Hydraulic Fracturing

By Stephen Larkin
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The History of Hydraulic Fracturing

Hydraulic fracturing commonly referred to as “fracking” has had an undeniable impact on the energy industry in the United States. Oil production last year reached its highest level in fourteen years, thanks in part to the output from North Dakota’s Bakken Shale.

One of the arguments against fracking is it’s a “new science.” Most people would be surprised to learn fracking dates back to the U.S. Civil War. “In November 1866, Civil War veteran, Colonel Edward Roberts received U.S. patent No. 59,936 for a process he called “Superincumbent Fluid Tamping.” Roberts invention came to be known as the “Exploding Torpedo.”

Roberts’ process involved lowering an iron case containing between fifteen to twenty pounds of black powder, into a well as near as could be determined, where it would be necessary to detonate it. The borehole was filled with water creating the “fluid tamping” effect, to concentrate the concussion and more efficiently fracture the surrounding oil strata. The “explosive shot” also removed built up paraffins from the well casing which clogged the casing and reduced production. In 1868, nitroglycerin became the preferred blasting agent over black powder, with nitroglycerin detonations continuing to be used until 1989.

The effects of the process were so successful, some oil companies hired unlicensed operators to “torpedo” their wells, working by “moonlight,” which was where the term, “moonlighting” originated. On April 18, 1939, Ira J. McCullough of Los Angeles received two patents for his multiple bullet-shot casing perforator. McCullough’s revolutionary innovation of firing at several levels through a borehole’s protective casing greatly enhanced the flow of oil.

In 1947, in Hugoton, Kansas a massive natural gas field was hydraulically fractured. This was the first time a gas field was fracked. In 1949, based upon the success of the fracking of the gas field in Kansas, a team of petroleum production experts performed the first commercial application of hydraulic fracturing east of Duncan, Oklahoma. Later that same day, Halliburton and Stanolind successfully fractured a well near Holliday, Texas.

America’s first “shale boom” sprang from the innovative thinking of an independent producer from Galveston, Texas, George P. Mitchell, (1919 – 2013). In the 1970s and 80s, the conventional large pools of natural gas were tapped out. Drillers searched in vain for new geological formations. Mitchell’s breakthrough was in the economic extraction of natural gas from shale. Mitchell found shale had naturally occurring cracks in it and drilled in the Barnett Shale in east Texas. The results were spectacular with the field producing huge quantities of natural gas. In the mid to late 2000s, other companies took the technology and applied it to the Bakken Shale in North Dakota and the Marcellus Shale in Pennsylvania.

In the Bakken field which had produced oil since 1951, billions of barrels of new oil production were produced. Regarding the Marcellus Shale, the U.S. now has an estimated over 200 years’ worth of natural gas. Because of fracking, the U.S. became the largest oil producer in the world. The U.S. is using more natural gas and the country is well positioned to meet the growing energy demands for the next twenty-five years.

The Hydraulic Fracturing Process

Hydraulic Fracturing is not a drilling technique. It is a technology used to enhance the flow of gas/oil from a well, once the drilling is completed and the drilling rig is removed from the site. The process takes on the average, three to five days to complete. Once the process is complete, the well is ready to produce oil and/or natural gas.

While the well is being drilled, multiple layers of casing and cement are installed. When the well has been drilled and cased to its intended depth and the horizontal section has been cased and cemented, the drilling crew is replaced by the fracking crew. The first operation in the well completion process is to perforate the casing in the production zone. It is through these perforations fracking fluids are pumped to ‘fracture’ the shale formations. Once the production zone casing is perforated, the fracking crew proceeds to prepare the water-based solution for the insertion into the geologic formation. As in the past, water remains the most important component of a successful fracturing operation. It is the water which not only creates the tiny fissures in the deep shale rock which liberates the natural gas, but also acts as the delivery mechanism for the sand, which works to keep those newly formed fissures open so the oil or gas can be collected. The water added to the well must be pressurized to create the fractures in the rock. A typical fracking operation can involve the use of 200 “pump trucks” to deliver pressurized water into the wellbore. Deep shale wells can require 2 to 10 million gallons of water. The solution added is 99.5% water and sand. The remaining percentage of the solution is composed of additives to control the growth of bacteria in the wellbore, which could corrode the pipes. Other additives alter the surface tension of the water, allowing it to be more easily sent down the hole and extracted when the fracking operation is complete.

While 99+% of the solution is composed of water and sand, environmentalists have raised the concern of the additives contaminating aquifers. The petroleum industry maintains there isn’t a single “hazardous” additive in the fracking solution. Operators maintain that under federal law, they are bound by the “Community Right-to-Know Act.” The law mandates...
detailed product information sheets be developed, updated as necessary and made immediately available to emergency response personnel in the event of an accident.

A recent effort by the U.S. Department of Energy and the Ground Water Protection Council culminated in the creation of Frac Focus. This is a searchable, nationwide database with specific well-by-well information on the additives used in the fracturing process. Further, a dozen states require additional disclosure. By weight and volume, the most prominent of the additives is a substance known as “guar.” This is an emulsifying agent typically found in ice cream.

Environmentalists also cite their concern over “Trade Secrets.” The current law allows a company to request a designated constituent contained within a larger “additive” set be protected. The petroleum industry responding, all component information must be released to responders and medical personnel in an emergency. Even without an emergency, companies still disclose the general name of the constituent in question. They also provide its common industrial uses and the volumes at which it is being deployed. Industry claims the vast majority of these substances are considered “non-hazardous” by the Environmental Protection Agency.

The American Exploration and Production Council, a national trade association representing thirty-one of America’s premier independent natural gas and oil exploration and production companies offers the following breakdown for the additive components of fracturing mixture:

| Water and Sand: 99.51% |
| Additives: 0.49% |
| Other: 0.49% |

| Also Found in: |
| Acid: 0.123% |
| Friction Reducer: 0.088% |
| Surfactant: 0.085% |
| Potassium Chloride: 0.06% |
| Gelling Agent: 0.056% |
| Scale Inhibitor: 0.043% |
| pH Adjusting Agent: 0.011% |
| Breaker: 0.01% |
| Crosslinker: 0.007% |
| Iron Control: 0.004% |
| Corrosion Inhibitor: 0.002% |
| Antimicrobial Agent: 0.001% |

When evaluating the potential for the contamination of an aquifer, the depth of the oil and gas wells is an obvious consideration. The American Exploration and Production Council state the average depth of a deep shale gas well to be about 7,500-feet. The website, Energy and Capital, states the average depth of an oil well on land can range from 5,000-feet to 20,000-feet. This is well below the depth of usable underground aquifers where an average private well can average <500-feet and a municipal water well <1,000-feet.

Once a well is drilled a fracture stimulation operation is performed to ready the well for production. The steps taken in the fracturing process are as follows:

- The well is engineered to ensure the casing and cementing program protects fresh water and the well can reach its intended target
- The well is drilled vertically through many thousands of feet of solid rock, well below any usable aquifers, and then drilled horizontally into the shale formation.
- As the well is drilled, state regulations require it to be reinforced with multiple layers of protective steel casing and cement, which is designed to stabilize and protect groundwater and fresh water aquifers. The casing is tested after cementing to ensure the integrity of the system.
- Once integrity is ensured, a fracture design, tailored to the formation's geology is created using fracture modeling software.
- The production zone in the horizontal section is perforated using a perforating gun lowered into the wellbore.
- Fluid is pumped into the formation at a calculated rate and pressure to generate carefully designed millimeter thick fissures in the target formation. The combination of the water and the additives combine to carry the sand into the fractures and when the water is removed, the sand remains, holding the fracture open. During the fracturing operations, injection pressure, volume and rate are carefully monitored to ensure the fracture meets the design parameters.
- For the well to produce natural gas, an initial volume of produced water and sediment is removed and collected at the surface to be recycled or disposed of at state regulated disposal facilities, once the operation has been completed.
- The newly created fissures are propped open by the sand. This allows the natural gas to flow into the wellbore and to be collected at the surface.

Source: American Exploration and Production Council: 2010
Geographical Shale Gas and Oil Sites in the Lower 48 States

Source: Energy Information Administration, May, 2009

The Positives Regarding Fracking

Increased Energy Production

The American Petroleum Institute (API) is the only national trade association representing all facets of the oil and natural gas industry, which supports 9,800,000 U.S. jobs and 8-percent of the U.S. economy. API’s more than six-hundred members include large integrated companies, as well as exploration and production, refining, marketing, pipeline, and marine businesses, and service and supply firms. The (API) has established a website at http://www.energytomorrow.org which details the growth in oil and gas production.

In 2007, the start of America’s shale oil production revolution, U.S. oil production was only about five million barrels per day. Since then U.S. oil production increased almost 70%. Most of this increase is due to shale oil production, which rose from less than half a million barrels per day in 2007 to almost four million barrels per day in 2014, constituting 46% of U.S. oil production in 2014.

### Shale Oil Production (bbl/d)

<table>
<thead>
<tr>
<th>Shale Field</th>
<th>2007</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bakken</td>
<td>74,173</td>
<td>1,077,444</td>
</tr>
<tr>
<td>Eagle Ford</td>
<td>59</td>
<td>1,360,266</td>
</tr>
<tr>
<td>Niobrara</td>
<td>35,940</td>
<td>217,510</td>
</tr>
<tr>
<td>Permian</td>
<td>1999,073</td>
<td>970,894</td>
</tr>
<tr>
<td>Other Shale</td>
<td>117,812</td>
<td>293,841</td>
</tr>
<tr>
<td>Total Shale</td>
<td>427,777</td>
<td>3,919,154</td>
</tr>
<tr>
<td>U.S. Non Shale</td>
<td>4,649,223</td>
<td>4,662,119</td>
</tr>
<tr>
<td>Total U.S.</td>
<td>5,077,000</td>
<td>8,581,273</td>
</tr>
</tbody>
</table>

Source: American Petroleum Institute, 2015

Since the start of America’s energy renaissance in 2007, U.S. production of shale gas has increased from five billion cubic feet (BCF) per day to thirty-six BCF per day, making the U.S. the world’s largest natural gas producer since 2011. Shale gas now constitutes over half of U.S. natural gas production, with over 30% of shale gas production in 2014 coming from the Marcellus field in Pennsylvania and West Virginia.

### Natural Gas Production (mcf/d)

<table>
<thead>
<tr>
<th>Shale Field</th>
<th>2007</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fayetteville</td>
<td>231</td>
<td>2,803</td>
</tr>
<tr>
<td>Eagle Ford</td>
<td>-</td>
<td>4,314</td>
</tr>
<tr>
<td>Haynesville</td>
<td>73</td>
<td>3,967</td>
</tr>
<tr>
<td>Marcellus</td>
<td>32</td>
<td>12,869</td>
</tr>
<tr>
<td>Barnett</td>
<td>2,514</td>
<td>4,141</td>
</tr>
<tr>
<td>Other Shale</td>
<td>2,333</td>
<td>7,974</td>
</tr>
<tr>
<td>Total Shale</td>
<td>5,182</td>
<td>36,067</td>
</tr>
<tr>
<td>U.S. Non-shale</td>
<td>47,602</td>
<td>34,363</td>
</tr>
<tr>
<td>Total U.S.</td>
<td>52,784</td>
<td>70,430</td>
</tr>
</tbody>
</table>

Source: American Petroleum Institute, 2015

Employment and the Economy

http://fuelfix.com/ the energy blog of the Houston Chronicle reported in August of 2013 employment in the oil and gas sector of the economy 40% since 2007. The report further stated the oil and gas industry created more than 162,000 jobs from 2007 to 2012 in drilling, extraction and support services.

The American Petroleum Institute states the oil and natural gas industry today employs 2.6 million Americans, and supports 9.8 million jobs in America or 5.6% of the total U.S. employment. Employment in the oil and gas industry is divided into three categories;

**Upstream: 1,150,500 (44%)**

Upstream operations refer to the exploration and identification of oil and natural gas resources, the design and construction of wells to retrieve those resources and the infrastructure to support retrieval.

**Midstream: 274,800 (11%)**

Midstream operations include pipelines, transportation and storage of oil and natural gas.

**Downstream: 1,165,400 (45%)**

Downstream operations include the refining of oil, as well as the marketing and distribution of oil-derived products and natural gas.

For every 1 person directly employed by the U.S. oil and gas industry, an additional 2.8 jobs are supported throughout the economy. Wages in the oil and natural gas industry, across many professions, far exceed the national average wage rate.

1.3 million – Projected job opportunities in the Oil & Gas and Petrochemical Industries over the 2010-2030 period.

Reduction in the Cost of Energy

IHS, Inc. based in Colorado provides information and analysis to support the decision-making process of businesses and governments in industries, such as aerospace, defense and security; automotive; chemical; energy; maritime and trade;
The hydraulic fracturing process: a survey by the following activities involving water that support was published in June 2015. The EPA defined the scope of the fracking to negatively affect groundwater. At the urging of the federal government, the Environmental Protection Agency undertook a study of the potential for Ground Water Pollution. The Concerns Regarding Fracking

Ground Water Pollution

At the urging of the federal government, the Environmental Protection Agency undertook a study of the potential for fracking to negatively affect groundwater. The final report was published in June 2015. The EPA defined the scope of the survey by the following activities involving water that support the hydraulic fracturing process:

**Water Acquisition**
The withdrawal of ground or surface water needed for hydraulic fracturing fluids

**Chemical Mixing**
The mixing of water, chemicals and proppant on the well pad to create the hydraulic fracturing fluid

**Well Injection**
The injection of hydraulic fracturing fluids into the well to fracture the geologic formation

**Flowback and Produced Water**
The return of injected fluid and water produced from the formation (collectively referred to as produced water in this report) to the surface, and subsequent transport for reuse, treatment, or disposal

**Wastewater Treatment and Waste Disposal**
The reuse, treatment and release, or disposal of wastewater generated at the well pad, including produced water

The EPA report estimated 25,000 to 30,000 new wells were drilled and hydraulically fractured annually in the United States between 2011 and 2014. Additional, pre-existing wells (wells more than one year old that may or may not have been hydraulically fractured in the past) were also likely fractured. Hydraulic fracturing took place in at least 25 states between 1990 and 2013. Almost half these wells were in Texas. Colorado was a distant second, while Pennsylvania and North Dakota were third and fourth respectively.

Between 2000 and 2013, approximately 9.4 million people lived within one mile of a hydraulically fractured well. Approximately, 6,800 sources of drinking water for public systems were located within one mile of at least one hydraulically fractured well during the same period. These drinking water sources served more than 8.6 million people year-round in 2013.

The EPA report concluded there were above and below ground mechanisms by which hydraulic fracturing activities had the potential to impact drinking water resources. The mechanisms included water withdrawals in times of or in areas with low water availability. Spills of hydraulic fracturing fluids and produced water; fracturing directly into underground drinking water resources; below ground migration of fluids and gases; and inadequate treatment and discharge of wastewater.

The EPA report concluded they did not find evidence these mechanisms had led to widespread, systematic impacts on drinking water resources. The report did find specific instances where one or more mechanisms led to impacts on drinking water resources, including the contamination of drinking water wells. The number of identified cases was considered small compared to the number of hydraulically fractured wells.

The EPA noted in their report this finding could reflect a rarity of effects on drinking water systems. Factors affecting this included insufficient pre- and post-fracturing data on the quality of the drinking water resources; the paucity of long-term systematic studies; the presence of other sources of contamination precluding a definitive link between hydraulic fracturing activities and an impact; and the inaccessibility of some information on hydraulic fracturing activities and potential impact.

Retrospective case studies are often constrained by a lack of baseline data (e.g., site-specific water quality data) which limited the EPA’s ability to link drinking water resource impacts to definitive causes or sources. Despite the difficulties in determining the specific sources of potential impacts, scientists were still able to use the data collected to shed light on potential vulnerabilities to drinking water resources.

During the period of the EPA field review there were numerous studies conducted by various groups, such as the Associated Press and Duke University. The results of some of these
studies claimed to find fracking led to the contamination of groundwater, either by chemicals or methane gas. Industry advocates cite the EPA report as the definitive answer to the question.

The issue of methane gas release attributable to fracking was brought to the public’s attention with the controversial film Gasland. The documentary produced in 2010 presented information, much of which was later shown to be inaccurate. The director of the film, Josh Fox was forced to admit methane gas has been present in New York wells for over 80 years. Studies in Pennsylvania found methane has been present in their groundwater since the 1980’s.

Methane is a naturally occurring gas found underground in both shallow and deep rock formations. Underground coal mining can release methane into nearby areas and the gas may eventually find its way into wells that use the groundwater. Many mines have systems to divert or remove methane from underground workings. However, these systems may not collect all of the methane released by the mining and it still may escape to water wells. Also, methane may continue to escape after the mine is closed.

Earthquake Generation and Fracking
As with the question of groundwater contamination, environmental groups claim fracking causes an increase in seismic activity. The petroleum industry contends it is not the fracturing process which is responsible for earthquake generation. Rather, it is the disposal of drilling wastewater which appears to be linked to increased seismic activity.

Disposal wells are the final resting place for used drilling water. These disposal wells are located thousands of feet underground, encased in layers of concrete. The disposal wells can often store the waste from several different wells. In the state of Texas, there are more than 50,000 disposal wells servicing more than 216,000 active drilling wells, according to the Texas Railroad Commission. Each of the active wells uses about 4.5 million gallons of chemical laced water, according to Hydraulic and Fracturing website.

The United States Geological Survey estimates there are about 500,000 injection wells across the United States. Waste water wells can serve a variety of purposes, including long-term CO2 storage, enhanced oil recovery, and disposal from industrial activities. According to the EPA there are approximately 144,000 “Class II” wastewater injection sites in operation. The following is a listing of the EPA Well Classifications:

<table>
<thead>
<tr>
<th>Class One</th>
<th>Industrial and Municipal Waste Disposal Wells</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Two</td>
<td>Oil and Gas Related Injection Wells</td>
</tr>
<tr>
<td>Class Three</td>
<td>Mining Wells</td>
</tr>
<tr>
<td>Class Four</td>
<td>Shallow Hazardous and Radioactive Injection Wells</td>
</tr>
<tr>
<td>Class Five</td>
<td>Non-Hazardous Fluids Wells</td>
</tr>
<tr>
<td>Class Six</td>
<td>Geologic Sequestration Wells (CO2)</td>
</tr>
</tbody>
</table>

The link between injection wells and seismicity has been understood for decades, according to the U.S. Department of the Interior.

- In the 1960’s, a series of small earthquakes around Denver were linked to disposal wells receiving wastewater from a nearby chemical plant.
- A study published in the Journal of Science in July of 2014 linked hundreds of earthquakes across a broad swath of Oklahoma to four wastewater wells used by the fracking industry. The wells were located south-east of Oklahoma City. The study found the wells near Oklahoma City had received nearly 5 million barrels a month of waste, causing the swarm of earthquakes.
- An article in the International Business Times on October 13, 2015 noted at a 4.5 magnitude earthquake struck on October 10th just miles from the Cushing Oil storage hub. The facility is located between Oklahoma City and Tulsa. This facility holds the largest share of U.S. crude stockpiles, sparking fears among the 8,000 residents.

Oklahoma surpassed California in 2014 as the earthquake capital of the lower 48 states and it will likely beat the Golden State in 2015. Nearly 700 earthquakes of magnitude 3.0 or greater have rocked Oklahoma in 2015. Insurance claims are rising as foundations crack and bricks crumble. Oklahoma officials are struggling to devise a strategy to reduce seismic activity without strangling the energy industry, the state’s largest employer. The government resisted calls from environmental groups to place a temporary ban on new wastewater injections while the issue is being studied. The state is limiting permits for new wells in “areas of interest” and they are requiring certain disposal wells to temporarily shutter or reduce water intake, if shaking occurs nearby.

Fracking and Nearby Residents
For years, environmentalists and the gas drilling industry have been in contention over the possible health implications of fracking. But to a great extent, the debate, as well as the emerging lawsuits and the various proposed regulations in numerous states, has been hampered by a shortage of science.

A study published in Environmental Science and Technology http://pubs.acs.org/doi/ipdf/10.1021/es502111u in February 2014 analyzed the exposure pathways and the health effects on unconventional natural gas extraction on industry workers and communities. The study looked at the pollutant sources, their fate and transport and the exposure pathways presented.

Pollutant Sources: Trucks, heavy equipment, generators, fracking fluids, drill cuttings, produced water, natural gas and associated chemicals, flaring.

Fate and Transport: Multiple chemicals emitted to air, water, and soil. Formation of secondary pollutants.

Exposure: Multiple routes; Indoor/outdoor Air, Domestic/irrigation Water. Surface and subsurface soil.
Oil and gas workers may be exposed to a wide range of hazards during well development. Residents and community members living, attending school and working adjacent to unconventional natural gas development sites may experience many of the same chemical and physical exposures. The 24/7 development cycle means long-term cumulative exposures may be of concern for people living near the development sites.

In addition to chemical concerns, other factors, such as increased truck traffic raise the potential for traffic accidents. The average multistage well can require between hundreds to a thousand truck trips to deliver equipment, (e.g., bulldozers, graders, pipe) chemicals, sand and water needed for well development and fracturing. Given the operational demands at the drill site, the trucks can frequently drive at high speeds. Increased traffic in development areas can also affect air quality due to diesel exhaust, road dust and nitrogen oxides. People living near development sites can be exposed to volatile organic compounds (VOC), silica and other chemicals involved in the fracturing process. It should be noted, there is still a lack of peer reviewed literature regarding such factors as industrial accidents, natural disasters and their effects on development sites.

The EPA report estimated the frequency and severity of hydraulic fracturing fluids spills for two states, Colorado and Pennsylvania. They found for Colorado, the average was one spill for every 100 wells. The average for Pennsylvania was slightly higher, averaging 0.4 to 12.2 spills for every 100 wells. The EPA report stated it was unknown if these estimates were representative of national occurrences. Also, while there are documented instances regarding odor complaints and increased concentrations of VOC’s and other compounds near well pads, there are limited studies discussing the emission and distribution of pollutants from well pads.

A study conducted in 2014 by five universities in Texas suggested hydraulic fracturing might not be a direct cause of groundwater contamination at selected wells sites. The study found contamination might instead originate from different, more manageable steps in the construction process. The problem was attributed to faulty casings and cement that was supposed to shield groundwater when petroleum products were drilled and pumped.

Bruce Bullock, director of the Maguire Energy Institute at Southern Methodist University’s Cox School of Business stated the industry had a relatively low failure rate on such wells.

Fracking and the Regulatory Environment

The Occupational Safety and Health Administration, (OSHA)

In late 2014, OSHA published a hazard alert entitled “Hydraulic Fracturing and Flowback Hazards Other than Respirable Silica,” in response to the large increase in fracturing in the past decade. The alert was published to provide information to workers; to protect them.

OSHA estimated 35,000 wells are hydraulically-fractured in the U.S, every year. The National Institute of Occupational Safety and Health (NIOSH) found workers were sometimes exposed to levels of fine sand dust in excess of 10 times the recommended safe limit. The dust contains silica or quartz, which if inhaled, can cause irreversible lung disease known as silicosis, which has been linked to lung cancer.

To address this exposure, OSHA proposed a rule regarding the “Occupational Exposure to Crystalline Silica.” The Occupational Safety and Health Administration is currently enforcing the existing silica standards and the proposed rule has not been enacted as of May 2016. OSHA a National Emphasis Program (NEP) in effect since 2008 regarding crystalline silica established a permissible exposure limit for silica also requiring workers exposed to silica be trained as part of the company Global Harmonization program and until effective engineering control can be instituted, workers wear respirators.

On November 2, 2015, President Obama signed the Federal Civil Penalties Inflation Adjustment Act Improvements Act, as part of the Bipartisan Budget Act. This act allows for a one time, catch-up inflation adjustment for federal fine structures. The act resulted in the following increases to the OSHA fine structure, which will be effective on August 1, 2016.

- Other than Serious Fines: $7,000 to $12,600
- Serious Fines: $7,000 to $12,600
- Willful Fines: $70,000 to $126,000
- Repeat Fines: $70,000 to $126,000

State Standards

Twenty-five states, Puerto Rico and the Virgin Islands have OSHA-approved State Plans and have adopted their own standards and enforcement policies. For the most part, these states adopt standards identical to Federal OSHA. However, some states have adopted different standards applicable to this topic or may have different enforcement policies.

California
- Title 8; Chapter 4, Division of Industrial Safety
- Subchapter 14: Petroleum Safety Orders-Drilling & Production

Alaska
- State Statutes and Regulations Related to Oil and Gas: Department of Natural Resources, Division of Oil and Gas

Texas
- Title 16; Economic Regulation; Part 1, Railroad Commission of Texas
- Chapter 3: Oil and Gas Division

Utah
- Rule R614-2 Drilling Industry
- Title R649 Natural Resources; Oil, Gas and Mining; Oil & Gas

Wyoming
- Oil and Gas Conservation Commission
Environmental Protection Agency

The EPA report, “The Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Waters Resources” published in June of 2015, found no evidence these mechanisms led to widespread, systemic impacts on drinking water resources. The report stated they found specific instances where one or more of these mechanisms led to impacts on drinking water resources, including contamination of drinking water wells. These cases occurred during both routine activities and accidents and have resulted in impacts to surface or ground water.

The report noted the number of identified cases where drinking water resources were impacted were small relative to the number of hydraulically fractured wells. The report stated this could reflect a rarity of effects on drinking water resources or be a result of other factors such as insufficient pre- and post-hydraulic fracturing data on the quality of drinking water resources. Other limiting factors could include the presence of other causes of contamination, the short duration of existing studies, and inaccessible information related to the hydraulic fracturing activities.

Proposed Federal and State Regulations

The federal Energy Policy Act of 2005 contained a provision that came to be known as the “Halliburton Loophole,” an exemption for gas drilling and extraction from requirements in the underground injection control (UIC) program of the Safe Drinking Water Act (SDWA). Other exemptions are also present in the Clean Air Act and the Clean Water Act.

Since that time, the federal government proposed rules associated with fracking dealing with air pollution, the placement of condensate tanks, carbon dioxide emissions, methane emissions, diesel fuels, usage of public lands, the protection of water resources and pipeline inspections. In March 2015, the Obama administration unveiled the nation’s first major federal regulations on hydraulic fracturing. The Interior Department will administer the rules to the about 100,000 wells on public lands. The states have jurisdiction over drilling on private and state-owned land where the vast majority of fracking is conducted. The new federal rules, by contrast, will cover the 100,000 oil and gas wells drilled on public lands, according to the Interior department. The Obama administration officials hope the federal rules will serve as a de facto standard for state legislatures struggling with their own regulations.

The Independent Petroleum Association of America immediately filed a lawsuit challenging the regulations, calling it “a reaction to unsubstantiated concerns” and requesting that the regulations be set aside. Additionally, states, such as Utah and Wyoming have also sued the government regarding the regulations.

Numerous states have proposed or enacted regulations related to fracking. Information related to what states are doing can be found on the website for the “National Conference of State Legislatures.” The website can be found here.

The website states, since 2010, more than 100 bills across 19 states have been introduced relating to hydraulic fracturing for natural gas. The most active states include New York and Pennsylvania. The most prominent recent trend in state legislatures is their attempt to require chemical disclosure, along with other fluid regulation such as proper disposal and additive stipulations.

Environmental Impairment Liability and Fracking

When insurers consider the insurability of companies involved in fracking, the key question is; are the companies serious about health and safety? While fracking was used for decades, with the rapid pace of technological advancements in the drilling process, insurance companies want insureds involved in fracking to be more forthcoming about their policies and practices. Insurers meeting with fracking companies are looking at their overall management and corporate commitment to safety.

Location is another key factor when insurers are considering underwriting a fracking operation. Insurers need to look at where the drilling is being done. There are different issues in the densely populated Northeast relative to other parts of the country. There are regions around the country where fracking is suspected of triggering earthquakes, but groundwater and air pollution as well. In areas such as these, the geology and geography of the region and the number of fracking stages required are primary concerns for insurers. Additionally, the demographic make-up of the population and the litigation history of an area are also concerns to insurers.

The question for an insurer is to insure or not to insure? The question often depends on their risk selection, essentially which companies are serious about health and safety. Accidents are an expected occurrence, but with strong safety programs companies need to demonstrate that they are a good risk. Insurers will evaluate the fracking company and their sub-contractors experience and loss history.

In remote areas, the proper disposal of waste waters can present a problem. These waters, which can contain chlorine and acids, if leaked into surface waters can cause harm to cattle and other animals drinking it. The proper evaluation of these companies and the monitoring of their work by rural land owners are essential to ensure their safe operations.

The debate on how to best balance the concerns for the environment with the desire to increase our nation’s energy independence is a topic being discussed across the land. In any industrial operation incidents are going to occur and claims will develop. The oil and gas industry reached settlements or buyout agreements with claimants and individuals. The settlements often involve confidentiality or non-disclosure agreements. However, some settlements were reached without such constraints on the claimants. The oil and gas industry took this step in an effort of transparency.

A growing number of shale oil and gas leases contain boilerplate indemnity provisions in which the gas company...
promises to indemnify and hold harmless the property owner in the event of a claim. Property owners and municipalities need to evaluate the financial solvency of the entity signing the oil and gas lease or applying for the oil and gas permit. This is particularly important when larger corporations are using LLCs and subsidiaries to enter into these legal contracts. Additionally, to ensure adequate protection, in the event of an environmental incident, any indemnification should be as broad as allowable under applicable law. Additionally, the lease should include an additional insured provision. The additional insured provision should specify the scope of the coverage for the additional insured.

Insurance companies have dedicated resources to field effective risk engineering expertise in their efforts to stay abreast of the developments related to fracking and horizontal drilling. Robert Weireter, Vice President and Senior Underwriter at Swiss Re said “If you make a determined effort and bring together the right resources, you can understand the exposures and make good risk selection decisions.”

Fracking and the Future
In March 2014, Forbes estimated at least 15.3 million Americans lived within a mile of a well drilled since 2000. That is more people than live in Michigan or New York City. Forbes documented the locations and the drilling dates of more than 2.3 million wells in 11 states with http://info.drillinginfo.com/ a data provider for the oil industry, as well as the Ohio Department of natural Resources.

While the U.S., U.S. Energy Information Administration estimates there are approximately ten times more oil and gas resources in shales outside the U.S., the vast majority of wells drilled into shales and fracked have been in the U.S. and Canada. Forbes listed a number of reasons for this:

Fracking was developed in the United States
North America has a larger specialized service industry (rigs, pressure pumping units, etc.) than anywhere else in the world
More wells have been drilled and there is a much better geologic record in the U.S. than elsewhere. That makes it easier to find shales.

Moreover, the mineral rights are usually owned by landowners in the United States, creating an incentive for the landowner to sign a lease with an oil and gas company. Outside of North America, most of the mineral rights are owned by the federal governments. This caused tensions between local communities, who do not stand to benefit directly from extraction activities, and the oil and gas companies.

The largest shale, by oil and gas output, in the world is the Marcellus Shale. This formation stretches from western New York State, covers the western half of Pennsylvania and all of West Virginia. In April 2014, according to the Energy Information Administration, Marcellus produced 40,131 barrels of oil and 14.8 billion cubic feet of natural gas every day. This was the equivalent of 2.5 million barrels of oil a day.

The price of crude oil depends on global supply and demand factors. But US natural gas prices have fallen significantly since the mid-2000s (though they rebounded during the cold 2013 winter, as heating demand surged). That’s saved consumers money. It also means that power plants are more likely to use natural gas for electricity. Many electric utilities have taken advantage of cheap prices to switch from coal to natural gas as their preferred power source. This trend is hurting the coal industry and is one reason why one-fourth of the nation’s coal power plants have closed since 2011.

America’s glut of cheap natural gas has been luring some manufacturers to the United States. The United States is also importing far less oil and natural gas than it used to, one reason why the trade deficit has dropped to its lowest level since 1998.

In 2014, U.S. crude oil and lease condensate proved reserves increased to 39.9 billion barrels – an increase of 3.4 billion barrels (9.3%) from 2013. U.S. proved reserves of crude oil and lease condensate have risen for six consecutive years, and exceeded 39 billion barrels for the first time since 1972. Proved reserves of U.S. total natural gas increased 34.8 trillion cubic feet (Tcf) to 388.8 Tcf in 2014. This increase (9.8%) boosts the national total of proved natural gas reserves to a record-high level for the second consecutive year.

Proved reserves are estimated volumes of hydrocarbon resources that analysis of geologic and engineering data demonstrates with reasonable certainty are recoverable under existing economic and operating conditions. Reserves estimates change from year to year as new discoveries are made, as existing fields are more thoroughly appraised, as existing reserves are produced, and as prices and technologies change.

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Source: BLS, Quarterly Census of Employment and Wages, 2012

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Reference Sources

The U.S. Energy Information Administration (EIA) [http://www.eia.gov/] is a principal agency of the U.S. Federal Statistical System responsible for collecting, analyzing, and disseminating energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment. EIA programs cover data on coal, petroleum, natural gas, electric, renewable and nuclear energy. EIA is part of the U.S. Department of Energy.

The American Petroleum Institute (API) [http://www.api.org/] is the largest U.S trade association for the oil and natural gas industry. It represents about 400 corporations involved in production, refinement, distribution, and many other aspects of the petroleum industry. The association's chief functions on behalf of the industry include advocacy and negotiation with governmental, legal, and regulatory agencies; research into economic, toxicological, and environmental effects; establishment and certification of industry standards; API both funds and conducts research related to many aspects of the petroleum industry.

America's Natural Gas Alliance (ANGA) [http://www.anga.us/] Representing North America's leading independent natural gas exploration and production companies, America's Natural Gas Alliance (ANGA) works with industry, government and customer stakeholders to promote increased demand for and continued availability of our nation's abundant natural gas resource for a cleaner and more secure energy future.

The Environmental Protection Agency (EPA) [https://www3.epa.gov/] The United States Environmental Protection Agency is an agency of the U.S. federal government which was created for the purpose of protecting human health and the environment by writing and enforcing regulations based on laws passed by Congress. The EPA was proposed by President Richard Nixon and began operation on December 2, 1970.

Frac Focus – Chemical Disclosure Registry [http://fraccfocus.org/] Frac Focus is managed by the Ground Water Protection Council and Interstate Oil and Gas Compact Commission, two organizations whose missions both revolve around conservation and environmental protection. The site was created to provide the public access to reported chemicals used for hydraulic fracturing within their area. To help users put this information into perspective, the site also provides objective information on hydraulic fracturing, the chemicals used, and the purposes they serve and the means by which groundwater is protected.

American Exploration and Production Council (AXPC) [http://www.axpc.us/#] The American Exploration & Production Council - AXPC, is a national trade association that represents 31 of the largest US independent natural gas and crude oil exploration and production companies - Leaders in finding and developing secure energy supplies throughout North America. Members are "independent" in the sense that that they do not have petroleum refining or retail marketing operations and therefore are not "fully-integrated".

Willis Towers Watson Natural Resources Team Based in the Energy Corridor, the Houston office is the WTW focal point for the energy industry in North America. Staffed with 50+ energy specialists, the team understands and fulfills the needs of companies operating in all sectors of the energy arena. Each member of the executive team has well over 30 years’ experience in the energy sector. The support and client advocate team members average more than 20 years’ experience. Maintaining their focus of client service, their account retention rate averages 98%. The client base for the team includes start-ups and new entrants to the energy space, established independents and global integrated majors. The services provided by the team include the following:

- The Energy Practice legal team provides contract review and advice
- Providing relevant, current insurance market expertise
- Proven success in terms, price, and claims collection
- Provides energy-specific claims advocates
- Strategic insurance program design
- Risk-loss control services

Footnotes

About Willis Towers Watson

Willis Towers Watson (NASDAQ: WLTW ) is a leading global advisory, broking and solutions company that helps clients around the world turn risk into a path for growth. With roots dating to 1828, Willis Towers Watson has 39,000 employees in more than 120 countries. We design and deliver solutions that manage risk, optimize benefits, cultivate talent, and expand the power of capital to protect and strengthen institutions and individuals. Our unique perspective allows us to see the critical intersections between talent, assets and ideas — the dynamic formula that drives business performance. Together, we unlock potential. Learn more at willistowerswatson.com.