

I'm Tom Ruhl & live in Rio Rancho-

There's a review by EPA's Science Advisory Board – or SAB - dated August 11, 2016 that **disputes** its original findings by fracking activities on drinking water resources.

SAB investigated fracking problems in such towns as Dimrock, PA. & Pavillion, WY.

Dimrock's fracking judgement award of over \$4 million for polluting **only** two family's water wells shows how **underfunded** the County's \$10 million liability bond & \$10 million pollution bond could be if **such** a fracking problem impacts a town the size of Rio Rancho.

In Pavillion, Stanford scientific research showed that the gas wells were not adequately cemented to **prevent** contaminants from flowing **into** the aquifer and that the fracking contaminants **were actually moving upwards** towards the aquifer & water wells.

Stanford stated this is **more likely** to happen in the West because the formations that hold the gas are **closer** to the surface & there is no **impermeable** rock or underground barrier to **prevent** such upward movement of the chemicals into the aquifer.

Stanford said that **limits** should be set for how **shallow** oil companies can use fracturing & only two states- Colorado & Texas have requirements for **shallow** hydraulic fracturing.

SAB stated that the EPA should include **additional** major findings on fracking such as: well construction, injection problems & the effects of fracturing **chemical mixing techniques** on drinking water supplies.

There is also a need to consider drinking water resources **greater** than 1 mile from the fracturing operation. This **includes** the vertical distance

between the fracking production zone and the current or future drinking water source.

So the proposed fracking well setbacks of 1000 ft. from the ground water recharge area, or the 750 ft. setbacks for homes is **woefully** inadequate.

The County must **standardize** all setbacks at least 1 mile from the fracking wells & even **further** for all **municipalities** based on population.

Sandoval County Manager Phil Rios recently said in the Journal that "We don't want to depend on oil & gas". As previous oil & gas earnings were \$1.3 million and dropped to \$300,000, a major loss to the County budget.

While in the same article, The County's Chief Assessment Officer Ed Olona estimated that 85% of the properties are residential and that "The housing market is starting to come back".

I submit that our future is tied to people and water, **not** oil & gas.

The County needs to not only work with Rio Rancho but also the NM OCD and declare a moratorium on all drilling until they can **guarantee all of us** a safe water supply.

Rhl



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

August 11, 2016

EPA-SAB-16-005

The Honorable Gina McCarthy
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, D.C. 20460

Subject: SAB Review of the EPA's draft Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources

Dear Administrator McCarthy:

The EPA Science Advisory Board (SAB) is pleased to transmit its response to a request from the U.S. Environmental Protection Agency (EPA) Office of Research and Development (ORD) to review and provide advice on scientific charge questions associated with the EPA's draft *Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft, EPA/600/R-15/047, June 2015)*. The draft Assessment Report synthesizes available scientific literature and data on the potential impacts of hydraulic fracturing for oil and gas development on drinking water resources, and identifies possible operational events during the life cycle of hydraulic fracturing for oil and gas operations that could result in impacts to drinking water.

The SAB was asked to comment on the EPA's statements on the goals, background and history of its Assessment; on the EPA's analyses regarding the water acquisition, chemical mixing, well injection, flowback and produced water, and wastewater treatment and waste disposal steps of the hydraulic fracturing water cycle (HFWC); on the EPA's analysis of chemicals used or present in hydraulic fracturing fluids; and on the EPA's synthesis of science on potential impacts of hydraulic fracturing on drinking water resources as presented in the Assessment's Chapter 10 and Executive Summary. The specific charge questions to the SAB Hydraulic Fracturing Research Advisory Panel (SAB Panel) from the EPA are provided as Appendix A to the SAB report.

The EPA developed the draft Assessment Report in response to a request in 2009 from the U.S. Congress, which urged the EPA to examine the relationship between hydraulic fracturing and drinking water resources. The EPA consulted with stakeholders, and developed a Research Scoping document followed by a detailed research Study Plan, both of which were reviewed by the SAB, in 2010 and in 2011, respectively. An EPA Progress Report on the study detailing the research approaches, activities, and remaining work was released in late 2012. A consultation on the Progress Report was conducted in May 2013 with members of the SAB Panel. The EPA's draft Assessment Report was released in June

2015 for public comment and review by the SAB Panel operating under the auspices of the chartered SAB.

In general, the SAB finds the EPA's overall approach to assess the potential impacts of HFWC processes for oil and gas production on drinking water resources, focusing on the individual stages in the HFWC, to be comprehensive but lacking in several critical areas. The SAB also finds that the agency provided a generally comprehensive overview of the available literature that describes the factors affecting the relationship of hydraulic fracturing and drinking water, and adequately described the findings of such published data in the draft Assessment Report. However, the SAB has concerns regarding various aspects of the draft Assessment Report, including concerns regarding several major findings presented within the draft that seek to draw national-level conclusions regarding the impacts of hydraulic fracturing on drinking water resources. The SAB has recommendations for changes to text in the draft Assessment Report and for follow-on activities to address gaps. Also included, as Appendix B, is a dissenting view from four of the 30 members of the SAB Panel regarding the broader SAB Panel's viewpoint on one of the EPA's major findings.

The SAB's key findings and recommendations are summarized below.

Clarity of and Support for Major Findings: The SAB has concerns regarding the clarity and adequacy of support for several major findings presented within the draft Assessment Report that seek to draw national-level conclusions regarding the impacts of hydraulic fracturing on drinking water resources. The SAB is concerned that these major findings as presented within the Executive Summary are ambiguous and appear inconsistent with the observations, data, and levels of uncertainty presented and discussed in the body of the draft Assessment Report. Of particular concern in this regard is the high-level conclusion statement on page ES-6 that "We did not find evidence that these mechanisms have led to widespread, systemic impacts on drinking water resources in the United States." The SAB finds that the EPA did not support quantitatively its conclusion about lack of evidence for widespread, systemic impacts of hydraulic fracturing on drinking water resources, and did not clearly describe the system(s) of interest (e.g., groundwater, surface water), the scale of impacts (i.e., local or regional), nor the definitions of "systemic" and "widespread." The SAB observes that the statement has been interpreted by readers and members of the public in many different ways. The SAB concludes that if the EPA retains this conclusion, the EPA should provide quantitative analysis that supports its conclusion that hydraulic fracturing has not led to widespread, systemic impacts on drinking water resources. Twenty-six of the 30 members of the SAB Panel concluded that the statement also requires clarification and additional explanation (e.g., discuss what is meant by "any observed change" in the definition of "impact" in Appendix J, and consider including modifying adjectives before the words "widespread, systemic impact" in the statement on page ES-6). Four members of the SAB Panel concluded that this statement is clear, concise and accurate.

The SAB recommends that the EPA revise the major statements of findings in the Executive Summary and elsewhere in the final Assessment Report to clearly link these statements to evidence provided in the body of the final Assessment Report. The EPA should consider prioritizing the major findings that have been identified within Chapters 4-9 of the final Assessment Report according to expectations regarding the magnitude of the potential impacts of hydraulic fracturing-related activities on drinking water resources. The SAB also recommends that the EPA discuss the significant data limitations and uncertainties, as documented in the body of the draft Assessment Report, when presenting the major findings. Regarding the EPA's findings of gaps and uncertainties in publicly available data that the agency relied upon to develop conclusions within the draft Assessment Report, the EPA should clarify

and describe the different databases that contain such data and the challenges of accessing them, and make recommendations on how these databases could be improved to facilitate more efficient investigation of the data they contain.

The final Assessment Report should make clear that while the hydraulic fracturing industry is rapidly evolving, with changes in the processes being employed, the Assessment necessarily was developed with the data available at a point in time.

Recognition of Local Impacts: The SAB finds that the EPA's initial goal of assessing the HFWC using national-level analyses and perspective was appropriate. However, the final Assessment Report should also recognize that many stresses to surface or groundwater resources associated with stages of the HFWC are often localized in space and temporary in time but nevertheless can be important and significant. For example, the impacts of water acquisition will predominantly be observed locally at small space and time scales. These local-level impacts, when they occur, have the potential to be severe, and the final Assessment Report needs to better recognize the importance of local impacts. In this regard, the SAB recommends that the agency should include and critically analyze the status, data on potential releases, and any available findings from the EPA and state investigations conducted in Dimock, Pennsylvania; Pavillion, Wyoming; and Parker County, Texas, where many members of the public have stated that hydraulic fracturing activities have caused local impacts to drinking water resources. Examination of these high-visibility cases is important so that the reader can more fully understand the status of investigations in these areas, conclusions associated with the investigations, lessons learned, if any, for the different stages of the hydraulic fracturing water cycle, what additional work should be done to improve the understanding of these sites and the HFWC, plans for remediation, if any, and the degree to which information from these case studies can be extrapolated to other locations.

Prospective Case Studies: The SAB is concerned that the EPA had planned to but did not conduct various assessments, field studies, and other research, and the SAB recommends that the EPA delineate these planned activities within the final Assessment Report and discuss why they were not conducted or completed. All but two Panel members find the lack of prospective case studies as originally planned by the EPA and described in the research 2011 Study Plan is a limitation of the draft Assessment Report.

Probability and Risk of Failure Scenarios: To help the reader understand the most significant failure mechanisms associated with the various stages in the HFWC, the EPA should clearly describe the probability, risk and relative significance of potential hydraulic fracturing-related failure mechanisms, and the frequency of occurrence and most likely magnitude and/or probability of risk of water quality impacts associated with such failure mechanisms. For example, the agency should include additional major findings associated with the higher likelihood of impacts to drinking water resources associated with hydraulic fracturing well construction, well integrity, and well injection problems. These findings should discuss factors and effects regarding the severity and frequency of potential impacts from poor cementation techniques, hydraulic fracturing operator error, migration of hydraulic fracturing chemicals from the deep subsurface, and abandoned/orphaned oil and gas wells. The agency should also provide more information regarding the extent or potential extent of the effects of chemical mixing processes from hydraulic fracturing operations on drinking water supplies. The EPA should provide additional detail on the extent and duration of the impacts of spilled liquids and releases of flowback and produced waters when they occur. Furthermore, the agency should also include additional major findings associated with the effects on drinking water resources of large spill events that escape site containment, and sustained, undetected leaks.

Chemical Toxicity and Hazard: The agency should compile toxicological information on constituents (e.g., chemicals, dissolved compounds and ions, and particulates) employed in hydraulic fracturing in a more inclusive manner, and not limit the selection of hydraulic fracturing constituents of concern to those that have noncancer oral reference values (RfVs) and cancer oral slope factors (OSFs) that were peer reviewed only by a governmental or intergovernmental source. The agency should use a broad range of toxicity data, including information pertinent to subchronic exposures from a number of reliable sources cited by the SAB in addition to those used in the draft Assessment Report to conduct hazard evaluation for hydraulic fracturing constituents. As the agency broadens inclusion of toxicological information to populate missing toxicity data, the EPA can expand the tiered hierarchy of data described in the draft Assessment Report to give higher priority to constituents with RfVs without excluding other quality toxicological information that is useful for hazard and risk assessment purposes.

Also, an important limitation of the agency's hazard evaluation of constituents across the HFWC is the agency's lack of analysis of the most likely exposure scenarios and hazards associated with hydraulic fracturing activities. To help prioritize future research and risk assessment efforts, the agency should identify the most likely exposure scenarios and hazards and obtain toxicity information relevant to these exposure scenarios. The EPA provides a wide range of possible scenarios along the HFWC, but more emphasis is needed on identifying the most likely durations and routes of exposures of concern so that the EPA can determine what toxicity information is most relevant and focus its research and monitoring efforts on the most important and/or likely scenarios. The SAB concludes that the selection of likely scenarios should be based on consideration of findings in prospective and retrospective site investigations, as well as case studies of public and private wells and surface water supplies impacted by spills or discharges of flowback, produced water or treated or partially treated wastewater from HFWC operations. Furthermore, the EPA developed a multi-criteria decision analysis (MCDA) approach to analyze hydraulic fracturing constituents and identify/prioritize those of most concern. In light of the limitations described in the SAB's response to Charge Question 7, and given that the EPA applied this approach to very few constituents, the EPA should explicitly state that these MCDA results (based only on constituents with RfVs) should not be used to prioritize the constituents of most concern nationally, nor to identify future toxicity testing research needs.

Characteristics of HF Fluids: For the sake of clarity, the final Assessment Report should distinguish between hydraulic fracturing constituents injected into a hydraulic fracturing well vs. constituents that come out of the hydraulic fracturing well in produced fluids, and between those constituents and potential impacts unique to hydraulic fracturing oil and gas extraction from those that also exist as a component of conventional oil and gas development, or those constituents that are naturally occurring in the formation waters of the production zone. The agency should also clarify whether constituents identified as being of most concern in produced water are products of the hydraulic fracturing activity, initial flowback, or later-stage produced water, or are constituents of concern derived from oil and gas production activities that are not unique to hydraulic fracturing activity or are naturally occurring in the formation water. This will help inform the readers about the different characteristics of HF injection flowback and produced waters and in-situ subsurface constituents relative to formation water produced in conventional oil and gas development.

The SAB finds that the data presented by the EPA within Chapter 5 of the Assessment Report indicate that spills occur at hydraulic fracturing sites; that there are varying causes, composition, frequency, volume, and severity of such spills; and that little is known about certain hydraulic fracturing constituents and their safety. The SAB also finds that the EPA's conclusion based on these limited data

(i.e., that the risk to drinking water supplies from this stage of the HFWC is not substantial) is not supported or linked to data presented in the body of the draft Assessment Report. The EPA should revise its interpretation of these limited data. In addition, Chapter 8's summary of water quality characteristics of hydraulic fracturing wastewaters from various sites clearly indicates that spills or discharges of inadequately treated hydraulic fracturing wastewater could result in significant adverse impacts on drinking water quality.

The EPA uses FracFocus 1.0 as the primary source of information on the identity and frequency of use of constituents in hydraulic fracturing processes, and the SAB expresses concern that the FracFocus database may not be sufficient. Although the agency acknowledged limitations of the FracFocus data, the EPA can do more to address these limitations by characterizing available toxicology data on proprietary constituents, and by using information provided in updated versions of FracFocus on chemical class, type, mass and concentration.

Baseline Water Quality Data: The EPA should discuss the importance of background and preexisting chemistry of surface and groundwater in developing a better understanding of whether impacts from drilling and completion activities can be identified. A major public concern is the appearance of contaminated or degraded drinking water in wells in areas where hydraulic fracturing occurs. Since naturally occurring contaminants and degraded drinking water in wells can occur from issues not related to hydraulic fracturing, the EPA should also include additional discussion on how background and pre-existing baseline chemistry of surface and groundwater data are used to better understand the impacts of hydraulic fracturing-related spills and leaks. The scientific complexity of baseline sampling and data interpretation should be clearly and concisely described.

Approach for Assessing Water Quality and Quantity Impacts: The SAB provides several suggestions to improve the agency's approach for assessing the potential that the hydraulic fracturing water cycle processes for oil and gas production may change the quality or quantity of drinking water resources. While the draft Assessment Report comprehensively summarizes available information concerning the sources and quantities of water used during HFWC operations from surface water, groundwater, and treated HFWC wastewaters, the SAB finds that the potential for water availability impacts on drinking water resources is greatest in areas with high hydraulic fracturing water use, low water availability, and frequent drought. The SAB notes, but did not independently confirm, the EPA conclusion that there are important gaps in the data available to assess water use that limit understanding of hydraulic fracturing potential impacts on water acquisition.

Definition of Proximity: The final Assessment Report should discuss the agency's rationale for selecting a one-mile radius to define proximity of a drinking water resource to hydraulic fracturing operations, and the potential need to consider drinking water resources at distances greater than one mile from a hydraulic fracturing operation. The EPA should present more information regarding the vertical distance between surface-water bodies and the target zones being fractured, the depths of most existing and potential future water-supply aquifers compared to the depths of most hydraulically fractured wells, and the increased potential, if any, for impacts on drinking water quality in aquifers. In regard to potential impacts on aquifers, of particular interest are situations where the vertical distance between the hydraulically fractured production zone and a current or future drinking water source is relatively small depending on local hydrogeological conditions.

Treatment of Hydraulic Fracturing Wastewater: The agency should provide clearer information on the fundamentals of certain hydraulic fracturing wastewater treatment processes, and the occurrence and

removal of disinfection by-product precursors in addition to bromide. The agency should describe the basis for nationwide estimates of hydraulic fracturing-related wastewater production, various aspects of hydraulic fracturing-waste disposal, the locations of hydraulic fracturing-related wastewater treatment and disposal facilities relative to downstream public water supply intakes and wells, the impacts of water recycling on pollutant concentrations and their potential impacts on drinking water quality should spills of recycled water occur, and trends in hydraulic fracturing-related wastewater disposal methods and their potential impacts on drinking water resources.

Best Management Practices and the Applicable Regulatory Framework: To better inform the readers on available processes, methods and technologies that can minimize hydraulic fracturing's potential impacts to drinking water resources, the SAB recommends that the agency describe best management practices used by industry at each stage of the HFWC. The EPA should also discuss: (1) federal, state and tribal standards and regulations implemented with the aim of minimizing the potential impacts to drinking water resources associated with hydraulic fracturing operations, and (2) the evolution of oilfield and federal, state and tribal regulatory practices relevant to HFWC activities. The EPA may develop these summaries as a longer-term future activity.

Accessibility of the Assessment to a Broad Audience: The SAB recommends that the draft Assessment Report be revised to make it more suitable for a broad audience. It is important that the Assessment Report, and especially the Executive Summary, be understandable to the general public. The SAB makes specific recommendations about opportunities to define terms, provide illustrations, and clarify ambiguities.

In the enclosed report, the SAB provides a number of specific recommendations to improve the clarity and scientific basis of the EPA's analyses within the EPA's draft Assessment Report, as well as recommendations that the agency may consider longer-term activities to conduct after finalization of the Assessment Report.

The SAB appreciates the opportunity to provide the EPA with advice on this important subject. We look forward to receiving the agency's response.

Sincerely,

/Signed/

Dr. Peter S. Thorne
Chair
Science Advisory Board

/Signed/

Dr. David A. Dzombak
Chair
SAB Hydraulic Fracturing Research Advisory Panel

Enclosure

NOTICE

This report has been written as part of the activities of the EPA Science Advisory Board, a public advisory group providing extramural scientific information and advice to the Administrator and other officials of the Environmental Protection Agency. The Board is structured to provide balanced, expert assessment of scientific matters related to the problems facing the agency. This report has not been reviewed for approval by the agency and, hence, the contents of this report do not represent the views and policies of the Environmental Protection Agency, nor of other agencies in the Executive Branch of the Federal government, nor does mention of trade names or commercial products constitute a recommendation for use. Reports of the EPA Science Advisory Board are posted on the EPA website at <http://www.epa.gov/sab>.

Ruhl

Federal jury awards \$4.24 million to Dimock families in fracking case

MARCH 10, 2016 | 6:39 PM
BY SUSAN PHILLIPS

An eight-member federal jury found Cabot Oil and Gas negligent and ordered the driller to pay a total of \$4.24 million to two Dimock families for polluting their well water starting back in 2008. The company says it will appeal the decision.

Only two families out of the original 44 plaintiffs in the case against Cabot Oil and Gas went to trial after years of delays, lack of representation, and legal setbacks. Lead plaintiff Scott Ely worked for the driller before becoming a whistleblower.

“I saw so much on these job sites,” he said after the verdict. “I’m not only working for them I’m also a resident and as I’m working for them, I end up becoming a victim of it.”

Ely testified that even today, his water is still brown and muddy. He says he persisted with the case even when his original attorneys had dropped out and he had to represent himself. The other plaintiffs settled with the company and signed nondisclosure agreements that prevent them from speaking about their water issues. Ely says he always wanted his day in court.

“This is America and we’re supposed to stand up for ourselves,” he said. “There’s a lot of neighbors who couldn’t be here. It’s like [I’m] sharing their voices, the ones who couldn’t get into the courtroom. [The jury] is vindicating them.”

Dimock’s water troubles date back to 2008, when Cabot Oil and Gas began drilling in Susquehanna County. In 2009, the Department of Environmental Protection found the company responsible for contaminating the village water supplies with methane. But the plaintiff attorneys were not allowed to present that as evidence.

The publicity surrounding the case of Dimock’s water helped touch off a global anti-fracking movement.

Filmmaker Josh Fox brought attention to Dimock’s struggle with Cabot Oil and Gas in the documentary Gasland.

“The gas industry and the frackers went down in the flames of Dimock’s water today,” he told State Impact. “The sense of relief and joy and vindication, it’s beyond words.”

Scott Ely and his wife Monica Marta-Ely each received \$1.3 million while their three children were awarded \$50,000 each. Ray and Victoria Hubert, who are tenants on the Ely’s property each received \$720,000 and their daughter was awarded \$50,000.

The Ely and Hubert’s attorney Leslie Lewis said she was “enormously relieved” by the verdict.

“Using actual evidence, they were able to find the truth,” Lewis said.

Lewis says members of the jury told Monica Marta-Ely that they were impressed by the testimony of her children.

Cabot Oil and Gas says the company is surprised by the decision and will appeal. In a statement, the gas driller says the jury's verdict "disregards overwhelming scientific and factual evidence that Cabot acted as a prudent operator in conducting its operations." The company said it would be filing motions to appeal "based upon lack of evidence as well as conduct of plaintiff's counsel calculated to deprive Cabot of a fair trial."

Plaintiff's attorney Elisabeth Radow said she had no comment about Cabot's statement. But she did say the system worked in this case.

"This is a good day," she said. "This is a really good day. The jury listened to these people and they listened to what they said. They believed they were honest and they were credible and that's where the vote went."



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 *Web Exclusive*

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 published this week in the journal *Environmental Science and Technology*.

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, a Stanford professor of environmental science.

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.

But the new Stanford study isn't the first to suggest hydraulic fracturing may have sullied groundwater near Pavillion. A 2011 draft report 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, 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 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 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 assessment showed pathways for contamination but found no evidence of widespread pollution of drinking water.

Rohit

Stanford

News

MARCH 29, 2016

Stanford researchers show fracking's impact to drinking water sources

A case study of a small Wyoming town reveals that practices common in the fracking industry may have widespread impacts on drinking water resources.

BY ROB JORDAN

Only one industry is allowed to inject toxic chemicals into underground sources of drinking water – hydraulic fracturing, or “fracking.” Concerns about this practice have riled the U.S. political landscape and communities around the country, perhaps nowhere more so than in Pavillion, Wyoming, population 231.

A new study by Stanford scientists published in *Environmental Science & Technology* finds for the first time that fracking operations near Pavillion have had clear impact to underground sources of drinking water. The research paints a picture of unsafe practices including the dumping of drilling and production fluids containing diesel fuel, high chemical concentrations in unlined pits and a lack of adequate cement barriers to protect groundwater. The well field has gone through several corporate hands since the 1960s, but various fracking operators have used acid and hydraulic fracturing treatments at the same depths as water wells in the area.

“This is a wake-up call,” said lead author Dominic DiGiulio, a visiting scholar at Stanford School of Earth, Energy & Environmental Sciences. “It’s perfectly legal to inject stimulation fluids into underground drinking water resources. This may be causing widespread impacts on drinking water resources.”

“Decades of activities at Pavillion put people at risk. These are not best practices for most drillers,” said co-author **Rob Jackson**, the Michelle and Kevin Douglas Provostial Professor at the **School of Earth, Energy & Environmental Sciences**.

As part of the so-called frackwater they inject into the ground, drilling companies use proprietary blends that can include potentially dangerous chemicals such as benzene and xylene. When the wastewater comes back up after use, it often includes those and a range of potentially dangerous natural chemicals.

“There are no rules that would stop a company from doing this anywhere else,” said Jackson, who is also a senior fellow at the **Stanford Woods Institute for the Environment** and at the **Precourt Institute for Energy**.

The study, based on publically available records and documents obtained through the Freedom of Information Act, is part of Jackson’s ongoing research on shallow fracking and its impact on groundwater. He and his colleagues have done various studies across the United States and in the Pavillion Field, an area of Wyoming’s Wind River Basin pocked by more than 180 oil and gas wells, some of them plugged and abandoned.

Back in 2008, the residents of Pavillion complained of a foul taste and odor in their drinking water and questioned whether it was related to physical ailments. In 2011, the U.S. Environmental Protection Agency issued a preliminary report putting the tiny town at the center of a growing fracking debate.

The EPA report, which linked shallow fracking to toxic compounds in aquifers, was met with heavy criticism from the drilling industry as well as state oil and gas regulators. Three years later, having never finalized its findings, EPA turned its investigation over to Wyoming. The state released a series of reports without firm conclusions, and, as of last month, has said it has no firm plans to take further action. In the meantime, the federal Agency for Toxic Substances and Disease Registry has advised area residents to avoid bathing, cooking or drinking with water from their taps.

The new Stanford study goes a step beyond the 2011 EPA report to document not only the occurrence of fracking chemicals in underground sources of drinking water but also their impact on that water that is making it unsafe for use.

The ripple effect goes well beyond Pavillion.

“Geologic and groundwater conditions at Pavillion are not unique in the Rocky Mountain region,” said DiGiulio. “This suggests there may be widespread impact to underground sources of drinking water as a result of unconventional oil and gas extraction.”

To avoid what happened in Pavillion, Jackson and DiGiulio suggest further investigation and regulations to limit shallow fracking and require deeper protective casings. Wyoming does not require the cementing of surface casings, and only two U.S. states, Colorado and Texas, have special requirements for shallow hydraulic fracturing. Safeguards mean little, however, if they are not enforced – something the EPA has done a mixed job with, according to Jackson.

“The EPA has consistently walked away from investigations where people and the environment appear to have been harmed” by fracking’s impact on groundwater, Jackson said.

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