ground, the fluid expands existing fractures in the shale and creates new ones. As part of the HF process, controlled explosions may also be set off underground. The oil or natural gas released by the HF event seeps into the wellbore, where it is pumped to the surface and transferred off site. The chemical composition of HF fluid is often held as proprietary information by oil and gas companies. Until recently, disclosure of the chemicals in HF fluid was largely unregulated in California.

HF in California

The first HF treatments in California took place in the early 1950s. Soon, HF became a well-known extraction technique.[1,2] A California study published in 1960 stated that "well stimulation by hydraulic fracturing and by associated techniques has been carried out in fields along the Whittier fault trend in the Los Angeles basin since 1953," with a total of 53 treatments performed in 45 wells.[3] By the mid-1970s, hundreds more HF treatments had been performed in the San Joaquin Valley.[4]

California has also been the site of some record-breaking HF treatments. In 1978, Tenneco Oil Co. conducted an experimental operation in the Paloma field, southwest of Bakersfield. In partnership with Halliburton Services, the company used 500,000 pounds of specially-prepared bauxite and a series of pressurized pumps. It was the biggest HF treatment in California to date.[5] Another treatment, also described as a "record frac," was conducted by Chevron and Dowell in 1994 in Kern County, when 2.97 million pounds of silica sand proppant and over 423,000 gallons of fluid were pumped into a single, 4,200-foot well at the Lost Hills oil field.[6]

Historically, oil and gas companies operating in California were not required to report when, where and how often HF treatments occur. For this reason, it is not known to what extent HF has been utilized in California.

Federal Regulatory Environment

After the oil and gas have been collected from a HF treatment, the residual fluid, also called "produced water," may be treated on site, transferred to a local treatment facility or reinjected into specially-designated injection wells known as Class II wells.

The 1974 federal Safe Drinking Water Act (SDWA) includes regulations for the Underground Injection Control (UIC) Program. Originally, SDWA gave the Environmental Protection Agency (EPA) the authority

to regulate Class II wells to protect underground sources of drinking water.

After a 2004 EPA study found that the use of HF for coalbed methane in the Midwest posed almost no risk to drinking water, the Energy Policy Act of 2005 was passed. This act stripped the EPA of authority to regulate HF under SDWA, except when diesel fuel is utilized as part of the HF process. This exclusion is commonly known as the "Halliburton Loophole" after the largest U.S. provider of HF oilfield services. The EPA regulates air pollutants associated with HF and requires disclosure of chemicals discharged into the ocean during offshore HF treatments.

State Regulatory Environment

In 1983, the EPA implemented a primacy agreement that granted the California Department of Conservation, Department of Oil, Gas & Geothermal Resources (DOGGR) regulatory authority over Class II UIC wells. This primacy agreement provided DOGGR regulatory authority under SDWA.

The EPA audited DOGGR's enforcement of SDWA twice per this agreement, once in 1984 and again in 2010. The 2010 review found that that DOGGR was not adequately protecting underground water drinking sources from the movement of HF fluids.[7]

As HF becomes increasingly popular as a method for enhanced recovery of oil and gas, it receives more scrutiny from the public, which has led to increased public interest in state oversight.[8] DOGGR, the state agency with primary authority, is required to put in place regulations for contaminants in compliance with the national primary drinking water regulation—rules that are no less stringent than the regulations promulgated by the EPA.

Section 3106 of the Public Resources Code gives DOGGR authority to supervise the underground injection of water and other substances for purposes of recovery of oil and gas, including HF techniques.

Proposed regulations were published by DOGGR in December 2012, and interim well stimulation regulations went into effect January 1, 2014, coinciding with the effective date of Senate Bill 4 (Pavley, Chapter 313, Statutes of 2013).[9] SB 4 defines well stimulation treatment, including HF, and requires regulations specific to HF to be adopted by DOGGR. The statute also requires DOGGR to adopt permanent regulations and to develop an environmental impact report on the impacts of well stimulation treatments in 2015.[10]

Further Reading:

Horsley Witten Group for the USEPA, Final Report: California Class II Underground Injection Control Program Review. June 2011.

Congressional Research Service, Hydraulic Fracturing and Safe Drinking Water Act Regulatory Issues. January 10, 2013. https://www.fas.org/sgp/crs/misc/R41760.pdf

Endnotes

1. J.L. Huitt, "Hydraulic Fracturing with the Single-Point Entry Technique." Journal of Petroleum Technology, March 1960, pp. 11-13.
2. W. Rintoul, Drilling Ahead: Tapping California's Richest Oil Fields. Santa Cruz: Valley Publishers, 1981.
3. W.K. Ghauri, "Results of Well Stimulation by Hydraulic Fracturing and High Rate Oil Backflush." Journal of Petroleum Technology, June 1960, pp. 19-27.
4. M.K. Strubhar, et al. "Fracturing Results in Diatomaceous Earth Formations, South Belridge Field, California." Journal of Petroleum Technology, March 1984, pp. 495-502.
5. B. Rintoul, "California's Biggest Frac Job." Pacific Oil World, May 1978, pp. 20-21.
6. "Chevron, Dowell set record frac in California. (hydraulic fracturing operation in Lost Hills oilfield)." Improved Recovery Week, 1994.
7. Horsley Witten Group for USEPA, Final Report: California Class II Underground Injection Control Program Review. June 2011.
8. Elena Miller, Supervisor, Division of Oil, gas & Geothermal Resources, Department of Conservation, to The Honorable Fran Pavley, 23rd District, California State Senate. Correspondence dated February 16, 2011.
9. Department of Conservation, Division of Oil, Gas and Geothermal Regulation, text of interim regulations: http://www.conservation.ca.gov/dog/Documents/Final%20Interim%20Regulations.pdf. Accessed January 14, 2014.
10. Department of Conservation, Division of Oil, Gas and Geothermal Regulation, "DOC Submits Notice of Preparation for SB 4 EIR." http://www.conservation.ca.gov/dog/Pages/WellStimulation.aspx#Item3. Accessed February 21, 2014.

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