Study Of Hydraulic Fracturing

And The Potential Impact It May Have On

Drinking Water Resources

Comments submitted to the U.S. Environmental Protection Agency

by the Texas Alliance of Energy Producers

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The process of hydraulic fracturing was developed initially in the 1940s to stimulate production from oil reservoirs with declining productivity. More recently, this practice has been used to initiate oil and gas production in unconventional (low-permeability) oil and gas formations. Its application-in combination with technological breakthroughs, such as horizontal drilling-in the production of natural gas from coal beds, tight gas sands, and unconventional shale formations has resulted in the marked expansion of U.S. crude oil and natural gas production and reserves.

Similarly, hydraulic fracturing is enabling the development of unconventional domestic oil resources, such as the Bakken Formation in North Dakota and Montana; the Marcellus in Pennsylvania, Ohio and West Virginia; the Eagle Ford Shale in South Texas; and many more throughout the United States.

It is the combination of hydraulic fracturing and horizontal/directional drilling that is allowing the economic development of unconventional oil and gas resources.

Hydraulic fracturing involves injecting into production wells large volumes of water, sand or other proppant, and specialized chemicals under enough pressure to fracture low-permeability rock formations containing oil and/or natural gas thousands of feet below the surface of the earth. The sand or other proppant holds the new fractures open to allow the oil or gas to flow freely out of the formation and into a production well. Fracturing fluid and water remaining in the fracture zone can inhibit oil and gas production, and must be pumped back to the surface. The fracturing fluid-"flowback"-along with any naturally occurring formation water pumped to the surface, together called produced water, typically has been disposed through deep well injection or treated before disposal into surface waters.

The use of hydraulic fracturing continues to increase significantly, as more easily accessible oil and gas reservoirs have declined and companies move to develop unconventional oil and gas formations. Hydraulic fracturing is used for oil and/or gas production in all 33 U.S. states where oil and natural gas production takes place. According to industry estimates, hydraulic fracturing has been applied to more than 1 million wells nationwide.

Shale gas production usually involves drilling a well vertically and then drilling horizontally out from the wellbore. Because of the low permeability of shales, more wells must be drilled into a reservoir than more permeable, conventional reservoirs. A benefit of horizontal drilling through a producing shale layer is that one well pad that utilizes horizontal well drilling can replace numerous individual well pads and reduce the surface density of wells in an area. Six to eight horizontal wells, and potentially more, can be drilled from a single well pad and access the same reservoir.

A single producing well may be fractured multiple times, using from 500,000 gallons to more than 6 million gallons of water, with compounds and propants of various amounts added to the water.

While the volume of water used for hydraulic fracturing may seem large, it's actually comparatively small. A report for the U.S. Department of Energy in 2009 concluded that water used for hydraulic fracturing constitutes between 0.1 percent and 0.8 percent of the total water demand for any given area. In Fort Worth, the Tarrant County Water District (the largest water provider there) says its water deliveries in 2011 for all oil and gas activity amounted to just 0.54 percent of its total water sold. Agriculture, golf courses, and even car washes often use considerably more water than

hydraulic fracturing.

CONGRESS EXCLUDES HYDRAULIC FRACTURING FROM S.D.W.A.

Congress included groundwater protection provisions in the 1974 Safe Drinking Water Act (SDWA). The SDWA, among other things, directs the EPA to regulate the underground injection of fluids (including solids, liquids, and gases) to protect underground sources of drinking water.

The SDWA directs the EPA Administrator to promulgate regulations for state UIC programs, and mandates that the EPA regulations "contain minimum requirements for programs to prevent underground injection that endangers drinking water sources." It specifies that EPA may not prescribe requirements for state UIC programs which interfere with or impede--(A) the underground injection of brine or other fluids which are brought to the surface in connection with oil or natural gas production or natural gas storage operations, or (B) any underground injection for the secondary or tertiary recovery of oil or natural gas, unless such requirements are essential to assure that underground sources of drinking water will not be endangered by such injection. Energy Policy Act of 2005 clarified that the term "underground injection" as it is used in the SDWA, means the subsurface emplacement of fluids by well injection, and specifically excludes the underground injection of fluids or propping agents associated with hydraulic fracturing operations related to oil, gas, or geothermal production activities. The use of diesel fuels in hydraulic fracturing, however, forfeits eligibility for this exclusion from the definition of "underground injection." This amendment

clarified that the UIC requirements found in the SDWA do not apply to hydraulic fracturing, although the exclusion does not extend to the use of diesel fuel in hydraulic fracturing operations.

Roughly five years after enactment of this amendment, EPA posted on its website a requirement that any service company that performs hydraulic fracturing using diesel fuel must receive prior authorization from the relevant UIC authority (state or EPA). EPA also determined that injection wells receiving diesel fuel are Class II wells for purposes of the UIC program. These determinations were not made via adoption of new regulations, but rather were noted on the agency's website in 2010. This determination on the EPA website (without notice and comment as would normally be done in an agency rulemaking proceeding) has been challenged by oil and gas trade organizations in a petition for review in the U.S. Court of Appeals for the District of Columbia.

GROUNDWATER POLLUTION ALLEGATIONS

Some allegations portrayed inaccurately that hydraulic fracturing pollutes our water. However, upon detailed examination the scientific and regulatory communities have strongly affirmed the safety of this important process.

For instance, opponents claim that hydraulic fracturing contaminates groundwater. Yet after being used more than 1.2 million times since the 1940s, there has not been a single confirmed case of contamination. As former EPA administrator Lisa Jackson said recently, "In no case have we made a definitive determination that [hydraulic fracturing]

has caused chemicals to enter groundwater." EPA came to a similar conclusion in its assessments in 2004 and 1995. State regulators from across the country have also affirmed that hydraulic fracturing does not contaminate water supplies.

State oil and gas regulators assert that the hydraulic fracturing process has never been linked directly to groundwater contamination. For example:

- "We've never had one case of fracing fluid going down the gas well and coming back up and contaminating someone's water well." John Hanger, former Secretary of the Department of Environment in Pennsylvania.
- "I've been working in hydraulic fracturing for 40-plus years and there is absolutely no evidence hydraulic fractures can grow from miles below the surface to the fresh water aquifers," Dr. Stephen Holditch, Department of Petroleum Engineering, Texas A & M University.
- "We have never had any instance of groundwater contamination from hydraulic fracturing – ever." Elizabeth Ames Jones, former Chair of the Texas Railroad Commission.
- "There have been no documented cases of drinking water contamination that have resulted from hydraulic fracturing operations to stimulate oil and gas wells in the State of Alabama." Nick Tew, Alabama State Geolorgist and Oil and Gas Supervisor.
- "There have been no verified cases of harm to ground water in the State of Alaska as a result of hydraulic fracturing." Cathy Foerster, Commissioner, Alaska Oil and Gas Conservation Commission.
- "To the knowledge of the Colorado Oil and Gas Conservation Commission staff,

there has been no verified instance of harm to ground water caused by hydraulic fracturing in Colorado." David Nesline, former Director, Colorado Oil and gas Conservation Commission.

- Additionally, former Energy Secretary Chu, Interior Secretary Salazar, former EPA Administrators Lisa Jackson and Carol Browner all have said that they know of no instance where groundwater has been contaminated by hydraulic fracturing.

If there were a major risk of water contamination from hydraulic fracturing, then why aren't there hundreds of thousands of examples across the country? And even if there were these examples that somehow escaped reporters' attention, wouldn't at least *one* regulatory body at the state or federal level acknowledge the risk?

Opponents frequently cite Dimock, Pa. – where a handful of residents have blamed poor water quality on the use of hydraulic fracturing – as an example of contamination. But the EPA conducted comprehensive water testing in Dimock, and its results "did not indicate levels of contaminants that would give EPA reason to take further action." (Private water wells across the country are well-known for having high levels of naturally-occurring chemicals and other products.)

Additionally, EPA investigated the potential role of hydraulic fracturing in the contamination of a cluster of water wells in the Pavillion, WY, area. Using its authority under the Comprehensive Environmental Response, Cleanup, and Liability Act (CERCLA, commonly known as Superfund), EPA began testing water wells after residents contacted EPA in 2008 to report changes in the quality and quantity of water following nearby gas development. The agency initially confirmed the presence of a compound known to be used in hydraulic fracturing in several wells. However, under

further investigation and testing by the U.S. Geological Survey it was learned that EPA drilled two monitoring wells and used "dense soda ash" to drill the wells, which is commonly found in the drilling of deep wells. Organic chemical have been found in ground water near Pavillion for some 50 years prior to hydraulic fracturing by the Geological Survey.

Range Resources faced another challenge in Parker County, Texas after drilling two wells that were fraced. The owner of a water well claimed that the wells were contaminated because of the fraced wells. The Texas Railroad Commission began its investigation, but before it could issue a report EPA's Region 6 Administrator Al Armendariz issued an emergency order against Range Resources. A month later, the RRC held a hearing and it was discovered that methane gas had been present in the water wells the day they were drilled which was several years before Range drilled its wells. The case was dropped by EPA.

Identifying the cause of contamination can be difficult for various reasons, including the complexity of hydrogeologic processes and investigations, a lack of baseline testing of nearby water wells prior to drilling and fracturing, as well as the confidential business information status typically given to fracturing compounds across the states. In other cases, contamination incidents have been attributed to poor well construction or surface activities, rather than the specific hydraulic fracturing process.

FRACTURING OCCURRS MILES BELOW GROUND WATER

The reason hydraulic fracturing does not connect to groundwater is that the process occurs often more than a mile below the surface, separated from drinking water supplies

by thousands of feet and billions of tons of impenetrable rock.

These natural barriers are also what have kept oil and gas trapped at such depths for millions of years. If they did not, companies wouldn't need to drill to such depths to access them!

And in case these geological facts aren't convincing enough, the industry is also tightly regulated under both state and federal laws, contrary to claims that the industry is "exempt" from regulations across the board. In addition to having to comply with federal rules set by the U.S. EPA and the Bureau of Land Management (among many others), the Texas Railroad Commission has regulated oil and gas industry operations – including hydraulic fracturing – longer than any other regulatory body in the country. The Texas Commission on Environmental Quality regulates air emissions from oilfield activity, and their efforts are responsible for the fact that over the last decade Texas has made more progress in cleaning up its air than any other state in the union.

Opponents claim the industry opposes any and all regulation. But in Texas (and in other states across the country) the industry supported and even encouraged landmark laws requiring disclosure of additives used during hydraulic fracturing. Legislation passed the Texas Legislature in 2011 that established a reporting requirement for fluids to a web page called FracFocus, which is operated by the Ground Water Protection Council. The industry also provided funds for additional air monitors in North Texas and has agreed to increase funding for the Texas Railroad Commission, and the RRC recently updated its drilling, completion and cementing regulations.

STUDY REVEALS LOWER AIR EMISSIONS

Emission of natural gas into the atmosphere has been investigated by the EPA for several years. Some suspected that hydraulic fracturing of natural gas wells could possibly release emissions.

The University of Texas at Austin released a two-year study of air emissions from drilling of natural gas wells in September 2013 that found that methane emissions actually were lower than previous estimates by EPA.

The UT study was the first study that measured emission directly at the source as wells were being drilled and factured.

The UT study found that total emissions in the 27 locations were 97 percent lower than current EPA estimates.

Additionally, only 0.42 percent of the natural gas produced is released, according to the UT measurements. Previously, EPA estimated that 1.3 percent escaped.

INCREASED PRODUCTION AND ECONOMIC IMPACT

The head of the Energy Information Administration (EIA), the data collection arm of the Energy Department, projects that the U.S. will become the largest producer of crude oil and natural gas in the world in 2013.

"This is a remarkable turn of events," said **Adam Sieminski**, the head of the Energy Information Administration. "This is a new era of thinking about market conditions, and

opportunities created by these conditions, that you wouldn't in a million years have dreamed about not long ago."

Saudi Arabia remains the world's largest producer of crude oil and related liquids. As of July, Saudi Arabia was producing 11.7 million barrels per day (bpd), according to the International Energy Agency. Russia was second, at 10.8 million bpd, with the US third at 10.3 million bpd.

While oil production in Russia has remained flat the past few years, U.S. oil production has grown and erased a 3 million barrel per day difference. The amount of crude from the Bakken oil field in North Dakota, the Permian Basin in West Texas and the Eagle Ford shale formation in South Texas continues to rise rapidly.

In 2012, the U.S. produced more natural gas than Russia for the first time since 1982.

The rise in oil and gas production in the U.S. has reduced imports and closed the huge trade deficit. Oil imports are down 32 percent and natural gas imports declined 15 percent.

Everyone in the oil and gas industry in the U.S. knows that shale drilling and production is very expensive. If exploration and production cannot be profitable, activity will decline. The industry has witnessed the decline in natural gas activity because natural gas prices have fallen and costs have not followed suit.

Just as important as price is action taken by government regulators that could drive up costs dramatically or prohibit drilling activity altogether.

A study from the University of Texas at San Antonio shows that the Eagle Ford shale in South Texas supported 47,000 jobs in 2011, worth more than $3 billion in salaries and benefits to Texas workers and their families. The Eagle Ford also added more than $257 million in new revenue to local governments, funding public services like schools, hospitals, and emergency services. Over the past ten years, the Barnett Shale in North Texas has supported more than 100,000 jobs, as well as generating a staggering $5.8 billion in tax receipts for the state.

If these wells cannot be fracked, they will not be drilled and the oil and gas production will be lost.

COST TO FEDERAL GOVERNMENT TO REGULATE

The funding and staffing resource implications of including hydraulic fracturing under the UIC program could be significant for regulatory agencies. The scope of the added workload under Class II UIC programs could more than double. Currently, there are approximately 146,800 Class II wells nationwide. In contrast, the DOE Energy Information Administration reports that the number of gas producing wells in the United States increased from 302,421 in 1999 to 493, 100 wells in 2009, and most new wells are fractured.

EPA's annual appropriation includes funds for state grants to support state administration of various EPA programs. Since the 1980s, annual appropriations to support state UIC programs have remained essentially flat (not accounting for inflation) at roughly $10.5 million. Ten EPA regional offices and 42 states share this amount

annually to administer the entire UIC program, which covers 1.7 million wells (Classes I through V) nationwide.

The GWPC has estimated that annual UIC program funding would need to increase to $56 million to fully meet the needs of the existing UIC program. The GWPC further estimated that EPA would need to provide funding at a level of $100 million annually to meet the needs for the full UIC program, including the regulation of geologic sequestration of carbon dioxide. Given the large number of wells that are fractured, UIC program oversight and enforcement costs for state agencies could be considerably higher if this process is subjected to federal UIC regulations. EPA and states would need to develop new regulatory requirements for these wells and increase staff to review applications and make permitting decisions. States and industry representatives have expressed concern that failure to provide sufficient resources would likely create permitting backlogs. For example, under UIC regulations, EPA or the primacy state must provide for a public hearing for each permit issuance, and have inspectors on site. Some states impose permit fees or use other revenue-generating mechanisms, while such approaches have not been embraced in other states.

COST TO INDUSTRY FROM FEDERAL REGULATION

A 2009 study prepared by a consultant for the DOE estimated the costs associated with "a stringent set of potential federal requirements" including (1) obtaining a permit, (2) conducting an area of review assessment, (3) performing in-situ stress analysis, (4) conducting three-dimension fracture simulation, (5) monitoring, (6) mapping fractures, or conducting other post-fracture analysis, (7) for some wells (perhaps 10%),

performing state-of-the-art down-hole fracture imaging, and (8) additional cement to ensure isolation of the target zone before fracturing. Based on these assumed elements of a regulatory program, the study estimated that the compliance costs for regulating hydraulic fracturing for oil and gas development would be $100,505 for new wells receiving hydraulic fracturing treatment.

CONCLUSION

The Texas Alliance of Energy Producers opposes federal regulation of hydraulic fracturing, noting that this process is regulated by the states. States have adopted comprehensive laws and regulations to provide for safe operations and to protect the nation's drinking water sources, and that these states have trained personnel with expertise to effectively regulate oil and gas exploration and production; thus, making the states the best-suited regulators of hydraulic fracturing.

Hydraulic fracturing is currently, and has been for decades, a common operation used in exploration and production by the oil and gas industry in all producing states. Because of the unique position of the states and their collective expertise on matters concerning the oil and gas industry, regulation of hydraulic fracturing should remain the responsibility of the States. The States have as much of a vested interest in the protection of groundwater as the federal government and as such, will continue to regulate the process effectively and efficiently, taking into account the particulars of the geology and hydrology within their boundaries. There is not a "one-size fits all" approach to effective regulation.

Proponents of EPA regulation of hydraulic fracturing have not determined that hydraulic fracturing has caused any damage to ground water. Simply, there is no evidence that federal regulation is necessary. State regulatory agencies have enforced the laws and regulation for decades.