[Explorer]

Commentary

Truth and Lies About Hydraulic Fracturing

By Terry Engelder

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During my recent 11-country AAPG Distinguished Lecture tour in Europe I had many requests for "The Environmental Realities of Hydraulic Fracturing: Fact versus Fiction," an analysis of the root causes of the global pushback against hydraulic fracturing, commonly known as "fracking." This came as no surprise considering the sensitivity to the prospect of shale gas exploration and extraction in much of Europe. My objective was to address the public fears that drove moratoria and bans on hydraulic fracturing in places as different as New York State, the United Kingdom and France.

Central causes of public fear arose in America because of a combination of early mistakes by industry and purposeful disinformation from activists and others seeking to profit from such mistakes.

Disinformation was easily spread beyond America to places with nothing more than a modest gas industry experience. Countries with less generous property rights laws than America were particularly vulnerable to disinformation.

"Environmental Realities: Fact versus Fiction" boils down to a clash between the recalcitrant notion that the worst will happen when the gas industry shows up, and an American optimism that gas can be produced at maximum benefit and minimum risk.

Several Europeans stated that hydraulic fracturing was not welcome until it was safe. While everyone wants a safe industry, safety is never absolute.

According to the Pennsylvania Department of Environmental Protection (PA-DEP), the water chemistry in only 30 private water wells spread among more than 7,000 Marcellus gas wells drilled in Pennsylvania over the past seven years was affected by industry and all were cases of methane migration.

While a rate of less than five water wells per year is too high, this occured in a state where more than 1,000 people are killed annually in automobile accidents. Although methane is dangerous when allowed to accumulate as indicated by one fatal drill-rig explosion during the past seven years, it is not toxic.

Despite a fatality rate at least 7,000 times larger over seven years, a poll among Pennsylvanians might identify driving as the safer activity!

My research on natural hydraulic fracturing in gas shale dates back to the 1970s, when both the horizontal drilling of shale source rocks and the use of high-volume hydraulic fracturing were first attempted in the United States.

Although both techniques date back 35 years, none of this early work on fracturing made much of an impression on the public.

If this long history of horizontal drilling and high volume hydraulic fracturing were recognized, it would have been hard to make the case that either is a new or dangerous practice.

Risks and Rewards

The process by which hydraulic fracturing entered the general consciousness may have started about 2007 with my calculation of the technically recoverable reserves in the Marcellus gas shale of the Appalachian Basin.

In late 2007 I went to the news media with my results, receiving a great deal of public attention. At that time the term “fracing” or “fracking,” was not part of the English language; within two years it had become shorthand for gas extraction by horizontal drilling and high-volume hydraulic fracturing, and most people now know what “fracking” is.

In Europe, I was frequently asked, “How can you be so certain (about hydraulic fracturing)?”

As Voltaire said: “Doubt is not a pleasant condition, but certainty is absurd.” Science is not capable of certainty beyond having a sense of when others are mistaken.

However, it is not a mistake to point out that shale gas comes with risk along with reward.

As the automobile fatalities example shows, people don’t do a very good job of normalizing risk. When asked for absolute numbers on risk, all I can do is point to the millions of hydraulic

fracture treatments and stimulations undertaken already, resulting in a modest number of examples of groundwater contamination from subsurface sources, virtually all from methane leaking along the cement-bedrock contact inside a borehole. Risks outside methane leakage come from poor surface management of fluids in the form of spills and leaks.

Air quality is at risk, and, ultimately, burning methane leaves a carbon footprint. These are concerns. The leaks need be found and fixed – but replacing coal-fired power plants with natural gas led to a significant reduction in America's carbon footprint over the past five years, according to the EIA.

This good news does not mean that mankind should discontinue its march toward a larger renewable energy portfolio. Even then, gas-fired turbines are the most immediate solution to maintaining reliable electricity generation when either solar and wind fail to meet demand.

A Number of Mistakes

Industry was responsible for six major "mistakes" during the early days of high-volume hydraulic fracturing in the Appalachian Basin.

I use the term "mistake" because each might have been anticipated – but only by someone with great clairvoyance. None were a manifestation of single events like the engineering carelessness of the Macondo well blowout.

They did, however, create a breeding ground for amplifying public fear of the unknown.

♦ Arguably, the most serious mistake was the failure to establish baseline water chemistry before drilling campaigns.

Many chemical elements (e.g. iron, magnesium, potassium) and compounds (e.g. methane) are dissolved in drinking water, but when water chemistry is measured after the arrival of industry, there is a belief that these chemicals, particularly methane, result from drilling.

Traditionally, the first oil wells in a region were drilled where oil is leaking to the surface. Likewise, gas leaks are associated with the great gas basins in the world, including the Appalachian Basin where there are several towns named Burning Springs. Methane was there all along but industry failed to present these details to the public prior to drilling.

Through the history of the O&G industry in the United States, regions that leaked gas exclusively were not nearly as interesting as those that leaked both oil and gas.

Pennsylvania, for example, had a long history of flaming faucets and bubbling streambeds, although the gas was not usually concentrated sufficiently in groundwater to manifest itself in drinking water. Intensified drilling in 2008 produced a heightened sensitivity to methane in groundwater, but with no baseline, it was impossible to know whether, and how much, methane resulted from this drilling.

Pennsylvania law held operators responsible for the methane in groundwater within 1,000 feet of a gas well, regardless of whether it was their fault.

♦ The second industry mistake involved the extent to which casing was cemented.

Early on, surface and intermediate casing was completely cemented but as much as 5,500 feet of open hole was left outside the production casing, as traditionally done in sparsely populated parts of the country with few water wells near gas ones.

This is fine if the overburden section is not gas-charged – but in northeastern Pennsylvania the overburden contains Upper Devonian coals, full of methane gas, which flowed into the open holes and in some cases likely increased groundwater concentration by leaking along poorly cemented gas wells.

Industry no longer leaves open-hole production casing, at least below the intermediate casing string.

♦ The use of air-drilling to penetrate the vertical legs of Marcellus gas wells was another error.

The pressure of air blowing into more permeable aquifers was sufficient to drive methane toward nearby water wells. It also increased the natural turbidity in groundwater, which often worries people.

♦ A fourth mistake was to lobby for elements in the Energy Policy Act of 2005, which allowed hydraulic fracturing companies to keep their additives proprietary.

The public feared that groundwater would become contaminated by unknown, possibly toxic, chemicals, and wanted to understand exactly what and how much was being pumped into the ground.

There also was the (inaccurate) perception that this act exempted the industry from Clean Water and Clean Air Acts. The industry elected to reveal the details of additives on a website, "Frac Focus," and, while posting volume and chemical composition was voluntary, most operators in the Appalachian Basin have joined in an attempt to become more transparent.

♦ The industry disposed of flowback in large enough volumes to trigger minor earthquakes in Ohio and Texas, which naturally played into the public fear.

Water under pressure flowing along faults reduces the frictional strength sufficiently to cause slip; triggering a large earthquake by injecting water was even the plot of a James Bond movie.

USGS studies confirmed there is a relationship between the injected volume of water and earthquake size, but showed that it was not possible to trigger a destructive earthquake with the amount of water used during fracturing – incidentally proving the implausibility of the James Bond plot.

♦ The sixth mistake involved water management issues associated with potentially leaking open pits, leading to the fear that groundwater could be contaminated if a lined pit was punctured or seals failed.

Presently, only fresh water is stored in open pits. Any flowback is contained in enclosed "frack" tanks where the chance of leaking is near zero.

Purposeful Disinformation?

Public anxiety arising from these very real mistakes was easily manipulated and magnified by activists who either did not know better or sought to profit by playing to this fear.

The most egregious case of purposeful disinformation being used to manipulate the public is found in the closing scene of the movie "Gasland," where a tap is lit.

In fact, the owner's water well was drilled though a coal bed giving off methane, and the film's producer admitted knowing that the methane in this movie scene had nothing to do with hydraulic fracturing.

Public fear also can be manipulated by famous people.

Movie star Matt Damon was quoted as saying that "Everyone knows that fracking poisons the water and air," adding that fracking " … tears apart local communities and subverts democracies."

Yoko Ono was quoted in the media as stating categorically that, "Fracking kills." Subsequently, signs declaring that "fracking kills" have shown up regularly at protest rallies in many places worldwide.

The most common prop at protest rallies has been the jug of rusty, brown water – easily transported and, unlike the flaming faucet, looking nasty enough to amplify fear that hydraulic fracturing is poisoning water.

Rusty, brown water is a natural product of the oxidation of dissolved iron. Tests suggest that nearly half the water wells in parts of Pennsylvania have enough dissolved iron in the groundwater to make it turbid when exposed to atmospheric oxygen, a process accelerated by pumping wells dry.

In fact, the U.S. EPA tested one water well repeatedly and found the water safe to drink. Later, the owners admitted pumping their water well dry to supply turbid water when visitors came knocking.

In summary, public pressure was largely responsible for political decisions to place moratoria or bans on hydraulic fracturing.

In a sense, industry was directly responsible for these political decisions because of early mistakes, making it easy for activists using purposeful disinformation to further cement a negative public position relative to “fracking.”

- See more at: http://www.aapg.org/publications/news/explorer/details/articleid/12416/truth-and-lies-about-hydraulic-fracturing#sthash.iClB86H1.dpuf