Frac Vs. Fiction

For more than 60 years, America's oil and gas producers have relied on a technology known as hydraulic fracturing to access hard-to-reach, otherwise inaccessible resources thousands of feet below the surface. In Texas, Oklahoma and throughout the Southwest, the technique has been widely used almost since its inception -- and, as a result, is widely known to be a safe and efficient method for extracting clean-burning natural gas.

But as communities outside these regions (most notably in the mid-Atlantic) wake up to the job- and revenue-creating potential that energy reserves such as the Marcellus Shale region have made possible, the debate over hydraulic fracturing in many ways finds itself today at square one – with opponents of the technology attempting to re-write its narrative to make the public believe that hydraulic fracturing poses a serious threat to human health.

To be successful in that charge, opponents first need to establish a credible (and growing) track record of danger. Unfortunately for them, in hydraulic fracturing they're running up against a technology that in 60 years of service has yet to be credibly tied to the contamination of drinking water.

Irrespective of the facts, efforts to tag hydraulic fracturing as the clear-cut cause for everything from exploding houses to hard water buildup continue in earnest today – and have in fact ratcheted up significantly over the past six months.

Some of the most notorious (and common) accusations include:

- **McMillian Well (Adger, Ala.)**: The contamination of a drinking water well used by Ruben and Cynthia McMillian was blamed on hydraulic fracturing.
- **Amos Well (Silt, Colo.)**: It has been alleged the hydraulic fracturing of a nearby gas well contaminated the drinking water of the Amos family, and led to various health problems experienced by Laura Amos.
- **Bainbridge House (Bainbridge, Ohio)**: Allegations have been made that hydraulic fracturing of a gas well caused a house to outright explode in Ohio.
- **Sublette County (Wyo.)**: A news account published by ProPublica last year suggested that hydraulic fracturing caused the contamination of numerous wells in the Pinedale Anticlive.
- **Durango Nurse (Colo.)**: Media reports have identified exposure to fracturing fluids as the cause for an emergency room nurse in Durango, Colo. to become seriously ill. It's also been asserted that the company in charge of producing the fluids refused to disclose critical information about the fluid's composition to the woman's physician.
- **Dimock Twp. (Pa.)** – In March 2009, Reuters reported that "leaks of toxic chemicals into groundwater" used in the fracturing of local natural gas wells were being blamed for "diarrhea and vomiting," loss of hair in animals, and poor-tasting drinking water.

Attached are fact sheets addressing each of these allegations in greater detail.

McMillian Well (1989: Adger, Ala.)

Summary of Allegations

Starting in 1989, Ruben and Cynthia McMillian began to assert that hydraulic fracturing operations at a gas well near their home had contaminated their family's drinking water well in Alabama. These allegations subsequently formed the basis for a federal lawsuit brought forth by the Legal Environmental Assistance Foundation (LEAF), challenging the decision by the U.S. Environmental Protection Agency (EPA) not to regulate hydraulic fracturing under federal statute.

After extensive study and examination by EPA and two separate state agencies in Alabama, investigators concluded that the issues involved in the McMillian well case were not related to hydraulic fracturing.

Background of Events

- Beginning in 1989, Ruben and Cynthia McMillian of Adger, Ala. alleged their drinking water well had become contaminated by hydraulic fracturing operations being used at various coalbed methane wells in the vicinity of their home. These concerns were conveyed by the McMillians again in July and August of 1990.
- The McMillian well is 200 feet deep, with the nearest coalbed methane well located approximately a quarter-mile away. Records show that coalbed methane wells located in the vicinity of the McMillian well underwent hydraulic fracturing operations at depths between 1,335 and 1,752 feet – more than 1,100 feet below the McMillian drinking water well.
- Extensive water sampling and analysis demonstrated that the McMillian well was not affected by these hydraulic fracturing operations. Some of that research included:
    - In 1989, the Alabama Department of Environmental Management and the Alabama Oil and Gas Board conducted four separate water quality tests on the McMillian well. The results indicated no water quality problems associated with the McMillian well.
    - In 1990, EPA conducted a water quality sampling of the McMillian well, finding that no problems with water quality could be found.
    - The Alabama Department of Environmental Management subsequently conducted water sampling of the McMillian well on five separate occasions between 1991 and 1993. With the exception of a single result indicating the likelihood of above-average iron content (completely unrelated to hydraulic fracturing), all results indicated the water met applicable drinking water
    - quality standards.

- In a 1989 letter to Mr. McMillian, the Alabama Department of Environmental Management stated that "no problems exist with your well water for the parameters sampled," adding there was no evidence that "that your well was adversely affected by the coalbed methane operation."

- From EPA's point of view, evidence at the scene suggested that hydraulic fracturing operations could not have affected the McMillian well -- even without water quality testing. As one EPA scientist noted: "The available information suggests that the propagation of fractures, and movement of fluids from the hydraulic fracture zone, should not have been extended to the location of the McMillian well from any of the hydraulic fracturing operations alleged to have caused the McMillian well water quality problems."

- In a legal brief submitted to the U.S. Court of Appeals for the Eleventh Circuit in 1995, EPA definitively stated that "[a]fter extensive testing, the McMillian water well has suffered no harm as a result of hydraulic fracturing activities."

- Finally, in a letter sent in 1995, Carol M. Browner -- then administrator of EPA -- wrote: "There is no evidence that the hydraulic fracturing at issue has resulted in any contamination or endangerment of underground sources of drinking water (USDWs). … Moreover, given the horizontal and vertical distance between the drinking water well and the closest methane gas production wells, the possibility of contamination or endangerment of USDWs in the area is extremely remote."

Conclusion

Allegations made by the McMillian family regarding the possible contamination of their drinking water well have been thoroughly investigated, studied and refuted by state, local and federal officials. After numerous samplings, no evidence whatsoever has surfaced in support of the view that the McMillian well was contaminated as a result of hydraulic fracturing. In truth, there remains very little evidence that the well was ever contaminated at all.

Amos Well (2001: Garfield Co., Colo.)

Summary of Allegations

Laura Amos, a resident of Garfield Country, Colo., alleged in 2001 that her water well was contaminated by fluids used to fracture several natural gas wells located near her house. Ms. Amos specifically claimed these frac fluids contained the chemical 2-butoxyethanol (2-BE), and that she had been exposed to them. Ms. Amos further alleged that her exposure to 2-BE caused her to develop Conn syndrome, which manifests itself as a benign tumor in one of the body's adrenal glands.

After years of thorough investigation led by the Colorado Oil and Gas Conservation Commission (COGCC), Ms. Amos's allegations were categorically rejected by the state agency – reaching the conclusion that frac fluids never reached Ms. Amos's well.

Background of Events

- In 2001, and then again in 2004, Ms. Amos complained to COGCC about a variety of problems associated with her drinking water well, including reduced volume and the presence of methane in the water. According to Ms. Amos, these problems were caused by hydraulic fracturing operations conducted on gas wells approximately 1,000 feet from her home. Reports indicate that fracing operations took place at depths over 2,000 feet; the Amos well is 225 feet deep.

- Ms. Amos later postulated the hydraulic fracturing activities had created a "hydrogeological connection" between her water well and the natural gas wells. The connection, according to Ms. Amos, allowed frac fluids to contaminate her well, while exposing her to harmful chemicals such as 2-BE.

- As is its charge, COGCC undertook a thorough investigation of Ms. Amos's complaints. On at least eight occasions between 2001 and 2005, COGCC staff tested the Amos well for contaminants associated with frac fluids, as well as for benzene, toluene, ethylbenzene, and xylenes (BTEX). Because the fluid used in the hydraulic fracturing operations at the nearby wells contained potassium chloride, the COGCC specifically tested water samples for potassium and chlorides. Neither BTEX compounds nor frac fluid constituents were ever detected in any of these samples. In addition, the COGCC staff specifically tested for 2-BE, but did not find any indication of its existence in the samples taken.

- Casting further doubt on the story, microseismic mapping conducted at the time showed the fractures created as a result of fracing activities were not oriented in the direction of the Amos well, rendering the flowing of those fluids toward the well a virtual impossibility.

Bainbridge House (2007: Bainbridge, Ohio)

Summary of Allegations

In December 2007, a house in Bainbridge, Ohio "exploded in a fiery ball," according to press reports – the result of hydraulic fracturing operations underway in the area. Of course, neither the house nor any of its furnishings suffered any fire or smoke damage. Nor was the elderly couple inside the house at the time injured in any way by the explosion.

Despite claims the explosion was caused by hydraulic fracturing operations, the Ohio Division of Mineral Resources (DMRM) determined the incident's the most critical contributing factor was the operator's failure to properly vent the gas well. DMRM also concluded that hydraulic fracturing fluid never entered local water supplies.

Background of Events

- On December 15, 2007, an explosion occurred in the basement of a home in Bainbridge, Ohio. An elderly couple that was asleep in the house at the time was awakened but unharmed by the incident. The house, which experienced minor damage to its foundation, remained standing after the incident. In fact, neither the house nor its furnishings suffered any kind of fire or smoke damage.

- DMRM conducted an extensive, year-long investigation of the incident – at the end, publishing an 150-page report summarizing its findings and describing what caused the incident. DMRM concluded the explosion was not caused by hydraulic fracturing.

- According to the DMRM report, three different factors contributed to the incident:
    - The first contributing factor was the inadequate cementing of the production casing in a nearby gas well. The improper cement job allowed pressurized gas to enter the space between the wellbore and the production casing (the "annalus") and travel up that space toward the ground surface.
    - The second contributing factor was the operator's decision to proceed with hydraulic fracturing of the well even though the operator knew the cementing of the production casing did not meet accepted industry standards.
    - The final and "most critical contributing factor leading to the incident," according to DMRM, was a decision by the operator to close valves at the surface of the well for 31 days while the well was "shut in." This caused gas pressure to build up in the annular space between

(continued on next page)

the surface and production casing of the gas well. As a result, high pressure gas traveled up the space between the wellbore and the production casing and migrated laterally into the surrounding area.

- While the operator's decision to fracturing the well without the proper cement protocol was a mistake, DMRM found no problems with the way in which the hydraulic fracturing operation was conducted. In fact, DMRM pointed out in its report that the over-pressurization of the natural gas well did not occur until after the fracing operation had been completed, noting "the valves on the surface production casing annulus remained open before, during, and after the hydraulic fracturing operation in accordance with standard industry practice."

- Over the course of its investigation, DMRM collected and analyzed water samples from 79 drinking water wells in the area, determining that none of those wells "had been contaminated or polluted by…hydro-fracture fluids."

- DMRM also concluded that "it is highly unlikely that fluids used in the hydraulic fracturing process, or flow back fluids escaped from the borehole or entered into local aquifers."

- This was the first and only documented incident where natural gas infiltrated groundwater aquifers in Ohio since the state established a groundwater investigation program in 1984.

Conclusion

Allegations suggesting the Bainbridge incident was caused by hydraulic fracturing are simply not supported by either the facts on the ground or DMRM's report. Instead, this incident was the direct result of several poor decisions made by the operator: 1) the operator should have corrected the improper cement job; 2) the operator should not have undertaken hydraulic fracturing operations knowing that the cement job was inadequate; and finally, 3) the operator should not have left the well "shut in" for 31 days.

Even still, the DMRM investigation determined definitively that local drinking water sources had not been contaminated by hydraulic fracturing fluids.

Sublette Co., Wyo. (2000)

Summary of Allegations

Sublette County, Wyo. is home to significant natural gas exploration and development. Not coincidentally, assertions have been made that hydraulic fracturing operations conducted in the area are contaminating local sources of drinking water.

Since 2000, however, this area has been the site of an extensive groundwater monitoring program over seen by the Bureau of Land Management (BLM). Water quality sampling and analysis associated with this program has consistently indicated that neither benzene nor any other petroleum hydrocarbon exist in detectable quantities in a drinking water supplies.

While contaminants have been found in some industrial wells, and in a well that provides water for livestock, two important facts remain: 1) no evidence exists that suggests hydraulic fracturing is responsible for the presence of these contaminants; and 2) a federal investigation found no evidence that hydraulic fracturing was the source of the contamination.

Background of Events

- The Pinedale Anticline Project Area ("PAPA") is a natural gas field in west-central Wyoming (Sublette County) located near the city of Pinedale. The PAPA encompasses an area of 308 square miles and is about 12 miles wide and 26 miles long. The uppermost gas-bearing geologic formations of economic significance are located 8,000 feet below the ground surface.

- In July 2000, BLM issued a Record of Decision for the Pinedale Anticline Oil and Gas Exploration and Development Project based on environmental assessment work that BLM had prepared. In that Record of Decision, BLM required operators of natural gas wells in the area to implement an extensive ground water monitoring program. This program, which continues today, requires monitoring and analysis of all water wells within a one-mile radius of existing and proposed natural gas wells.

- The monitoring program covers over 200 wells, of all sizes and sorts. To date, water samples have been collected from 167 industrial wells, 50 domestic wells, and 22 stock wells located throughout the PAPA.

- Water extracted from industrial wells is used only for industrial purposes and is never consumed by either humans or animals. Water from the stock wells is used to supply water for livestock but is never used for human consumption. Water quality requirements for stock wells are typically less stringent than those set for domestic wells. There is no water quality standard for industrial wells -- because such water, even in its natural state, is not fit for human or animal consumption.

- According to testing conducted as recently as July 2008, domestic wells in the PAPA have always met or exceeded applicable water quality standards for both benzene and other hydrocarbons.

- For the first time ever, a stock well within the PAPA recently tested positive for toluene. However, the level of toluene detected was well below the approved limit for drinking water. Additional water samples taken from this well demonstrate the amount of toluene present has decreased to almost non-detectible levels (there was less than 1.0 microgram per liter of toluene detected in the most recent round sampling for which data are available).

- A single industrial well in the PAPA recently tested positive for levels of benzene in excess of drinking water standards. However, water from industrial wells is not meant for human consumption and neither state nor federal regulators have expressed any concern that this result is any way related to hydraulic fracturing.

- The presence of petroleum hydrocarbons has been detected at other industrial wells in the area as part of the monitoring program. However, these hydrocarbon levels are sufficiently low so as to not run afoul of groundwater quality standards.

- Federal and state regulatory agencies, as well as private parties, are working together to determine the cause(s) of this contamination. However, neither state nor federal regulators believe the contamination is related to hydraulic fracturing.

- Instead, their investigative efforts have been focused on the lack of backflow prevention devices between storage tanks and industrial water wells, the use of hydrocarbon-based pipe dope compounds in well construction, problematic water well drilling techniques, and natural sources of contamination.

Conclusion

Results from exhaustive groundwater testing activities demonstrate that drinking water wells in the PAPA region remain uncontaminated by petroleum hydrocarbons. While hydrocarbons have been detected in some of the area's industrial wells, there's no reason to believe this is related to hydraulic fracturing – a fact asserted continuously by BLM and other agencies involved in the investigation.

Durango Nurse (2008: Durango, Colo.)

Summary of Allegations

Cathy Behr, an emergency room nurse from Durango, Colo., suffered significant health problems after allegedly being exposed to frac fluids she claims were on the clothes of a field worker to whom she was rendering medical assistance.

The claim has been made that the service company involved in manufacturing the frac fluid refused to disclose the composition of that fluid to Ms. Behr's physician. However, there still is no evidence that Ms. Behr was ever exposed to frac fluids to begin with. Moreover, the service company involved never refused to provide information to Ms. Behr's physician; in fact, the physician never contacted the service company to seek that information.

Background of Events

- In April 2008, a well site on tribal lands 10 miles east of Durango, Colo. was fractured. According to published accounts, the valve on a tote containing frac fluids fell off during the operation, spilling fluid on an employee of the service company performing the operation.

- The service company employee has testified he was wearing protective clothing at the time of the spill, including a chemical suit, boots, gloves and a helmet with goggles. The employee further stated that he had removed all protective clothing prior to being transported to the emergency room at Mercy Regional Medical Center in Durango and that he did not have any frac fluid on him when he arrived at the hospital. The service company employee—who experienced only mild nausea—was treated and released from the emergency room without complaining of or suffering from any significant health problems.

- The service company involved in the frac job provided information to the medical professionals at the hospital to assist in the treatment of its employee. A supervisor who accompanied the worker to the emergency room provided the emergency room staff with a copy of the material safety data sheet (MSDS) associated with the frac fluid. MSDs are required by federal law to contain significant health and safety information and must also include the name of, and an emergency phone number for, the chemical's manufacturer.

- Ms. Behr, the emergency room nurse, attended to the service company employee and handled his boots and other personal effects. At the time she was attending to the gas field worker, Ms. Behr experienced only a slight headache and, at the end of her shift, returned home. Two days later Ms. Behr began to get sick and would ultimately spend 30 hours in an intensive care until before being diagnosed with and treated for chemical exposure. Ms. Behr has now recovered from her illness and has returned to her job at the hospital.

- Ms. Behr claims that she was exposed to frac fluid when handling the employee's boots and other personal effects, and that this exposure led to her illness.

- According to recent statements made by Ms. Behr to the Durango Herald, her doctor attempted to determine what constituent chemicals were contained in the frac fluid by conducting various internet searches. However, the doctor did not undertake a thorough search for information. Most notably, her doctor never attempted to contact the energy services company that manufactured the frac fluid for information on what was in it.

- Had Ms. Behr's physician contacted the energy service company, it would have been required by federal law for the company to disclose the "specific chemical identity" of the frac fluid, including all of the constituent chemicals that it contained.

Conclusion

That Ms. Behr was forced to endure a serious illness is not in dispute. However, serious questions remain about the source of her illness – including how she could have been exposed to frac fluids if the field worker she treated 1) had discarded his protective gear before arriving at the hospital, 2) did not get sick himself.

Regardless of the source of her illness, the service company involved did not refuse to provide information concerning the constituents of its frac fluids. In fact, Ms. Behr's doctor never tried to contact the service company to determine the makeup if the frac fluid to which Ms. Behr had allegedly been exposed.

Dimock Twp., Pa. (2009)

Summary of Allegations

In January 2009, the cap situated atop a natural gas well in Dimock Twp., Pa. "exploded with some force," according to local reports. The incident caused no injuries, but the resulting investigation by the Pennsylvania Department of Environmental Protection (DEP) found small traces of methane gas in the air and in three private wells in the area. According to DEP spokesman Mark Carmon, the level of methane present in the wells was not sufficiently high so as to be considered harmful.

On February 27, DEP served the operator in the area with a "Notice of Violation," claiming its production activities had caused some local private water wells to be contaminated with methane. Two weeks later, Reuters reported that "leaks of toxic chemicals into groundwater" used in the fracturing of local natural gas wells were being blamed for "diarrhea and vomiting," loss of hair in animals, and poor-tasting drinking water.

On March 28, DEP reversed its previous position after weeks of intensive study – reporting that dozens of water samples collected in Dimock Twp. showed no indication of being tainted from activities related to hydraulic fracturing.

Background of Events

- On Jan. 1, 2009, the cap of a natural gas well located in Dimock Twp., Pa. "exploded with some force," compromising a concrete slab that was positioned on top of a private water well
- The disturbance caused no injuries, but the resulting investigation by the Pennsylvania Department of Environmental Protection (DEP) found small traces of methane gas in the air and in three private wells in the area. According to DEP spokesman Mark Carmon, the level of methane present in the wells was not sufficiently high so as to be considered harmful.
- A full investigation of the incident and its possible impacts was commissioned almost immediately, with DEP conducting water quality tests on more than 20 separate residences. Mike Bedrin, DEP's northeast regional director, said in the release that three area residents had alerted the department about potential infiltration of natural gas into their drinking water
- Despite the fact that all test samples had not yet been returned for analysis, DEP served the operator in the area with a "notice of violation" on February 27, claiming its drilling activities in the vicinity of the home of Dimock resident Ronald Carter had caused local wells to be contaminated with methane.

- The Dimock Twp. story received national news attention thanks to a Reuters piece published on March 13, and picked up from the wire by several other news outlets. In that item, the reporter (John Hurdle) explicitly ties the alleged contamination of area water wells to hydraulic fracturing – and specifically the "highly toxic…brew" of "proprietary" chemicals blamed for "diarrhea and vomiting," loss of hair in animals, and poor-tasting drinking water.

- One month after the DEP had issued its notice of violation to the local operator, the agency reversed its position – as completed tests analyzing the water's content of dissolved solids, chlorides, pH, alkalinity, hardness, sodium, calcium, barium, iron, manganese, potassium and aluminum showed no indication of water contamination due to hydraulic fracturing.

- Despite the reversal, the energy operator in question continues to provide drinking water for homes in the area that have experienced elevated levels of methane.

Conclusion

Despite the best efforts of Reuters reporter John Hurdle to conflate one issue (infiltration of natural gas into water) with another (chemical contamination of drinking water via hydraulic fracturing), DEP failed to find a single molecule of frac-related fluid in any of the dozens of wells it tested.

In the final analysis, it remains entirely possible the DEP will eventually conclude the operator in question had something to do with the methane infiltration in Dimock Twp. DEP has not issued a conclusive ruling on that point. What is known at this stage is that no contamination that occurred – either real or alleged – was the result of hydraulic fracturing, a finding on which DEP has in fact ruled conclusively.