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Fracking linked to groundwater contamination in Pavillion, Wyoming

Contaminants that likely came from fracking were found in an aquifer that supplies drinking water.

Elizabeth Shogren | DC DISPATCH | March 30, 2016

An investigation by Stanford scientists into a long-simmering controversy finds that hydraulic fracturing did pollute an underground source of drinking water used by people who live near Pavillion, Wyoming, according to a [paper](http://pubs.acs.org/doi/abs/10.1021%2Facs.est.5b04970) (<http://pubs.acs.org/doi/abs/10.1021%2Facs.est.5b04970>) published this week in the journal *Environmental Science and Technology*.



An EPA monitoring well near Pavillion, Wyoming.

Environmental Protection Agency

The companies that drilled wells over the decades did nothing illegal to cause this problem, which suggests similar undetected contamination may be widespread, according to the scientists.

The scientists base their conclusions on a comprehensive analysis of reams of data available because the tiny rural community has been the scene of one of the highest profile test cases of whether the modern drilling techniques endanger drinking water supplies. In hydraulic fracturing, companies inject large quantities of water, sand and chemicals underground at high pressure to blast open rock or tight sands to get oil or gas flowing.

In several places across the country, people who live near drilling have complained that their well water was newly contaminated with foul odors, rainbow swirls or gases that would easily ignite. But establishing connections between the drilling and the pollution has not been easy. Companies have said the contaminants were naturally occurring or came from other sources.

The Stanford scientists say they are the first to prove the link anywhere in the country. They point to evidence from water samples taken from Environmental Protection Agency monitoring wells near Pavillion. Organic chemicals used in fracking fluids and not otherwise found in the environment such as methanol, ethanol and isopropanol were detected. “It is the match between chemicals used recently (in hydraulic fracturing and acid stimulation) and what’s in the aquifer that is compelling,” says Rob Jackson (<https://earth.stanford.edu/rob-jackson>), a Stanford professor of environmental science.



***Sampling water from an EPA monitoring well in
Pavillion, Wyoming.***

Environmental Protection Agency

The new research shows that gas wells were not adequately cemented to prevent contaminants from flowing into the aquifer. It also shows that in some cases, hydraulic fracturing and acid stimulation of gas wells took place at depths similar to private drinking water wells, which is not illegal and is more likely to happen in the West because the formations that hold the gas are closer to the surface. The scientists also document that there is no barrier underground such as a

layer of impermeable rock to prevent the gas from moving through the aquifer. In other regions of the country, fracking takes place thousands of feet below drinking water wells and impermeable layers of rock block chemicals from moving upwards over time.

The authors' conclusions conflict with a 2015 draft report (<http://deq.wyoming.gov/wqd/pavillion-investigation/resources/investigation-draft-report/>) from the Wyoming Department of Environmental Quality which found that hydraulic fracturing fluids had a “negligible likelihood” of reaching shallower zones used for drinking water.

The Canadian company that produces gas near Pavillion, Encana, criticized the Stanford study. “I would call this speculation or theory,” said Doug Hock, a spokesman for Encana. “After numerous rounds of testing by both the state of Wyoming and EPA, there is no evidence that the water quality in domestic wells in the Pavillion field has changed as a result of oil and gas operations.”

But the new Stanford study isn't the first to suggest hydraulic fracturing may have sullied groundwater near Pavillion. A 2011 draft report (https://www.epa.gov/sites/production/files/documents/EPA_ReportOnPavillion_Dec-8-2011.pdf) by the EPA was the first to begin to draw the link between hydraulic fracturing and the contaminants in the underground drinking water. As *ProPublica* and *High Country News* reported (<https://www.hcn.org/blogs/articles/feds-link-water-contamination-to-fracking-for-the-first-time>), the agency found suspicious quantities of hydrocarbons and trace contaminants in residents' wells that could be tied to gas development. Then the EPA drilled two 1,000-foot-deep monitoring wells and found high levels of benzene and other carcinogens in the deep groundwater underlying Pavillion. But after much criticism that it had flubbed its research, the agency dropped its study in 2013, and shifted responsibility for further investigation to Wyoming.

Not long after, Dominic DiGiulio, the main researcher of that draft EPA study, retired from the agency and became a visiting scholar at Stanford so he could complete that work. He's the lead author of the new paper.

“We looked at everything we could get our hands on,” DiGiulio said in an interview with *HCN*, including getting data on methanol levels from the EPA through a Freedom of Information Act request. This data helped the scientists show that contaminants from fracking are moving upwards in the aquifer towards where people are getting drinking water.

DiGiulio says he was compelled to complete this “unfinished business” because he believes the problems revealed in Pavillion may be widespread, particularly in the West, where companies conduct hydraulic fracturing in relatively shallow formations to extract coal bed methane and gas locked in tight sands.

“Especially in the Western United States, where it’s really dry, there needs to be a better balance” between energy development and the protection of water resources, DiGiulio adds.

Under the 2005 Energy Policy Act, hydraulic fracturing was exempted from the Safe Drinking Water Act. The industry is the only one allowed to inject toxic chemicals into underground formations that may be used for public drinking water. Companies have long contended that they don’t contaminate drinking water.

He and Jackson say states or federal government should set limits for how shallow companies can use hydraulic fracturing. No such limits exist. DiGiulio also hopes that the paper will rebut some of the criticisms of his 2011 draft study.

“EPA never responded to any criticisms. It allowed misconceptions to continue. Hopefully this paper will clarify some of that,” DiGiulio says.

The authors anticipated criticism, given how much controversy has swirled around Pavillion. As one indication of just how contentious this study is, the journal had it reviewed by seven independent experts, rather than the normal two or three, according to Jackson.

The Stanford scientists concede that their research does not prove that the contamination from fracking goes all the way to domestic wells. What they did prove was that it got into an aquifer that supplies wells and the contaminants are moving upwards, possibly towards wells.

A [draft report](http://deq.wyoming.gov/wqd/pavillion-investigation/resources/investigation-draft-report/) published in December by the Wyoming Department of Environmental Quality concluded the well water is generally suitable for domestic use, although the levels of some compounds exceeded the EPA’s health-based standards.

However, the EPA [criticized](https://www.epa.gov/region8/pavillion#1) many aspects of Wyoming’s report in an 18-page comment. For example, the EPA found the Wyoming report failed to reflect uncertainties about health risks or to specify when contaminants such as arsenic and uranium were found at much higher levels than would naturally be expected. Some of the

uncertainty about health risks stems from the fact that there are no safe drinking water standards for about half of the organic chemicals detected in the drinking water wells, according to the EPA.

The EPA did not have an immediate comment on the Stanford paper but said it would review the findings as part of its final nationwide assessment of the risks of modern drilling techniques for drinking water. The agency's [draft \(https://www.hcn.org/articles/epa-study-finds-fracking-can-contaminate-drinking-water\)](https://www.hcn.org/articles/epa-study-finds-fracking-can-contaminate-drinking-water) assessment showed pathways for contamination but found no evidence of widespread pollution of drinking water.

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