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LESSONS LEARNED: EPA'S INVESTIGATIONS OF HYDRAULIC FRACTURING

JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY &
SUBCOMMITTEE ON ENVIRONMENT

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRTEENTH CONGRESS

FIRST SESSION

July 24, 2013

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LESSONS LEARNED: EPA'S INVESTIGATIONS OF HYDRAULIC FRACTURING

WEDNESDAY, JULY 24, 2013

HOUSE OF REPRESENTATIVES,
JOINT HEARING WITH THE SUBCOMMITTEE ON
ENVIRONMENT AND THE SUBCOMMITTEE ON ENERGY
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittees met, pursuant to call, at 10:04 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Chris Stewart [Chairman of the Subcommittee on Environment] presiding.

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

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House of Representatives
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Subcommittee on Environment
And
Subcommittee on Energy

Lessons Learned: EPA's Investigations of Hydraulic Fracturing

Wednesday, July 24, 2013
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Witnesses

Dr. Fred Hauchman, Director, Office of Science Policy, Office of Research and Development, Environmental Protection Agency

Dr. David A. Dzombak, Chair, Environmental Protection Agency Science Advisory Board, Hydraulic Fracturing Research Advisory Panel

Mr. John Rogers, Associate Director, Oil and Gas, Division of Oil, Gas, and Mining, Utah Department of Natural Resources

Dr. Brian Rahm, New York Water Resources Institute, Cornell University

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON ENVIRONMENT
SUBCOMMITTEE ON ENERGY

HEARING CHARTER

Lessons Learned: EPA's Investigations of Hydraulic Fracturing

Wednesday, July 24, 2013
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

PURPOSE

The Subcommittee on Environment and the Subcommittee on Energy will hold a joint hearing entitled *Lessons Learned: EPA's Investigations of Hydraulic Fracturing* on Wednesday, July 24th, at 10:00 a.m. in Room 2318 of the Rayburn House Office Building. The purpose of the hearing is to examine the EPA's conduct of its investigation into the relationship between hydraulic fracturing and groundwater, with an emphasis on adherence to protocols, procedures, and other policies governing these research activities. A particular focus of the hearing will be to examine the EPA's investigations in Parker County, Texas; Pavillion, Wyoming; and Dimock, Pennsylvania, and ascertain any lessons that might be learned from these experiences and used to inform and improve the EPA's ongoing study of the potential impacts of hydraulic fracturing on drinking water resources.

WITNESS LIST

- **Dr. Fred Hauchman,** Director, Office of Science Policy, Office of Research and Development, Environmental Protection Agency
- **Dr. David A. Dzombak,** Chair, Environmental Protection Agency Science Advisory Board, Hydraulic Fracturing Research Advisory Panel
- **Mr. John Rogers,** Associate Director, Oil and Gas, Division of Oil, Gas, and Mining, Utah Department of Natural Resources
- **Dr. Brian Rahm**, Post-Doctoral Associate, New York State Water Resources Institute, Cornell University

BACKGROUND

The Environmental Protection Agency (EPA) is involved in several research efforts focused on hydraulic fracturing, including an ongoing study to determine the relationship, if any, between hydraulic fracturing and drinking water resources being conducted by the Office of Research and Development (ORD). Additionally, the Agency is part of a research initiative

intended to addressed the "highest priority challenges" related to unconventional oil and gas production, as outlined in an April 2012 Memorandum of Agreement (MOA) between the EPA, the Department of Energy (DOE), and the Department of Interior (DOI).[1] According to the MOA, this research effort is intended to "improve our understanding of the impacts of developing our Nation's unconventional oil and gas resources," and in doing so, will focus each Agency on its area of core competency. Accordingly, the EPA portion of this research initiative will focus on air monitoring, environment and human health risk, and water quality.[2]

In addition to these ongoing efforts, the EPA has conducted investigations into individual cases involving hydraulic fracturing, ostensibly to determine the impact, if any, that the practice had on groundwater resources in the area. The EPA examined specific cases of hydraulic fracturing in Parker County, Texas; Pavillion, Wyoming; and Dimock, Pennsylvania.

EPA Ongoing Activities: Hydraulic Fracturing Research

The Fiscal Year 2010 Department of the Interior, Environment, and Related Agencies Appropriations Act (P.L. 111-88) directed EPA to carry out a study on hydraulic fracturing, in accordance with the following report language:

> *"Hydraulic Fracturing Study.--The conferees urge the Agency to carry out a study on the relationship between hydraulic fracturing and drinking water, using a credible approach that relies on the best available science, as well as independent sources of information. The conferees expect the study to be conducted through a transparent, peer-reviewed process that will ensure the validity and accuracy of the data. The Agency shall consult with other Federal agencies as well as appropriate State and interstate regulatory agencies in carrying out the study, which should be prepared in accordance with the Agency's quality assurance principles."*

The study, entitled *Study of Hydraulic Fracturing and Its Potential Impact on Drinking Water Resources*, is ongoing and its scope includes the full lifespan of water in hydraulic fracturing. In February of 2011, EPA released a draft study plan for public comment and review by its Science Advisory Board (SAB), and a final study plan was released in November 2011.[3] The purpose of the study, as outlined in the final study plan, is to "elucidate the relationship, if any, between hydraulic fracturing and drinking water resources" and "assess the potential impacts of hydraulic fracturing on drinking water resources and to identify the driving factors that affect the severity and frequency of any impacts."[4]

The study plan identified the following fundamental research areas and questions:

- *Water Acquisition: What are the potential impacts of large volume water withdrawals from ground and surface waters on drinking water resources?*

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[1] Memorandum, Multi-Agency Collaboration on Unconventional Oil and Gas Research, April 13, 2012. Accessible at: http://www.doi.gov/news/pressreleases/loader.cfm?csModule=security/getfile&pageid=289759
[2] Ibid.
[3] Environmental Protection Agency, *Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*, November 2011. Accessible at: http://www2.epa.gov/sites/production/files/documents/hf_study_plan_110211_final_508.pdf
[4] Ibid.

- *Chemical Mixing: What are the possible impacts of surface spills on or near well pads of hydraulic fracturing fluids on drinking water resources?*
- *Well Injection: What are the possible impacts of the injection and fracturing process on drinking water resources?*
- *Flowback and Produced Water: What are the possible impacts of surface spills on or near well pads of flowback and produced water on drinking water resources?*
- *Wastewater Treatment and Waste Disposal: What are the possible impacts of inadequate treatment of hydraulic fracturing wastewaters on drinking water resources?*

On December 21, 2012, EPA released a "Progress Report" to this ongoing study which provided information on current work being done by the Agency, including the status of research projects that are anticipated to inform the final study.[5] The progress report did not include conclusions regarding the relationship between hydraulic fracturing and drinking water resources. The final report, which has been classified by the Agency as a Highly Influential Scientific Assessment, is anticipated to be released in late 2014 for peer review and public comment.[6]

Prior to the release of the Progress Report, the EPA Office of Research and Development requested the Scientific Advisory Board to conduct a "consultation" review of the research that would be found in that report. A consultation is a mechanism whereby the SAB panelists may provide their individual expert comments to the Agency for consideration, but does not require consensus among committee members nor result in preparation of a detailed report. To this end, the ad hoc SAB panel, known as the Hydraulic Fracturing Research Advisory Board Panel[7] participated in a consultation with the full SAB in May of this year. In this meeting, the ad hoc SAB panel responded to charge questions from the Agency and provided input and comments on the Progress Report. The written comments submitted by the panelists were compiled into a report, which was released on June 25.[8]

In addition to the ongoing hydraulic fracturing study, the EPA is also involved in a multi-agency research initiative with the DOE and DOI intended to address the "highest priority

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[5] News Release, Environmental Protection Agency, *EPA Releases Update on Ongoing Hydraulic Fracturing Study*, December21, 2012. Accessible at: http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/4af0024955d936ef85257adb0058aa29!OpenDocument

[6] Environmental Protection Agency, Stakeholder Engagement Roadmap and Peer Review Overview for EPA's Study on the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources. Accessible at: http://www2.epa.gov/hfstudy/stakeholder-engagement-roadmap-and-peer-review-overview-epas-study-potential-impacts

[7] Members of Hydraulic Fracturing Research Advisory Panel. Accessible at: http://yosemite.epa.gov/sab/sabpeople.nsf/WebExternalSubCommitteeRosters?OpenView&committee=BOARD&subcommittee=Hydraulic%20Fracturing%20Research%20Advisory%20Panel

[8] EPA Science Advisory Board Consultation on EPA Office of Research and Development Report, *Progress Report: Potential Impacts of Hydraulic Fracturing on Drinking Water Resources- December 2012*, June 25, 2013. Accessible at: http://yosemite.epa.gov/sab/sabproduct.nsf/5F72227CF643BF8785257B9500764E6B/$File/Individual+Comments+from+Members+of+Science+Advisory+Board+Hydraulic+Fracturing+Research+Advisory+Panel+on+EPA.pdf

challenges" related to unconventional oil and gas development as established in an MOA.[9] In May 2012, the agencies established a Steering Committee to lead this effort and publish a research plan by January 2013. This research plan has yet to be released. The goal of this effort is to focus on "policy relevant science" directed toward research topics where collaboration among the three Agencies can produce results and technologies that "support sound policy decisions by state and Federal agencies".

EPA Site Specific Activities: Hydraulic Fracturing

Parker County, Texas:

In December 2010, the EPA issued an Emergency Administrative Order to Range Resources, an operator in the Barnett Shale in Northeast Texas, alleging that natural gas found in nearby water wells was likely from the same source as the gas produced by Range and accusing the company of groundwater contamination.[10] In response to these allegations, the Texas Railroad Commission conducted a staff investigation[11] and held a hearing to examine the situation. The Commission found evidence that demonstrated the gas found in the water wells in question came from the shallow Strawn gas field, located about 200 to 400 feet below the surface. The gas being produced by Range, on the other hand, was from the Barnett Shale field, some 5,000 feet below the surface. Thus, the Commission concluded, the gas being produced by Range was not connected to the gas discovered in the water wells. Additionally, the Railroad Commission concluded that the wells produced by Range were mechanically sound and without leaks.

The Railroad Commission, finding no evidence to suggest that Range was responsible for the alleged contamination, ruled in March 2011 that the company be allowed to continue to produce from the wells in question.[12] In March 2012, the EPA vacated its emergency order against Range.[13] Additionally, in July 2012 the EPA Office of Inspector General notified the Acting Regional Administrator for Region 6 that a review of the enforcement actions against Range would be conducted.[14]

Pavillion, Wyoming:

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[9] Memorandum of Agreement on Multi-Agency Collaboration on Unconventional Oil and Gas Research, DOE, DOI, EPA, April 13, 2012. Accessible at:
http://www.doi.gov/news/pressreleases/loader.cfm?csModule=security/getfile&pageid=289759

[10] Press Release, U.S. Environmental Protection Agency, *EPA Issues an Imminent and Substantial Endangerment Order to Protect Drinking Water in Southern Parker County*, December 7, 2012. Accessible at:
http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/713f73b4bdceb126852577f3002cb6fb!OpenDocument

[11] Railroad Commission of Texas, Revised Examiners' Report and Proposal for Decision, March 11, 2011. Accessible at: http://www.rrc.state.tx.us/meetings/ogpfd/RangePFD-03-11-11.pdf

[12] Railroad Commission of Texas, Final Order, March 22, 2011. Accessible at:
http://www.rrc.state.tx.us/meetings/ogpfd/RangePFD-SignedOrder.pdf

[13] Press Release, Railroad Commission of Texas, *Railroad Commissioners: "EPA's Vacate Order in Range Case Confirms Railroad Commission Findings Based on Scientific Evidence,"* March 30, 2012. Accessible at:

[14] Memorandum, U.S. Environmental Protection Agency, New Project Notification. Accessible at:
http://www.epa.gov/oig/reports/notificationMemos/newStarts_07-17-12_Region_6_Range_Resources.pdf

On December 8, 2011, EPA released a draft report summarizing the Agency's findings pursuant to its groundwater investigation in Pavillion, Wyoming.[15] The Agency initiated this inquiry in September of 2008 in response to complaints made by some private well-owners regarding taste and odor concerns. Numerous concerns with the draft report were quickly identified, including the absence of peer review prior to the report's release, a lack of data transparency, failure to adhere to information quality guidelines, and poor sampling and monitoring techniques that called into question the validity of the results.

In September 2012, the USGS released a technical report summarizing its findings in the Pavillion case.[16] Specifically, the report described the results of their attempts to reproduce EPA's results from its monitoring wells. Ultimately, the USGS samples did not yield the same results: materials were found at lower concentrations than EPA findings, the USGS did not find the presence of key chemicals of interest found by EPA, and the USGS was unable to produce a representative groundwater sample from one of EPA's deep monitoring wells.

In response to significant public concerns, the EPA twice extended the public comment period for its draft report on Pavillion. The second extension was for an additional nine months and was scheduled to close in September of this year. However, on June 20th, the EPA terminated activity on the report, stating that the draft report would not be finalized nor would the Agency seek peer review. Additionally, EPA indicated it would leave any future action regarding the investigation to the State of Wyoming.[17]

Dimock, Pennsylvania:

In 2008, residents of Dimock, Pennsylvania notified the Department of Environmental Protection (DEP) of issues with their private water wells, including water clarity and odor. These allegations led state officials to shut down wells owned by Cabot Oil & Gas and resulted in negotiations between the company, the landowners, and the Pennsylvania Department of Environmental Protection (DEP), which included water sampling and testing.

The EPA announced in January 2012 that it would ensure temporary delivery of water supplies to some residents of Dimock and conduct tests of water wells in the area.[18] Between January and June 2012, EPA sampled private drinking water wells in 64 homes. On July 25, 2012, the EPA announced that it had completed its sampling and declared there were "not levels

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[15] EPA Region 8, Pavillion, Groundwater Investigation: http://www2.epa.gov/region8/pavillion

[16] Press Release, U.S. Geological Survey, *USGS Releases Reports on Groundwater-Quality Sampling Near Pavillion, Wyo.*, September 26, 2012. Accessible at: http://www.usgs.gov/newsroom/article.asp?ID=3410&from=rss_home

[17] Press Release, U.S. Environmental Protection Agency, *Wyoming to Lead Further Investigation of Water Quality Concerns Outside of Pavillion with Support of EPA*, June 20, 2013. Accessible at: http://yosemite.epa.gov/opa/admpress.nsf/20ed1dfa1751192c8525735900400c30/dc7dcdb471dcfe1785257b90007377bf!OpenDocument

[18] Press Release, U.S. Environmental Protection Agency, *EPA to Begin Sampling Water at Some Residences in Dimock, Pa.*, January 19, 2012. Accessible at: http://yosemite.epa.gov/opa/admpress.nsf/79c090e81f0578738525781f0043619b/8eb78248ce13d9dc8525798a0070f991!opendocument

of contaminants present that would require additional action by the Agency" and that the water in Dimock was safe to drink.[19]

Additional Reading:

- Hearing Charter, House Science, Space, and Technology, Subcommittee on Energy and Environment Hearing entitled, *Fractured Science—Examining EPA's Approach to Ground Water Research: The Pavillion Analysis*, February 1, 2012. Available at: http://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/HHRG-112-SY20-20120201-SD001.pdf
- Railroad Commission of Texas, Revised Examiners' Report and Proposal For Decision Statement of the Case, March 11, 2011. Available at: http://www.rrc.state.tx.us/meetings/ogpfd/RangePFD-03-11-11.pdf
- Letter, Pennsylvania Department of Environmental Protection to EPA Regional Administrator, January 5, 2012. Accessible at: http://s3.documentcloud.org/documents/282670/stateimpact-pa-krancer-dimock-letter.pdf

[19] Press Release, U.S. Environmental Protection Agency, *EPA Completes Drinking Water Sampling in Dimock, Pa.*, July 25, 2012. Accessible at: http://yosemite.epa.gov/opa/admpress.nsf/0/1A6E49D193E1007585257A46005B61AD

Chairman STEWART. The joint hearing on the Subcommittee of the Environment and the Subcommittee on Energy will come to order.

Good morning, everyone. Welcome to today's joint hearing entitled "Lessons Learned: EPA's Investigations of Hydraulic Fracturing."

Before we get started today, I would like to recognize my friend, David Piantanida—I can never say his name right—who is with the EPA Office of Research and Development. And Dave and Lisa had a little boy last Monday, as I understand. Congratulations. Probably the most important thing we will do today, so we want to recognize you for that.

In front of each Member are packets containing the written testimony, biographies, and the truth-in-testimony disclosures for today's witnesses. Before we get started, since this is a joint hearing involving two Subcommittees, there were some questions, so I wanted to explain how we will operate procedurally so all Members understand how the question-and-answer period will be handled.

As always, we will alternate between the majority and the minority Members, first recognizing the Chair and Ranking Members of the Environment and Energy Subcommittees. We will recognize those Members present at the gavel in order of seniority on the full Committee, and those coming in after the gavel will be recognized in the order of their arrival.

And I would now like to recognize myself for five minutes for my opening statement.

I want to thank the witnesses for being here today. We had a chance to introduce ourselves and welcome you earlier, and again we thank you. Thank you for your time and your expertise. I would like to include a special welcome to John Rogers, Department of Natural Resources, from my home State of Utah.

EPA's recent announcement that it is walking away from its attempt to link hydraulic fracturing to groundwater issues in Wyoming is the most recent example of the Agency employing what I consider a "shoot first, ask questions later" policy towards unconventional oil and gas production. Following investigations in Parker County, Texas, and also Pennsylvania, this marks the third case in which EPA has made sweeping allegations of fracking-caused contamination, only to have to recant these claims later due to errors, omissions, or breaches of protocol. At a time when so many Americans are learning to distrust their Federal Government, this is another blow for the credibility of the Federal agencies.

This hearing is focused on EPA's ongoing study of hydraulic fracturing, a project initiated by a single line in a 2010 appropriations bill that has blossomed into an examination costing tens of millions of taxpayer dollars that may not be complete until the latter half of this decade. Given EPA's rush to judgment in Wyoming and Texas and Pennsylvania, we should question whether the Agency's ongoing study is a genuine fact-finding and scientific exercise or could it be a witch-hunt to find a pretext to regulate?

Officials from EPA's Office of Research and Development, the scientists who are in charge of this study, have stated publicly that they are also conducting "a pretty comprehensive look at all the

statutes to determine where holes may allow for additional Federal oversight." These same officials have also overseen large shifts in both the study's timeline and the scope of the study since the last time the Agency's independent Science Advisory Board weighed in.

Given the Administration's anti-fossil fuel, pro-environmental alarmism in their approach to energy, we need to be vigilant in ensuring that the Agency does not put the regulatory cart before the scientific horse, threatening tens of thousands of good-paying jobs and hundreds of millions of dollars in economic development that have resulted from oil and gas production in recent years.

Toward this end, this Committee, which has jurisdiction over the study and all science at EPA, has held dozens of hearings and sent far too many letters to the regulators in the last two Congresses.

For example, in the beginning of May of this year, I sent a letter to the newly-formed independent Science Advisory Board panel on hydraulic fracturing asking what I thought were some fundamental questions about EPA's ongoing study, and I would like to enter a copy of this letter into the record.

[The information follows:]

Chairman STEWART. Under the Environmental Research, Development, and Demonstration Act of 1978, SABs were created to "provide such scientific advice as may be requested" by this Committee. And I would like to emphasize that. Let me say it again. SABs were created to provide scientific advice to this Committee.

Unfortunately, despite promises made to the members of this panel, EPA's lawyers have prevented the supposedly independent panel of experts from responding directly to these questions. I believe that wastes taxpayers' resources and it is preventing the Board from following the law. Even worse, EPA's Office of General Counsel has refused to meet with me and my staff to explain this position. It bothers me that the Office of General Counsel refuses to meet with us. With such arrogance and dismissiveness, little wonder that the Administration is losing the confidence of the American people, as well as this Congress.

This panel provided critical comments back to EPA on its study progress in late June, and, unfortunately, much of the feedback we received reiterated many of the concerns that we have. Independent scientists raised questions about the nature of EPA's study and whether it would have any use for decision-makers. One panelist suggested the Agency needs to "examine the rapid changes of chemicals being used and future trends toward greener chemicals." Another summarized that the failure to consider industry practices "runs the risk of making the Agency's evaluation of the data, which in some cases may be several years old, obsolete and not relevant to the public, industry, and decision-makers at all levels in 2014."

Several members of this independent panel—whom, by the way, if I could point out, were appointed by the EPA Administrator—stated that the Agency's figures and characterizations were "misleading," lacked relevant context, and were designed to produce "self-fulfilling results."

The Agency's—or the Administration's interagency fracking research is now over a year late in making its study plan public. This seems especially important in light of the landmark study released this week by DOE's National Energy Technology Laboratory show-

ing no evidence that fracking chemicals impacted drinking water in western Pennsylvania.

For these and other issues, I look forward to this very important hearing.

[The prepared statement of Mr. Stewart follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENVIRONMENT CHAIRMAN CHRIS STEWART

Good afternoon, I'd like to welcome everyone to today's hearing, which is being held to review innovative approaches to technology transfer at universities, research institutes and National Laboratories, and to examine a discussion draft of legislation, titled the "Innovative Approaches to Technology Transfer Act of 2013."

In 2012, the Federal Government funded more than $131 billion in research and development activities. More than half of all basic research conducted at our nation's colleges and universities is funded by the Federal Government.

According to the Association of University Technology Managers, technology transfer is the process by which universities and research institutes transfer scientific findings from one organization to another for the purpose of further development or commercialization.

The Bayh-Dole Act, passed in 1980, changed the incentive structure for universities and research institutes to work with commercial entities, including small businesses, to license and patent technologies. The Small Business Technology Transfer or STTR program was created to provide federal R&D funding for proposals that are developed and executed jointly between a small business and a researcher in a nonprofit research organization. My own state of Indiana has seen 99 STTR awards totaling more than $26 million. Both Bayh-Dole and the STTR program have helped to create jobs and translate new technologies into the marketplace.

However, while the rate of technology transfer at our nation's universities, research institutes and national laboratories has increased since the passage of the Bayh-Dole Act and the creation of the STTR program, I believe we can do even better.

The draft legislation, which is being developed under the leadership of my colleague from New York, Mr. Collins, will create a program to incentivize research institutions to implement innovative approaches to technology transfer to achieve better outcomes. The legislation would dedicate a portion of STTR program funding to provide grants to research institutions to help facilitate and accelerate the transfer of federally funded research and technology into the marketplace.

We will be hearing today from the co-founder of a growing biotechnology business based in Charlottesville, Virginia that was developed out of federally funded R&D, with the assistance of private foundation technology transfer grant funding. We will also hear from the Assistant Vice President for Research and Associate Director of the Burton D. Morgan Center for Entrepreneurship at Purdue University in my home state of Indiana. And from the Assistant Vice Chancellor for the Office of Innovation, Technology, and Alliances at the University of California, San Francisco. Our witnesses have first-hand experience in technology transfer and can provide insight into how the proposed grant program could help facilitate better technology transfer outcomes.

I'm looking forward to hearing from our witnesses on their thoughts about the proposed legislation, including any recommendations they have for improvements.

We thank our witnesses for being here today and we look forward to your testimony.

Chairman STEWART. I would now like to recognize the Ranking Member, Ms. Bonamici, for her opening statement.

Ms. BONAMICI. Thank you very much, Chairman Stewart and Chair Lummis.

Over the past several years, we have seen a substantial expansion of fracking for oil and gas across the country. As this expansion continues, we must not ignore the potential public health risks that may be caused if the operations of fracking companies contaminate drinking water.

I want to thank the Chairs of the Subcommittees for recognizing the importance of this issue by including in the hearing charter that a focus of the hearing will be to examine the EPA's investigations and ascertain any lessons that might be learned from these experiences and use to inform and improve the EPA's ongoing study of the potential impacts of hydraulic fracturing on drinking water resources.

Hydraulic fracturing emerged as a commercial success in large part because of Federal investment in developing today's fracking technologies. Although fracking has boosted shale gas exploration to make it a formidable economic driver, providing increased energy security and creating jobs, the fast-paced and enormous scale of fracking for shale gas may be putting our water resources at risk.

Our surface and groundwater resources are under tremendous strain throughout the country. Population expansion, residential and industrial development, droughts, and limited precipitation not seen before in some areas of the country have all contributed to this strain. These circumstances make access to clean water and the EPA's study even more important. If we want to enjoy the advantages and economic benefits of shale gas development, we must do so with the highest regard for safety and the protection of our precious water resources.

We have all heard the stories about exploding drinking water wells, families with children who are exposed to potentially harmful levels of methane gas in their drinking water, and we should all be concerned about what could happen going forward. Fracking for shale gas is predicted to continue for some time. State, federal, and tribal leaders, in addition to Americans all over the country are alarmed about whether their drinking water is at risk and they deserve answers to their questions.

The current debate over fracking goes beyond groundwater and includes well integrity concerns, documented induced seismicity events, and potential negative impacts to the health of workers at these facilities. Although the primary focus of the EPA's study we will discuss today is the connection to drinking water resources, all of these concerns and important questions must be addressed. Some, especially from the industry, submit that no additional studies are needed, that Americans should trust that the industry knows what it is doing or that Federal interference is unnecessary because States are already implementing best practices.

Although some States may be up to the managerial task if they have demonstrated knowledge of local geology, hydrology, and infrastructure, other States are not as prepared. Some have only begun to develop rules establishing best practices for companies operating fracking facilities within their borders.

The oil and gas industry has a history of adopting environmental measures only after the drop of the regulatory gavel by state or Federal environmental regulatory authorities. Accordingly, EPA's role, aided by rigorous peer review process overseen by the EPA Science Advisory Board must figure prominently in this debate. State and tribal leaders will need the results from the fracking study to formulate stronger policies to protect their water resources and the health of their citizens. And hopefully, communities will

have answers to the questions about drinking water safety they have long been asking their state and Federal leaders.

Since the initial passage of the Environmental Research Development and Demonstration Authorization Act almost 40 years ago, the role of the EPA has been to ask and answer the most challenging scientific questions related to industrial activity in our communities. Their scientific research in collaboration with States, tribal authorities, industry, community leaders, and other stakeholders has led to the development of clear and stronger environmental policies and practices over the decades.

The result of that collaboration has been unquestionable benefits for our economy, certainty for industry, and protection of our water quality. Without a better understanding of the fracking water cycle and the impacts to drinking water and groundwater, we will not know enough about the potential risks to equip State and localities with the tools necessary to keep their citizens healthy and safe.

I look forward to hearing about EPA's progress on its drinking water study. And with that, Mr. Chairman, I yield back.

[The prepared statement of Ms. Bonamici follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENVIRONMENT RANKING MEMBER SUZANNE BONAMICI

Thank you, Chair Stewart and Chair Lummis. Over the past several years we have seen a substantial expansion of fracking for oil and gas across the country. As this expansion continues, we must not ignore the potential public health risks that may be caused if the operations of fracking companies contaminate drinking water. I want to thank the Chairs of the Subcommittees for recognizing the importance of this issue by including in the Hearing Charter that a focus of the hearing will be to examine the EPA's investigations and "ascertain any lessons that might be learned from these experiences and used to inform and improve the EPA's ongoing study of the potential impacts of hydraulic fracturing on drinking water resources."

Hydraulic fracturing, or "fracking," emerged as a commercial success in large part because of federal investment in developing today's fracking technologies. Although fracking has boosted shale gas exploration to make it a formidable economic driver, providing increased energy security and creating jobs, the fast pace and enormous scale of fracking for shale gas may be putting our water resources at risk.

Our surface and groundwater resources are under tremendous strain throughout the country. Population expansion, residential and industrial development, droughts, and limited precipitation not seen before in some areas of the country have all contributed to this strain. These circumstances make access to clean water and the EPA's study even more important. If we want to enjoy the advantages and economic benefits of shale gas development, we must do so with the highest regard for safety and the protection of our precious water resources.

We have heard about exploding drinking water wells and families with children who are exposed to potentially harmful levels of methane gas in their drinking water—we should all be concerned about what could happen going forward. Fracking for shale gas is predicted to continue for some time. State, federal, and tribal leaders, in addition to Americans all over the country, are alarmed about whether their drinking water is at risk, and they deserve answers to their questions.

The current debate over fracking goes beyond groundwater and includes well integrity concerns, documented induced seismicity events, and potential negative impacts to the health of workers at these facilities. Though the primary focus of the EPA study we will discuss today is the connection to drinking water resources, all of these concerns and important questions must be addressed.

Some, especially from the industry, submit that no additional studies are needed, that Americans should trust that the industry knows what it's doing, or that federal interference is unnecessary because states are already implementing their own best practices. Although some states may be up to the managerial task if they have demonstrated knowledge of local geology, hydrology, and infrastructure, other states are

not as prepared. Some have only begun to develop rules establishing best practices for companies operating fracking facilities within their borders.

The oil and gas industry has a history of adopting environmental measures only after the drop of the regulatory gavel by federal or state environmental regulatory authorities. Accordingly, EPA's role—aided by the rigorous peer-review process overseen by the EPA Science Advisory Board—must figure prominently in this debate. State and tribal leaders will need the results from the fracking study to formulate stronger policies to protect their water resources and the health of their citizens. And, hopefully, communities will have answers to the questions about drinking water safety that they have long been asking their state and federal leaders.

Since the initial passage of the Environmental Research, Development, and Demonstration Authorization Act almost 40 years ago, the role of the EPA has been to ask and answer the most challenging scientific questions related to industrial activity in our communities. Their scientific research, in collaboration with states, tribal authorities, industry, community leaders, and other stakeholders, has led to the development of clearer and stronger environmental policies and practices over the decades. The result of that collaboration has been unquestionable benefits for our economy, certainty for industry, and protection of our water quality. Without a better understanding of the fracking water cycle and the impacts to drinking water and groundwater, we will not know enough about the potential risks to equip states and localities with the tools necessary to keep their citizens healthy and safe.

I look forward to hearing EPA's progress on its drinking water study. And, with that I yield back.

Chairman STEWART. Thank you, Ms. Bonamici. The Chair now recognizes the Chairman of the Subcommittee on Energy, Mrs. Lummis, for her opening statement.

Chairman LUMMIS. Thanks, Mr. Chairman.

And I want to thank both the Chairman of the Environment Subcommittee to my right and the Chairman of the full Committee to my left for holding this important hearing, "Lessons Learned: EPA's Investigations of Hydraulic Fracturing." Also, I want to thank the witnesses for taking time to be here this morning.

The EPA's Study of the Potential Impact on—of Hydraulic Fracturing on Drinking Water Resources has been going on for over three years now, and the final report is expected next year. Given the national and international interest in the results of this endeavor, I think it is important that the Committee take a step back and assess the Agency's track record on hydraulic fracturing. I hope the phrase "lessons learned" can be a useful starting point as we review past EPA behavior to inform and hopefully improve the ongoing work on hydraulic fracturing. Sadly, the Agency's track record in this regard, particularly in my home State of Wyoming, gives me little confidence.

Last month, the Agency decided to terminate work on its draft report that wrongly alleged that groundwater contamination near Pavillion, Wyoming, was related to fracking. The EPA's work in Wyoming was so riddled with mistakes in well construction, errors in sampling techniques, and failures to follow protocol that their only course of action was to do the right thing and withdraw the report.

And while I am relieved that EPA transferred authority to the State of Wyoming on any continued work in Pavillion, I am troubled that the Agency continues to insist that it "stands by its work" on Pavillion.

I hope the EPA will avoid making these same mistakes in its broader ongoing study, but I lack confidence when the EPA stands by its work even when that work is shoddy and led even prestigious publications to frighten Americans about this significant

technology. The new study design is flawed and indicative of the Agency's characteristic outcome-driven approach to hydraulic fracturing, where achieving desired conclusions takes precedent over basing those conclusions on the best available science.

For example, this study, intended to be a seminal and authoritative work on whether or not hydraulic fracturing impacts drinking water, is guided not by what is likely or probable but by a search for what is merely possible. In this manner, the Agency appears headed towards developing conclusions completely divorced from any useful context. It is akin to a weatherman warning citizens to take shelter based on the possibility that a storm will occur without including any indication of when, where, and how likely it is to actually take place.

I am not alone in this concern, as several of the panelists on EPA's Science Advisory Board's Hydraulic Fracturing Research Advisory have similarly expressed apprehension over the lack of context the Agency is providing and its neglect of risk assessment.

Let me just read a few comments, which I urge EPA to incorporate. These comments are from the advisory. "To simply discount the regulatory work in place and model what-if and worst-case scenarios will not produce realistic results, relevant context has to be taken into account, absent information on chemical concentrations, amounts used, site storage conditions, duration of storage onsite, and containment systems, the information will not support an assessment of the potential impact to drinking water resources. Inappropriately, this experimental design produces self-fulfilling results." Mind you, these are quotes. "Clearly, EPA should do much more to put this information into context" from the advisors.

These statements summarize just some of the concerns I have with EPA's approach to hydraulic fracturing, concerns I hope are a result of the collection of honest mistakes made by the Agency rather than a calculated pattern of behavior based on regulatory intentions. I look forward to hearing how the Agency has learned from its past work and plans to improve its work in the future.

Thank you, Mr. Chairman. I yield back.

[The prepared statement of Mrs. Lummis follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENERGY CHAIRMAN CYNTHIA LUMMIS

Good morning and I thank the Chairman of the Environment Subcommittee for holding this important hearing, Lessons Learned: EPA's Investigations of Hydraulic Fracturing. I want thank the witnesses for taking the time to be here this morning and I look forward to their valuable testimony.

The EPA's Study of the Potential Impact of Hydraulic Fracturing on Drinking Water Resources has been going on for over three years now, and the final report is expected next year. Given the national-and international-interest in the results of this endeavor, I think it's important that the Committee takes this time to take a step back and assess the Agency's track record on hydraulic fracturing. I hope that phrase lessons learned can be a useful starting point this morning as we review past EPA behavior in order to inform and hopefully improve its ongoing work on hydraulic fracturing. Unfortunately, the Agency's track record in this regard—particularly in my home state of Wyoming—gives me no cause for confidence.

Initially, I was pleased to hear last month that the Agency decided to terminate all work on its draft report alleging fracking contaminated ground water in Pavillion, Wyoming. This undertaking was so riddled with mistakes in well construction, errors in sampling techniques, and failures to follow protocol that even the USGS—a fellow federal agency—could not replicate the results. However, while I am relieved that EPA decided to stop digging itself into a deeper scientific hole,

I am extremely troubled that the Agency continues to brazenly insist it "stands by its work" on Pavillion.

I hope the EPA will avoid making these same mistakes in its broader, ongoing study, but cause for optimism is wanting. The study design is flawed and indicative of the Agency's characteristic outcome-drive approach to hydraulic fracturing, where achieving desired conclusions takes precedent over basing those conclusions on the best available science. In that vein, this study, intended to be a seminal and authoritative work on whether or not hydraulic fracturing impacts drinking water, is guided by a search for what is possible, rather than what is likely or probable.

In this manner, the Agency appears headed toward developing conclusions completely divorced from any useful context. It is akin to a weatherman warning citizens to take shelter based on the possibility that a storm will occur, without including any indication of when the storm might occur, where it might hit, and how likely it is to actually take place. I am not alone in this concern, as several of the panelists on the EPA's Science Advisory Board's Hydraulic Fracturing Research Advisory have similarly expressed apprehension over the lack of context the Agency is providing and its neglect of risk assessment.

Let me just read a few of those comments, which I urge the EPA to incorporate:

- "To simply discount the regulatory network in place and model "what if" and "worse case" scenarios will not produce realistic results"
- "relevant context has to be taken into account"
- "absent information on chemical concentrations, amounts used, site storage conditions, duration of storage onsite, and containment systems, the information will not support an assessment of the potential impact to drinking water resources."
- "Inappropriately, this experimental design produces self-fulfilling results"
- "clearly, EPA should do much more to put this information into context"

These statements summarize just some of the concerns I have with EPA's approach to hydraulic fracturing, concerns I hope are a result of a collection of honest mistakes made by the Agency rather than a calculated pattern of behavior based on regulatory intentions. I look forward to hearing how the Agency has learned from its past work and plans to improve its work in the future.

Thank you Mr. Chairman, and I yield back.

Chairman STEWART. Thank you, Madam Chairwoman.

The Chair now recognizes Mr. Swalwell for his opening statement.

Mr. SWALWELL. Thank you, Chairman Stewart and Chairman Lummis, for holding this hearing and also I want to thank our witnesses for being here with us today. And I also embrace and look forward to the opportunity to examine EPA's efforts to determine whether there is a significant link between fracking and groundwater quality and, if so, what next future steps we need to take to make sure that our drinking water is clean and safe, and if this technology is able to be done safely, where and how is the best way to do that?

As I have said before over and over in this Committee, I do support an all-of-the-above approach to energy production and I do believe that if we can make it safe, we should make it happen. However, in any technology, if we cannot make it safe, we should try and fix it to make it safe, and if not, certainly not expose consumers and citizens to any of the hazards that may exist in any project.

The emerging natural gas boom obviously provides an exciting opportunity for our Nation, not to mention California, to create jobs and diversify energy options for both consumers and industry over the next several years. That said, when it comes to fracking, I still believe we need to proceed with extreme caution.

And I understand the concern of the Chairman, both Chairman Lummis and Chairman Stewart about the length of time it has

taken, but, frankly, I don't think three years is too long at this point for something that is so serious. And, as I have said, and I know many of my colleagues are committed, if we can make this technology safe, we are willing to make it happen, but we do have concerns, especially in California, about seismic activity and what fracking could do with seismic activity.

And with respect to the study in Wyoming, I certainly share Chairman Lummis' concerns about what happened with that EPA study, and what I am interested in learning is whether that study was something that was supposed to be limited and limited in scope only to the concern of groundwater affecting a particular person or a particular group of individuals and rather that—and whether that study should really be projected more broadly as an EPA groundwater study.

So I think there is legitimate debate about whether the study that was done should be used or whether there is a more broad, comprehensive study taking place. But I look forward to working with both Chairs to see that.

And we have to be careful that when we do extract this resource that we do it carefully without unintended, serious consequences to either our health or environment. And while I know that the focus of this hearing is mostly on the EPA and groundwater contamination, I have brought up my concerns in the past about what I think are direct links between seismic activity and fracking.

And as I have said, it may be the case that perhaps California is not the best place to have hydraulic fracking and perhaps other States that don't have seismic concerns, if they can show that there will not be groundwater contamination, that would be the best place to conduct fracking. It would be very shortsighted, though, to produce energy via fracking in California to only find that it would lead to seismic activity or further seismic activity.

So I am pleased that the EPA and other Federal agencies, along with many of the partners in your States, are taking these issues seriously. And I urge you to take the time you need to get the most accurate answers possible, even if some of them don't turn out to be what we want to hear. There is simply no place for politics when it comes to making sure that the water that our families rely upon is safe and that the homes that we live in are not put at further risk of a manmade disaster. And so I look forward to learning more on this issue.

And with that, Mr. Chairman, I yield back the balance of my time.

[The prepared statement of Mr. Swalwell follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENERGY RANKING MEMBER ERIC SWALWELL

Thank you Chairman Stewart and Chairman Lummis for holding this hearing today, and I also want to thank the witnesses for being here. I appreciate the opportunity to further examine the EPA's efforts to determine whether there is a significant link between fracking and groundwater quality and, if so, the next steps we need to take to ensure that our drinking water is clean and safe.

As I've said before, I agree with those who say we need an "all of the above" approach to energy production. The emerging natural gas boom obviously provides an exciting opportunity for our nation—not to mention California—to create jobs and

diversify energy options for both consumers and industry over the next several years.

That said, when it comes to fracking, we need to proceed with extreme caution. We have to be careful that we extract this resource safely, without unintended, serious consequences to either our health or the environment. While I know it is not the focus of this particular hearing, it is still worth noting to these expert witnesses that a particular concern to Californians is the possibility that hydraulic fracturing might cause earthquakes. It would be very short-sighted to produce energy via fracking only to find out later that it caused such damage.

So I am pleased that the EPA and other relevant federal agencies, along with many of your partners in the states, are taking these issues seriously. I urge you to take the time you need to get the most accurate answers possible, even if some of them don't turn out to be what we want to hear. There is simply no place for politics when it comes to making sure that the water that our families rely on is safe, and the homes that we live in are not at risk of a man-made disaster.

I look forward to learning more on this important issue, and with that, I yield back the balance of my time.

Chairman STEWART. Thank you, Mr. Swalwell.

Like you, I would love to explore that question of the impacts. Geological impacts of fracking, I think, would be something that would be obviously beneficial and I think the result would be, I think, positive as well in the sense of it would allow the country to continue towards energy independence.

With that, though, I now recognize Mr. Smith, the Chairman of the full Committee, for an opening statement.

Chairman SMITH. Thank you, Mr. Chairman.

First of all, before I start my opening statement, I do want to acknowledge the opening statements by the Ranking Members of the Energy and Environment Subcommittees because I thought they were very measured opening statements and we can look for ways to try to achieve the same goals.

It seems that each week there is more good news about the incredible benefits of the fracking energy revolution that is underway across America. Whether it is the manufacturing renaissance taking place in this country thanks to cheap natural gas, the creation of over one million jobs and counting, or the potential for liquefied natural gas exports to spur economic growth, the benefits of shale gas production can hardly be overstated.

The fracking process is turning out to be a way to achieve energy independence, strengthen our national security, and stimulate the economy, all with minimal impact to the environment.

However, some—however, the EPA has too often been complicit in an effort to try to undercut this new development. They have attempted to link fracking to water contamination in at least three cases, only to be forced to retract their statements after further scrutiny proved them to be unfounded. Their track record and bias makes the EPA's ongoing study of the relationship between hydraulic fracturing and drinking water resources even more troubling.

I am concerned that the EPA has failed to include a risk assessment as part of this study, instead choosing to simply identify potential risks without providing any context or consideration of their likelihood. This deficiency would significantly undermine the study's objectivity and ultimately impair its utility.

Recent Science Advisory Board reviewers have noted this deficiency as well. In comments last month on the EPA study, one reviewer stated, "There is no quantitative risk assessment included

in EPA's research effort. Thus, a reader has no sense of how risky any operation may be in ultimately impacting drinking water." This is a concern that I hope the EPA will address in today's hearing.

The Agency should base its work on sound science rather than regulatory ambition. However, if the Agency fails to do this, a legislative remedy may be warranted to address the study's deficiencies.

Thank you, Mr. Chairman, and I will yield back.

[The prepared statement of Mr. Smith follows:]

PREPARED STATEMENT OF FULL COMMITTEE CHAIRMAN LAMAR SMITH

It seems that each week there is more good news about the incredible benefits of the fracking energy revolution that is underway across America. Whether it's the manufacturing renaissance taking place in this country thanks to cheap natural gas, the creation of over one million jobs and counting, or the potential for liquefied natural gas exports to spur economic growth, the benefits of shale gas production can hardly be overstated.

The fracking process is turning out to be a way to achieve energy independence, strengthen our national security and stimulate the economy, all with minimal impact to the environment. However, some choose to ignore these benefits and instead focus on finding ways to restrain, if not stifle, the new development.

The EPA has too often been complicit in this effort. They have attempted to link fracking to water contamination in at least three cases, only to be forced to retract their statements after further scrutiny proved them to be unfounded.

Their track record and bias makes the EPA's ongoing study of the relationship between hydraulic fracturing and drinking water resources even more troubling. I am concerned that the EPA has failed to include a risk assessment as part of this study, instead choosing to simply identify potential risks without providing any context or consideration of their likelihood. This deficiency would significantly undermine the study's objectivity and ultimately impair its utility.

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The Agency should base its work on sound science rather than regulatory ambition. However, if the Agency fails to do this, a legislative remedy may be warranted to address the study's deficiencies.

Thank you and I yield back.

Chairman STEWART. Thank you, Mr. Chairman.

And if I could just reiterate your comments about Mr. Swalwell and Ms. Bonamici, that their efforts, a bipartisan effort, their goodwill and frankly their background and intelligence that they bring to these conversations is greatly appreciated. So thank you for recognizing that.

Chairman SMITH. Mr. Chairman, may I be recognized for one more quick comment?

Chairman STEWART. Yes, of course, Mr. Chairman.

Chairman SMITH. And that is just to apologize to our witnesses today. I am going to need to shuttle between this hearing and a markup in the Judiciary Committee, so I will be missing some important testimony but we will catch up later on.

Thank you, Mr. Chairman. I yield back.

Chairman STEWART. Yes, Mr. Chairman.

The Chair now recognizes the Ranking Member of the full Committee, Ms. Johnson, for an opening statement as well.

Ms. JOHNSON. Thank you, Mr. Chairman, and thanks to the Chairman and Ranking Members of these committees.

I am pleased that Energy and Environment Subcommittees are holding the hearing today and I welcome all of our distinguished panelists to the Committee.

Like so many others, I am concerned about the health and welfare of hardworking families who live around fracking facilities. Concerns about contamination of groundwater and drinking water have troubled us since the shale gas boom started over a decade ago. And of course that shale gas boom would likely not exist without critical research investments from the Department of Energy over 30 years ago to bring new natural gas online.

But as a number of fracking facilities operating in oil and gas in States have gone from hundreds to thousands, the number of reports from citizens complaining of contamination of their drinking water has increased. Excuse me. We must be careful not to sacrifice the quality of our natural water resources for the sake of cheaper gas.

We need clean water as much as we need affordable energy options. Our water resources are already stretched to support our industrial and our agricultural sectors and residential and commercial development. We cannot afford to contaminate the limited drinking water supplies that we have. Like so many of our hearings involving oil and gas industry, I expect that some of our colleagues across the aisle will not like anything that the EPA has to say about its progress in researching these issues, but it is in the best interest of everyone, especially the fracking industry, to resolve questions surrounding the fracking water cycle and impact on groundwater and drinking water.

In closing, I would like to again dispel the myth that because I expect it will be undoubtedly raised, that Democrats are mounting a war on oil and gas, that is simply not true. We simply recognize that our Nation is strengthened by both diversifying our energy supply and protecting public health. These go hand-in-hand. Americans have a right to clean water and a healthier environment. The gas will be there and it is up to the industry to make sure it can be produced in an environmentally sound manner.

Thank you and I yield back.

[The prepared statement of Ms. Johnson follows:]

PREPARED STATEMENT OF FULL COMMITTEE RANKING MEMBER EDDIE BERNICE JOHNSON

I am very pleased that the Energy and Environment Subcommittees are holding this hearing today, and I welcome all of our distinguished panelists to the Committee. Like so many others, I am concerned about the health and welfare of hardworking families who live around fracking facilities. Concerns about contamination of groundwater and drinking water have troubled us since the shale gas boom started over a decade ago. And of course, that shale gas boom would likely not exist without critical research investments made by the Department of Energy over 30 years ago to bring new natural gas online.

But, as the number of fracking facilities operating in oil and gas rich states has gone from hundreds to thousands, the number of reports from citizens complaining of contamination of their drinking water has increased. We must be careful not to sacrifice the quality of our natural water resources for the sake of cheaper gas. We need clean water as much as we need affordable energy options. Our water resources are already stretched to support our industrial and agricultural sectors, and residential and commercial development. We cannot afford to contaminate the limited drinking water supplies that we have.

Like so many of our hearings involving the oil and gas industry, I expect that some of my colleagues across the aisle will not like anything that the EPA has to say about its progress in researching these issues. But, it is in the best interest of everyone, especially the fracking industry, to resolve questions surrounding the fracking water cycle and the impact to groundwater and drinking water.

In closing, I would like to once again dispel the myth-because I expect that it will undoubtedly be raised—that the Democrats are mounting a war on oil and gas. We simply recognize that our nation is strengthened by both diversifying our energy supply AND protecting public health. These go hand in hand. Americans have a right to clean water AND a healthier environment. The gas will be there, and it is up to the industry to make sure it can be produced in an environmentally sound manner.

Thank you, and I yield back.

Chairman STEWART. Thank you, Ms. Johnson.

If there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

We now turn our attention to our witnesses, and I will introduce each of you just previous to your opportunity to speak and give your opening statements for five minutes.

Our first witness is Dr. Fred Hauchman, Director of the Office of Science Policy at EPA's Office of Research and Development. Dr. Hauchman has worked with EPA since 1985 in a variety of scientific and executive positions. He previously served as the Director of Microbiological and Chemical Exposure Assessment Research Division and is a Senior Scientist in EPA's Office of Air Quality Planning and Standards.

Dr. Hauchman received his Ph.D. from Johns Hopkins University. He is a senior official overseeing EPA's ongoing study of hydraulic fracturing and drinking water. And, Dr. Hauchman, welcome to the Committee. And you are now allowed five minutes for your opening testimony.

TESTIMONY OF DR. FRED HAUCHMAN,
DIRECTOR, OFFICE OF SCIENCE POLICY,
OFFICE OF RESEARCH AND DEVELOPMENT,
ENVIRONMENTAL PROTECTION AGENCY

Dr. HAUCHMAN. Thank you, and good morning, Chairman Lummis, Chairman Stewart, and other distinguished Members of the two Subcommittees. My name is Fred Hauchman and I am, as was stated, the Director of the Office of Science Policy within the Office of Research and Development at the U.S. Environmental Protection Agency. I appreciate this opportunity to talk with you today about the EPA's study of the potential impacts of hydraulic fracturing on drinking water resources with an emphasis on adherence to protocols, procedures, and other science policies that govern our research.

As the President has stated, oil and natural gas are important sources of energy, and these will continue to play a vital role in our Nation's energy future. The Administration has further emphasized that the extraction and development of these energy resources must be done safely, responsibly, and be guided by the best available science.

In 2010, Congress requested that EPA conduct a study of the relationship between hydraulic fracturing and drinking water resources. In response this request, the EPA designed a study that

covers the full hydraulic fracturing water cycle from the actual acquisition of the water through the ultimate treatment and disposal. The EPA's Science Advisory Board affirmed the study's scope and the research approaches that are being taken and found that it is responsive to the Congressional request.

In December of this past year, we released a progress report on the study, and in late 2014, we will issue a draft final report that will be presented to the Science Advisory Board for review and will also of course be available for public comment.

I would like to turn now to the important issue of scientific integrity. The EPA is committed to ensuring scientific integrity in its research and is conducting this study consistent with the Agency's Scientific Integrity Policy. As noted in the EPA's study plan, all agency-funded research projects must comply with the Agency's rigorous quality assurance requirements. We are following the six principles that were laid out by Congress when it requested EPA to conduct the study.

First, we are using the best available science. Under the direction of the EPA's senior scientific leadership, highly skilled teams of EPA's scientists are conducting research using state-of-the-art laboratories and methods. All the data analyses and literature reviews are using the highest-quality information that is available.

Second, we are incorporating independent sources of information into our research. EPA's scientists are gathering and analyzing data from the peer-reviewed literature, from state agencies, from industry, and from other sources to ensure that we have a thorough and current understanding of information relating to hydraulic fracturing.

Third, we are following a rigorous quality assurance protocol. All research associated with the study is conducted in accordance with the Agency's rigorous quality assurance program and meets the Office of Research and Development's requirements for the highest level of quality assurance. Each research project is guided by an approved and publicly available quality assurance project plan.

Fourth, we are engaging stakeholders at every level. This includes the public, industry, nongovernmental organizations, tribal representatives, and state, interstate, and Federal agencies. For example, we have conducted a series of technical workshops. These occurred in 2011, 2012, and we are conducting another round of expert workshops dealing with the technical issues pertaining to the study this very year. We have also solicited data and literature from stakeholders through the Federal Register.

Fifth, we are conducting the study in a transparent fashion. Throughout the course of this study from the very beginning, the EPA shared and will continue to share information with the public about our research procedures, the status of our work, and our findings. We have held numerous public information sessions, workshops, and roundtables, and we have posted extensive information on the EPA's website.

Sixth, we are committed to a thorough peer review. The EPA conducts its reviews in accordance with the Agency's peer review policy, EPA's peer review handbook, and the guidance provided by the Office of Management and Budget. The EPA is committed to this peer review of the report as a highly influential scientific as-

sessment and this review will be reviewed by the Science Advisory Board in 2014.

In conclusion, the EPA's study is a high-quality study, it is transparent, it is current, and it is peer-reviewed. It also is responsive to the request of Congress.

Thank you for the opportunity to be here with you today. I look forward to answering any questions you may have.

[The prepared statement of Mr. Hauchman follows:]

TESTIMONY

Fred S. Hauchman, Ph.D.
Director, Office of Science Policy
Office of Research and Development
U.S. Environmental Protection Agency

Joint Hearing on Lessons Learned: EPA's Investigations of Hydraulic Fracturing
before the
U.S. House of Representatives
Committee on Science, Space, and Technology
Subcommittee on Environment
Subcommittee on Energy
July 24, 2013

Good morning, Chairman Lummis, Chairman Stewart, and other distinguished members of the two Subcommittees. My name is Fred Hauchman, and I am the Director of the Office of Science Policy in the Office of Research and Development (ORD) at the U.S. Environmental Protection Agency (EPA).

I appreciate the opportunity to talk with you today about the EPA's work to study the potential impacts of hydraulic fracturing on drinking water resources, with an emphasis on adherence to protocols, procedures, and other science policies governing our research activities associated with the study.

Oil and natural gas are important sources of energy, among others, that will continue to play a vital role in our nation's energy future. As the President has stated, "Recent innovations have given us the opportunity to tap large reserves of natural gas in the shale under our feet. But just as is true in terms of us extracting oil from the ground, we've got to make sure that we're extracting natural gas safely, without polluting our water supply." The extraction and development of these energy sources must be done safely, responsibly, and be guided by the best available science.

The Study: Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

In its FY2010 Appropriations Committee Conference Report, Congress requested that the EPA study the relationship between hydraulic fracturing and drinking water, and to use the best available science and independent sources of information. The EPA is undertaking the study using a transparent, peer-reviewed process. We have engaged experts in developing our approach and we continue to consult with experts and stakeholders throughout the study.

In 2011, the EPA began research under its *Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*. The purpose of the study is to assess the potential impacts of hydraulic fracturing on drinking water resources, if any, and to identify the driving factors that may affect the severity and frequency of such impacts.

The scope of the proposed research includes the full hydraulic fracturing water cycle, from acquisition of the water, through the mixing of chemicals and injection of fluids, to the post-fracturing stage, including the management of flowback and produced water and its ultimate treatment and disposal. The EPA's Science Advisory Board (SAB), in their June 2010 review of the draft Study Plan, affirmed that the study scope and general research approaches proposed by the EPA were appropriate. The Study Plan, finalized on November 3, 2011, outlines fundamental research questions associated with each stage the hydraulic fracturing water cycle.

Study Progress Report and Synthesis Report

In December, 2012, the EPA released the *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources: Progress Report* to provide the public with the latest information on the work being undertaken as part of the research study. This report, which describes the progress that has been made to date, does not contain any findings. As such, it cannot be used to draw conclusions about

the potential impacts of hydraulic fracturing on drinking water resources. The EPA's synthesis of existing literature and data, in combination with laboratory studies, toxicity assessments, scenario evaluations (modeling), and case studies, will address the key research questions about the potential impacts of hydraulic fracturing on drinking water resources. The draft EPA report that synthesizes the results of these studies is expected to be released for peer review and public comment in late 2014.

Scientific Integrity

As noted in the EPA's Study Plan, all EPA-funded research projects must comply with the agency's rigorous quality assurance requirements. Individual projects, for example, are subjected to technical system and data quality audits, and all products will receive quality assurance reviews. The EPA is committed to ensuring scientific integrity in its research, and is conducting this study consistent with the agency's Scientific Integrity Policy[1] and with the six principles laid out by Congress when it requested that EPA conduct the study.

To that end, the EPA is conducting the study following these six principles. First, we are using the best available science. Highly skilled teams of EPA scientists and support staff are conducting rigorously designed research using state-of-the-art laboratories and methodologies. Data analyses and literature reviews are being conducted using the highest quality information available.

Second, we are incorporating independent sources of information in our research. In addition to conducting original research, EPA scientists are gathering and analyzing existing data from a wide variety of sources to ensure a thorough understanding of current information on hydraulic fracturing

[1] http://www.epa.gov/research/htm/scientific-integrity.htm

activities and to provide better context for the study findings. This includes data from State agencies, industry, federal agencies and other public sources.

Third, we are following rigorous quality assurance procedures in the study. All research associated with this study is conducted in accordance with the EPA's Quality Assurance Program for environmental data and is meeting ORD's requirements for the highest level of quality assurance. The study's Quality Management Plan establishes the overall quality assurance approach. Each research project is guided by an approved quality assurance project plan, which outlines the necessary quality assurance procedures, quality control activities, and other technical activities that will ensure the collection of accurate data. Results from every project will undergo a comprehensive quality assurance review before being released for peer review.

Fourth, we are engaging stakeholders at every level. This includes the public, industry, non-governmental organizations, tribal governments, and State, inter-state, and federal agencies. Stakeholder input is being considered as we conduct the study and develop the 2014 draft report.

Fifth, we are conducting the study in a transparent fashion. The EPA is communicating research procedures and providing status updates to the public, and will present findings along with underlying assumptions and any uncertainties associated with the final conclusions. The EPA has supported full transparency by holding public information sessions and by posting all quality assurance project plans online.

Sixth, we are committed to a thorough peer review. The EPA conducts its reviews in accordance with the agency's Peer Review Policy,[2] EPA's Peer Review Handbook,[3] and the guidance provided in OMB's Peer Review Bulletin.[4] The initial scoping plan, the draft Study Plan and the 2012 Progress Report were all reviewed by technical experts from the SAB. As a Highly Influential Scientific Assessment, the 2014 draft report will also receive meaningful and timely peer review by an SAB panel, with opportunities for public comment. The panel members will be briefed periodically as the research progresses to prepare them to conduct the peer review of the 2014 draft report.

In sum, this integrated approach of openness and scientific rigor is ensuring that the EPA study will provide the full range of policymakers with high quality, policy-relevant science that will inform their decision making.

Stakeholder Engagement

Stakeholder input has played, and will continue to play, an important role in the study. We have implemented a strategy that has provided many opportunities for exchange of information and input on the study design and the research as it progresses. The EPA has further enhanced the stakeholder process to ensure that experts in key areas, including cutting-edge industry technologies and practices, are being engaged to provide input on the EPA's research. Five technical roundtables were held in late 2012 on each stage of the water cycle, and a second round of expert workshops on important technical topics[5]

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[2] USEPA, Peer Review and Peer Involvement at the U.S. Environmental Protection Agency, January 31, 2006 http://www.epa.gov/peerreview/pdfs/peer_review_policy_and_memo.pdf
[3] USEPA. Peer Review Handbook, 3rd Edition, March 2006 http://www.epa.gov/peerreview/pdfs/peer_review_handbook_2012.pdf
[4] Office of Management and Budget, Memorandum: Issuance of OMB's "Final Information Quality Bulletin for Peer Review", December 16, 2004 http://www.whitehouse.gov/sites/default/files/omb/memoranda/fy2005/m05-03.pdf
[5] Analytical Chemical Methods; Well Construction/Operation and Subsurface Modeling; Wastewater Treatment and Related Modeling; Water Acquisition Modeling; and Case Studies.

began in February 2013. Information from these roundtables and workshops is being made widely available to the public through webinars and the hydraulic fracturing study website.[6]

In November 2012, the EPA published a *Federal Register* notice to solicit data and studies from stakeholders to inform the study. To ensure transparency, the information received (with the exception of confidential business information) is placed in the EPA docket so that it is accessible to everyone. The EPA has extended the period for submissions to November 2013 to help ensure that the most up-to-date information is available for the preparation of the 2014 draft report. We will continue to engage stakeholders by providing updates and receiving technical input as the research progresses.

Coordination with Other Federal Agencies

The EPA has been actively consulting with several key federal agencies regarding this important research. The EPA, the Department of Energy (DOE) and the US Geological Survey (USGS) routinely exchange information regarding research plans and current activities. Exchanges among the principal investigators, in addition to high level discussions, help to assure that scientific details about the work are shared and can be used to help inform work underway by others. DOE's National Energy Technology Laboratory, for example, recently briefed EPA on the progress of their work in hydraulic fracturing. In addition, DOE and USGS are among those participating in our technical workshops.

Conclusion

In conclusion, the President believes the prudent development of our oil and natural gas resources can make a critical contribution to meeting our nation's energy needs. I am proud to be part of the research effort that will help enable the development of these resources in a way that protects the human health

[6] www.epa.gov/hfstudy

and the environment while providing the benefits of these important energy sources. We are pursuing this work with the best available science and the highest level of transparency. This study will continue to be conducted through a transparent, peer-reviewed process in consultation with other federal agencies, appropriate State and inter-state regulatory agencies, and with input from industry, non-governmental organizations, tribal governments, and other stakeholders. As you have heard today, we will continue to collaborate with our federal partners and work with our stakeholders to address the highest priority challenges to safely and prudently develop unconventional gas and oil resources.

I look forward to keeping this Committee updated on our progress, and thank you for the opportunity to appear before you today. I am happy to take any questions you may have at this time.

July, 2013

BIO
Dr. Fred S. Hauchman

Fred Hauchman has worked for the U.S. Environmental Protection Agency since 1985 in a variety of scientific and executive leadership positions. He is currently director of the Office of Science Policy (OSP) within EPA's Office of Research and Development (ORD) in Washington, DC. OSP is ORD's lead organization for the integration of scientific and technical information into Agency decisions. His office also coordinates ORD's Regional Science Program and several other ORD science activities. Fred previously served as the director of ORD's Microbiological and Chemical Exposure Assessment Research Division, as the ORD National Program Director for Drinking Water Research, and as a senior scientist in EPA's Office of Air Quality Planning and Standards. In addition, Fred has worked internationally on projects relating to water quality and risk assessment. He received his M.S. in Public Health from the University of North Carolina, and his Ph.D. in environmental sciences from the Johns Hopkins University.

Chairman STEWART. Thank you, Dr. Hauchman. And we look forward to addressing some of your statements and following up with that as well.

Our second witness today is Dr. David Dzombak, Chair of EPA's Science Advisory Board's Hydraulic Fracturing Research Advisory Panel, which recently provided feedback to the Agency on its ongoing hydraulic fracturing study and will review the completed study in late 2014.

Dr. Dzombak is also the head of the Department of Civil and Environmental Engineering at Carnegie Mellon University. In addition to his current capacity, Dr. Dzombak has been part of EPA's National Advisory Council for Environmental Policy and Technology and the National Research Council. He received his Ph.D. from MIT. Dr. Dzombak, then, your testimony.

TESTIMONY OF DR. DAVID A. DZOMBAK, CHAIR, ENVIRONMENTAL PROTECTION AGENCY SCIENCE ADVISORY BOARD, HYDRAULIC FRACTURING RESEARCH ADVISORY PANEL

Dr. DZOMBAK. Good morning. Chairman Stewart, Ranking Member Bonamici, Chairman Lummis, Ranking Member Swalwell, distinguished Subcommittee Members, ladies and gentlemen, thank you for the opportunity to testify before both Subcommittees.

I am Dave Dzombak, Professor and Head of the Department of Civil and Environmental Engineering at Carnegie Mellon University. My teaching and research is focused in water quality engineering and science. I have also been continuously engaged in professional and public service, including service on the EPA's Science Advisory Board in various roles since 2002. I am Chair of the SAB Hydraulic Fracturing Advisory Panel. This is an ad hoc panel formed by the SAB staff in response to a request from the EPA Office of Research and Development for peer review of their study.

As requested in your invitation, I will provide some background on the SAB, the role the SAB and the advisory panel with respect to the EPA's study, panel activities to date, and our plans for future activities. I should emphasize that my testimony I speak for myself and not for the advisory panel members, the chartered SAB, or SAB management and staff.

Congress established the SAB in 1978 and gave it a broad mandate: to advise the Agency on scientific and technical matters. The EPA Administrator appoints members to the chartered SAB, which conducts its work using subcommittees or ad hoc panels of chartered SAB members augmented with additional experts. The SAB is subject to and operates under the regulations of the Federal Advisory Committee Act, or FACA.

The SAB has been involved with providing scientific peer review and expert advice since the beginning of the EPA research study. This has included review of the research scoping plan in 2010 and the detailed research study plan in 2011. I chaired both of these reviews, which were conducted by two different panels. Both resulted in consensus advisory reports that were submitted to the Administrator after review by the chartered SAB.

For the December 2012 progress report, EPA requested a consultation and the current panel was formed. An SAB consultation is an opportunity for EPA to hear from individual experts and does not require consensus among the experts, nor preparation of a detailed report. After a consultation occurs, a compilation of individual expert comments from SAB panel members is often developed for the Agency's consideration.

The SAB anticipates that the Agency will submit a scheduled 2014 report of research study results for peer review. At that time, the panel will conduct a review organized around charge questions, consider public comment, and develop a written report for review by the chartered SAB. Each of these steps will be conducted at open meetings.

The advisory panel has 31 members and is the largest SAB panel ever formed. The panel has at least three experts in each of nine areas of expertise identified by the SAB staff as needed considering the activities included in the final study plan. The members of the panel represent a balance of industrial, academic, nongovernment, and government experts.

During our May 2013 consultation meeting, panel members provided their individual expert comments on 12 charge questions covering five—the five major stages of the hydraulic fracturing water cycle. Seven members of the public presented oral statements at the beginning of the meeting and two presented clarifying oral statements at the end. Written public comments were submitted by 13 individuals or organizations for consideration by the panel, and all these submitted comments were posted promptly to the SAB website.

There will be additional opportunities for the advisory panel to consider new and emerging information related to the hydraulic fracturing research study. The panel plans to hold a teleconference in fall 2013 to discuss such information. As I noted previously, our panel will be in place to conduct peer review of EPA's 2014 report.

I thank both Subcommittees again for the opportunity to testify. In closing, I would like to note that EPA reached out early to the SAB for scientific peer review of the hydraulic fracturing research study. The engagement has continued since initiation of the research and it is my understanding that EPA plans to continue the engagement in their review of research products. I will do my best as Chair to ensure in-depth, very high-quality, and transparent peer review.

[The prepared statement of Mr. Dzombak follows:]

TESTIMONY OF
DAVID A. DZOMBAK
BEFORE THE
SUBCOMMITTEE ON ENVIRONMENT AND THE SUBCOMMITTEE ON ENERGY
OF THE
HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

JOINT HEARING ON
LESSONS LEARNED: EPA'S INVESTIGATIONS OF HYDRAULIC FRACTURING

JULY 24, 2013

Good morning Chairman Stewart, Ranking Member Bonamici, Chairman Lummis, Ranking Member Swallwell, Distinguished Subcommittee Members, Ladies and Gentlemen. Thank you for the opportunity to testify before both subcommittees. I am Dave Dzombak, the Walter J. Blenko, Sr. University Professor and Head of the Department of Civil and Environmental Engineering at Carnegie Mellon University. I am in my 25th year on the faculty at Carnegie Mellon. My teaching and research is focused in water quality engineering and science, and I have worked on a wide range of topics in this domain as a researcher and consultant. I have also been continuously engaged in professional and public service, including professional society service and editorial service for professional journals; service on various state and regional committees; and service for several federal agencies, including the U.S. Environmental Protection Agency (EPA). I served as a member of the Environmental Engineering Committee of the EPA Science Advisory Board (SAB) from 2002-2007, Chair of the Committee from 2007-2010, and since 2007 I have been a member of the Chartered SAB. I also served on the Environmental Technology Subcommittee of the EPA National Advisory Council for Environmental Policy and Technology from 2004-2008. In addition, I am a member of the National Academy of Engineering, and have served on and chaired a number of committees of the National Research Council, the research division of the National Academies.

I am Chair of the SAB Hydraulic Fracturing Advisory Panel. This is an ad hoc panel formed by the SAB staff in response to a request from the EPA Office of Research and Development for peer review of research progress and products from their Congressionally-requested study of the relationship of hydraulic fracturing and drinking water resources. In the July 16 invitation letter

from Chairman Stewart and Chairman Lummis, I was asked to address four specific topics. I have organized my testimony to address these topics.

I should emphasize that in my testimony I speak for myself and not for the Hydraulic Fracturing Advisory Panel members, the Chartered SAB, or SAB management and staff.

Role of the Science Advisory Board Hydraulic Fracturing Research Advisory Panel

Discuss the role of the Science Advisory Board's Hydraulic Fracturing Research Advisory Panel in reviewing, commenting on, and otherwise assessing the EPA's ongoing study of hydraulic fracturing. This should include an explanation of the relationship between the Panel, the SAB, and the Agency, as well as the roles and responsibilities of the Panel relative to the study and a timeline of review-related activities.

Relationship between the Panel, the SAB, and the Agency

Congress established the EPA Science Advisory Board in 1978 and gave it a broad mandate to advise the Agency on scientific and technical matters. The EPA Administrator appoints members to the Chartered SAB. The Chartered SAB often conducts its work using subcommittees, sometimes augmented with additional experts, or panels composed of SAB members and additional experts or consultants. All such groups report to the Chartered SAB, and are chaired by Chartered SAB members. Authority to approve and transmit advice to the EPA Administrator lies solely with the Chartered SAB. The SAB is subject to and operates under the regulations of the Federal Advisory Committee Act (FACA).

The SAB has been involved with providing scientific peer review and expert advice since the beginning of the EPA research study. This has included review of the research scoping plan in 2010 and the detailed research study plan in 2011. The SAB Environmental Engineering Committee augmented with other SAB members reviewed the research scoping plan in 2010, and the SAB formed a new ad hoc panel to review the research study plan. I chaired both of these reviews, and both resulted in consensus advisory reports that were submitted to the Administrator after review by the Chartered SAB. The EPA requested a consultation for the December 2012 Progress Report, for which the current Advisory Panel was formed by the SAB.

An SAB consultation is an opportunity for EPA to hear from individual experts and does not require consensus among the experts nor preparation of a detailed report. After a consultation meeting occurs, a compilation of individual expert comments from SAB Panel members is often developed for the Agency's consideration. Although individual members may prepare written comments, let me emphasize that this is not consensus advice and no report is prepared for consideration by the Chartered SAB. A brief letter is sent to the EPA Administrator for notification that the consultation was held.

The review conducted by the Chartered SAB on draft SAB reports is called a "quality review," which focuses on the quality, technical accuracy and clarity of the report. The quality review occurs in a separate public meeting, and is guided by four questions: a) Were the charge questions to the SAB committee or panel adequately addressed; b) Are there any technical errors or omissions or issues that are not adequately dealt with in the draft report; c) Is the draft report clear and logical; and d) Are the conclusions drawn or recommendations provided supported by the body of the draft report. As with panel meetings, Chartered SAB members usually prepare written pre-meeting comments that address the quality review questions. Members' review comments are posted to the SAB website.

During the SAB advisory process, representatives of EPA offices provide review documents for the SAB's consideration, and specific charge questions for which SAB response is requested. Agency representatives also provide briefings on scientific issues. They are a resource for the panel members, and answer questions about the work being reviewed. However, Agency personnel are not involved with preparation of an SAB advisory report; the SAB is independent in its evaluations and guards this independence scrupulously. The Agency is provided an opportunity to request technical corrections (errors of fact) or clarification of text in draft reports. Requests from the Agency for such clarifications or corrections must be made in writing and are posted to the SAB website. The SAB Staff Designated Federal Officer may request additional information from the Agency on behalf of the panel, and this information also is part of the public record.

The SAB anticipates that the Agency will submit the scheduled 2014 report of research study results for peer review. At that time the SAB will address charge questions, review the document, and develop a written report after deliberations by the Advisory Panel, opportunity for public comment, and a review by the Charted SAB before advice is provided to the Administrator. Each of these steps will be conducted at open meetings or teleconferences in accordance with FACA.

Roles and Responsibilities of the Panel relative to EPA's Hydraulic Fracturing Research, and Timeline for Panel Activities

EPA requested an SAB consultation on EPA's December 2012 "Progress Report: Potential Impacts of Hydraulic Fracturing on Drinking Water Resources." The SAB formed an advisory panel with appropriate expertise. The SAB announced in March 2013 the Hydraulic Fracturing Research Advisory Panel and conducted a consultation on the December 2012 Progress Report on May 7-8, 2013.

The Advisory Panel plans to hold a teleconference in Fall 2013 to discuss new and emerging information related to hydraulic fracturing and drinking water resources. The SAB Staff Office will follow the standard procedure to provide notice in the Federal Register on the SAB's website describing the logistics and venue for this teleconference.

I understand that EPA plans to develop a complete report of initial results of its research on the potential impacts of hydraulic fracturing on drinking water resources by December 2014 and request a peer review of this report. After receiving the report, I anticipate that it will take 10 months to one year before a final, consensus SAB Report is completed and subjected to quality review by the Chartered SAB. The Panel may also provide advice on other technical documents and issues related to the EPA study upon further request by EPA.

SAB Hydraulic Fracturing Research Advisory Panel Formation and Panel Member Information

The Advisory Panel was formed by the SAB Staff Office. SAB members do not participate in the selection of Panel members. Questions about Panel formation should be directed to the SAB Staff Office. The SAB Staff Office announced the SAB Hydraulic Fracturing Research

Advisory Panel on March 21, 2013.

The Advisory Panel has 31 members and is the largest SAB panel ever formed. The members of the Panel represent a balance of industrial, academic, non-government, and government experts.

The Panel has at least three experts in each of the following nine areas of expertise that were identified by the SAB staff as needed considering the activities included in the final Study Plan: Petroleum/Natural Gas Engineering; Petroleum/Natural Gas Well Drilling; Hydrology/Hydrogeology; Geology/Geophysics; Groundwater Chemistry/Geochemistry; Toxicology/Biology; Statistics; Civil Engineering; and Waste Water and Drinking Water Treatment.

The Panel comprises eight current employees of companies and consulting firms; two government employees; and 21 academics/university professors (including some previously employed in industry).

The eight Panel members who are currently employed by industry have a collective total of 218 years working in industry or consulting (average of 27 years experience each). Ten other Panel members have significant industry experience (i.e., at least two or more years working as industry employees or as full-time consultants). These ten members have a collective total of 61 years working in industry or consulting (i.e., an average of 6 years experience each).

May 2013 SAB Consultation on EPA's Hydraulic Fracturing Research Progress Report
Explain and discuss the consultation that took place between the Panel, the full SAB, and the Agency in May of 2013 with respect to the EPA Progress Report: Potential Impacts of Hydraulic Fracturing on Drinking Water Resources – December 2012. Please summarize the interactions that took place, the review mechanisms and processes that were undertaken, and the nature of the review.

During 2012, prior to release of the Progress Report, EPA requested the SAB to conduct a consultation on the research described in the report. An SAB consultation is a mechanism for

SAB Panel members to provide their individual expert comments for the Agency's consideration early in the implementation of a project or action. A consultation does not require consensus among the committee members nor preparation of a detailed report.

The SAB conducted the consultation at a public meeting in Arlington, VA on May 7 and 8, 2013. The meeting provided opportunity for individual members of the Advisory Panel to hear public comment, listen to EPA staff briefings, and provide their individual expert oral comments on charge questions associated with the research described in EPA's December 2012 Progress Report, as well as an opportunity for members of the public to provide oral and written comments for the Panel's consideration.

All materials and presentations from the May 7-8, 2013 meeting are posted on the SAB meeting website: http://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/928483abb4f2a13285257b02004ab250!OpenDocument&Date=2013-05-07.

The SAB used several approaches to ensure the May 7-8, 2013 consultation meeting of the Panel was open to the public. Members of the public could attend the meeting, call into the meeting via teleconference, or follow the meeting via a live webcast with audio and visual feed from the meeting.

During the May 7-8, 2013 consultation meeting, the individual members of the SAB Hydraulic Fracturing Research Advisory Panel provided their individual expert comments on the 12 charge questions covering the five major stages of the hydraulic fracturing water cycle: water acquisition, chemical mixing, well injection, flowback and produced water management, wastewater treatment and disposal. Lead discussants were assigned by the Chair and DFO to facilitate the discussions, as identified in the Agenda for the meeting. The Panel did not seek to identify points of agreement or consensus advice. After the meeting, individual written comments were prepared by Panel members wishing to do so. These comments were compiled and posted on SAB's website. All Panel members were encouraged to provide individual written

comments responding to the charge questions and any other issues they identified in the Progress Report.

Seven members of the public presented oral statements at the beginning of the May 7, 2013 meeting, and two members of the public presented clarifying oral statements at the end of the May 8, 2013 meeting.

Six sets of written public comments for consideration by the SAB Hydraulic Fracturing Research Advisory Panel were received prior to the May 7-8, 2013 meeting. Seven sets of written public comments for the Panel's consideration were received after the start of the May 7-8, 2013 meeting. All submitted comments were posted promptly to the SAB website.

A letter was sent to the EPA Acting Administrator on June 27, 2013, notifying him that the May 2013 consultation meeting occurred.

Minutes of the May 2013 consultation meeting are being developed in accordance with requirements under FACA and will be posted on SAB's website when final.

Chairman Stewart sent a letter to Dr. David Allen, SAB Chair, and me on May 2, 2013, requesting that the SAB Hydraulic Fracturing Research Advisory Panel address thirteen specific questions related to EPA's ongoing research related to the potential effects of hydraulic fracturing on drinking water resources. Chairman Stewart's letter was provided to the Advisory Panel, and was placed on SAB's website prior to the Panel's May 7-8, 2013 meeting. The Panel members also received a copy of the SAB May 31, 2013 response to Chairman Stewart's letter. In the May 31 response to this letter, the SAB noted that the Panel members will have opportunity to consider these questions independently. Future meetings of the Panel are planned to consider new and emerging information related to the EPA study, including the May 2nd letter, and the SAB will provide notice in the Federal Register and on the SAB website about all future meetings of the Panel. Plans are in development for the Panel to hold a teleconference in Fall 2013.

Compilation of Individual Comments from Members of the SAB Panel

Explain the report on the consultation that was released by the Science Advisory Board on June 25, and summarize any comments, key findings, or details.

A compilation of individual comments on the December 2012 Progress Report from members of the SAB Hydraulic Fracturing Research Advisory Panel was released on June 25, 2013, and is available on SAB's website:
http://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/928483abb4f2a13285257b02004ab250!OpenDocument&Date=2013-05-07
These are comments from individual members of the Panel. The Panel did not deliberate toward a consensus among the committee members, did not develop materials that can be construed as a product of the Panel, nor did the Panel present a product to the Chartered SAB for consideration.

Next Steps for the Panel

Discuss what the Panel's next steps will be in this process and explain the Panel's responsibilities with regard to the final study due out next year.

There will be additional opportunities for the SAB Hydraulic Fracturing Research Advisory Panel to consider new and emerging information related to the EPA hydraulic fracturing research study. The Panel plans to hold a teleconference in Fall 2013 to discuss such information. The SAB Staff Office will provide notice in the Federal Register and on SAB's website on the logistics for this meeting of the Panel.

The Panel anticipates receiving the Agency's draft report of results in late 2014. The same Advisory Panel will be in place to conduct peer review on EPA's 2014 report. At that time the SAB Staff Office will schedule an advisory meeting for the panel in 2015 to respond to charge questions related to the Agency's research results and to develop a panel draft peer review report.

The SAB will issue a peer review report through the Chartered SAB that will include the SAB's advice on EPA's 2014 report.

Any meetings or teleconferences of the SAB Hydraulic Fracturing Research Advisory Panel and Chartered SAB regarding its review and advice on EPA's research on the potential impacts of hydraulic fracturing on drinking water resources will occur in a public forum and follow the procedures required by FACA to keep the public informed.

Public and Stakeholder Confidence in the EPA Study

Based on your experience chairing the Panel to review the EPA study, please provide your recommendations on how EPA can best ensure public and stakeholder confidence in the design, methods, and associated scientific findings related to its ongoing study of hydraulic fracturing and drinking water resources. Additionally, please comment specifically on whether or not you believe that EPA's study of hydraulic fracturing should ensure that identification of the possible impacts of hydraulic fracturing on drinking water resources be accompanied by a corresponding analysis of risk based on probability and consequence, taking into account the current risk management practices of industry and the states.

I cannot speak for the Chartered SAB or the SAB Hydraulic Fracturing Research Advisory Panel regarding recommendations associated with EPA's research on the potential impacts of hydraulic fracturing on drinking water resources. As Chair of the Panel, it would be inappropriate for me offer personal views of the EPA study. However, I can offer the following observations of fact regarding process.

EPA has conducted a number of outreach efforts to ensure public and stakeholder confidence in its research. It would be appropriate for EPA, and not me, to provide more details on these efforts.

EPA has engaged the SAB and entered a transparent and public process to develop the scientific and technical information needed to complete the study. This public process encourages public discourse to identify and address issues. Earlier in my testimony I outlined the SAB efforts to convene a panel that:

- encompasses a broad range of professional expertise and background;

- includes a balance of industrial, academic, non-government, and government representatives across the needed disciplines; and
- includes members who have very strong credentials and who serve on the highest levels of industry and government committees and leadership positions within their professional associations.

Inclusion of Risk Analysis in the EPA Study

Please comment specifically on whether or not you believe that EPA's study of hydraulic fracturing should ensure that identification of the possible impacts of hydraulic fracturing on drinking water resources be accompanied by a corresponding analysis of risk based on probability and consequence, taking into account the current risk management practices of industry and the states.

I cannot speak for the Chartered SAB or the SAB Hydraulic Fracturing Research Advisory Panel regarding recommendations associated with EPA's research on the potential impacts of hydraulic fracturing on drinking water resources. As Chair of the Panel, it would be inappropriate for me offer personal views of the EPA study. I would note, however, that EPA finalized its Study Plan, which included consideration of various risks, after considering SAB advice on its draft Study Plan. Various risk topics were discussed in the March 2011 advisory meeting on the Study Plan and in the course of the May 2013 consultation. The Advisory Panel has had and will continue to have opportunities to opine on risk issues pertaining to the EPA study.

Concluding Remarks

I thank both subcommittees again for the opportunity to testify today and explain the role of the Science Advisory Board in providing scientific peer review and expert advice to EPA. In concluding I would like to note that EPA reached out early to the SAB for scientific peer review of the hydraulic fracturing research study, the engagement has continued since the initiation of the research, and it is my understanding that EPA plans to continue the engagement in the review of research products. I will do my best as Chair to ensure in-depth, very high quality, and transparent peer review.

DAVID A. DZOMBAK, Ph.D., P.E., BCEE, NAE

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Dr. Dzombak is the Walter J. Blenko, Sr. University Professor and Head of the Department of Civil and Environmental Engineering at Carnegie Mellon. The emphasis of his research and teaching is on water quality engineering, environmental remediation, and energy-environment issues. At Carnegie Mellon he also has served as Associate Dean for Graduate and Faculty Affairs for the College of Engineering (2006-2010), as Director of the Steinbrenner Institute for Environmental Education and Research (2007-2013), and as Interim Vice Provost of Sponsored Programs (November 2012-July 2013).

Dr. Dzombak received his Ph.D. in Civil Engineering (environmental engineering focus) from the Massachusetts Institute of Technology in 1986. He also holds an M.S. in Civil Engineering (1981, environmental engineering focus) and a B.S. in Civil Engineering (1980) from Carnegie Mellon, and a B.A. in Mathematics from Saint Vincent College (1980). He is a registered Professional Engineer in Pennsylvania, a Board Certified Environmental Engineer by the American Academy of Environmental Engineers and Scientists, and a member of the National Academy of Engineering.

Dr. Dzombak's research and professional interests include: aquatic chemistry; fate and transport of chemicals in water, soil, and sediment; water and wastewater treatment; in situ and ex situ soil and sediment treatment; hazardous waste site remediation; abandoned mine drainage remediation; river and watershed restoration; energy and environment; population and environment; and public communication of environmental engineering and science. He has published numerous articles in leading environmental engineering and science journals; book chapters; articles for the popular press; and three books. He also has a wide range of consulting experience.

His professional service activity has included the EPA Science Advisory Board (Chartered SAB, 2007-present; Environmental Engineering Committee, 2002-2010); the EPA National Advisory Council for Environmental Policy and Technology, Environmental Technology Subcommittee (2004-2008); the National Research Council (various committees, 2000-present); Associate Editor of *Environmental Science & Technology* (2005-2012); Editorial Board of *Water Environment Research* (1993-1998) and *Ground Water* (1991-1993); Chair, Board of Directors, AEESP Foundation (2012-present); Board of Directors and Officer (Treasurer) of the Association of Environmental Engineering and Science Professors (1996-1999); chair of committees for the American Academy of Environmental Engineers, American Society of Civil Engineers, and Water Environment Federation; and advisory committees for Allegheny County and the Commonwealth of Pennsylvania. He also has served in various advisory roles for Saint Vincent College since 1990, and was elected to the Board of Directors in 2012.

Dr. Dzombak was elected to the National Academy of Engineering in 2008. Other recognitions include election as Fellow of AEESP (2013), the Water Environment Federation (2012), and the American Society of Civil Engineers (2002); an honorary Doctor of Science degree from Saint Vincent College (2010); Professional Research Award from the Pennsylvania Water Environment Association (2002); Jack Edward McKee Medal (2000) and the Harrison Prescott Eddy Medal (1993) from the Water Environment Federation; Aldo Leopold Leadership Program Fellowship from the David and Lucile Packard Foundation (2000); Distinguished Lecturer Award (2011) and Distinguished Service Award (1999) from AEESP; Walter L. Huber Civil Engineering Research Prize from the American Society of Civil Engineers (1997); and National Science Foundation Presidential Young Investigator Award (1991).

Chairman STEWART. Thank you, Dr. Dzombak.

Our third witness is Mr. John Rogers, Associate Director of the Division of Oil, Gas, and Mining at the Utah Department of Natural Resources. Mr. Rogers manages the petroleum section that permits, monitors, and regulates oil and gas production in Utah. He has 15 years of experience in oil and gas exploration, reservoir analysis, and economic analysis of oil and gas fields. Mr. Rogers received his MS and MBA from Brigham Young University.

Mr. Rogers.

TESTIMONY OF MR. JOHN ROGERS,
ASSOCIATE DIRECTOR,
OIL AND GAS, DIVISION OF OIL,
GAS, AND MINING,
UTAH DEPARTMENT OF NATURAL RESOURCES

Mr. ROGERS. Good morning, Chairman Stewart, Chairman Lummis, and Members of the Subcommittee. As was stated, my name is John Rogers and I am the Associate Director of the Division of Oil, Gas, and Mining in the State of Utah. The division manages permitting, regulation, and monitoring of oil and gas drilling, Class II injection wells, and oil and gas disposal facilities in Utah. This includes hydraulic fracturing, which we have regulated for many years, which is the primary focus of this hearing.

Hydraulic fracturing has been an operational practice for completing and stimulating oil and gas wells in Utah since the early 1960s. In all the historical records of the division, there has never been a verified case of hydraulic fracturing in causing or contributing to contamination of water resources. The division has always had very stringent rules concerning wellbore construction and the protection of water resources.

However, to make the process of hydraulic fracturing more transparent and alleviate the recent public fear of hydraulic fracturing, the division has adopted a formal hydraulic fracturing rule in October of 2012. This rule combined many of the division's current existing rules concerning overall best management practices for oil and gas production as related to safe and efficient operations, as well as public disclosure of chemicals used in the hydraulic fracturing process.

There are three major concerns that have come to the forefront concerning hydraulic fracturing. The BLM has presented these in their proposed rule and Utah has addressed them historically and with their current new rule. The first is provide public disclosure of chemicals used in hydraulic fracturing; secondly, include regulations to ensure wellbore integrity; and third, to address issues related to flow-back water.

First, public disclosure, the Utah rule requires operators to report to fracfocus.org within 30—within 60 days of completion of a hydraulic fracturing operation of the chemicals used in this process. The primary purpose of fracfocus.org is to provide factual information concerning hydraulic fracturing and groundwater protection. FracFocus is a national hydraulic fracturing chemical registry accepted by both industry and government. It is managed by the Ground Water Protection Counsel and the Interstate Oil and Gas

Compact Commission, two organizations whose missions revolve around conservation and environmental protection.

The site was created to provide the public access to reported chemicals used for hydraulic fracturing at specific well sites. To help users put this information into perspective, the site also provides objective information on hydraulic fracturing, the chemicals used, and the purpose they serve, and the means by which groundwater is protected. This reporting process that the division uses is also the same method proposed by the BLM rule.

Secondly, wellbore integrity, existing rules were already in place to ensure wellbore integrity and construction. This includes detailed rules on casing and cementing programs, blowout prevention and uncontrolled flow, protection of freshwater aquifers, and casing pressure tests.

Utah's hydraulic fracturing rule emphasizes the use of already existing rules that have managed oil and gas production in Utah for many years. The regulatory process of the division are effective in ensuring the responsible development of Utah's resources with due regard for and protection of the environment. This begins with wellbore integrity. The staff at DOGM, which we refer to the Division of Oil, Gas, and Mining, has local knowledge and expertise to address the technical and scientific challenges proposed by Utah's unique geology and geography.

Onsite inspections of oil and gas wells are a key component of the division's regulatory program. All wells drilled on the site, on the State or private lands in Utah are subject to rigorous inspection programs that include inspection and witnessing of well-control equipment, casing and cementing operations, follow-up to third-party complaints, and general compliance verification. In 2012, 8,983 such onsite inspections were performed by the division.

Finally, management of flow-back water and service protection, the division rule states the operator shall take all reasonable precautions to avoid polluting lands, streams, lakes, reservoirs, natural drainages, and underground water. Prior to any drilling operation, all drill sites have onsite inspections and are analyzed for surface conditions and best practices are employed to prevent any contamination of surface water or groundwater.

The division's board has recently approved a new rule July 1, 2013, entitled "Waste Management and Disposal." These rules update methods and restraints for disposal of RCRA-exempt waste from oil and gas production. This would include the management of hydraulic fracturing fluid flow-back.

Utah's production water is disposed of by two methods. The first is underground injection wells, which 94 percent of the water is included into those injection wells, which we have a primacy from the EPA; and secondly, evaporative disposal ponds. These are in very detailed rules and controlling these disposal ponds, and so between those two methods, we feel we control the surface and subsurface.

Finally, I believe our Federal and state interaction with the division has worked very well with Federal agencies with concerns spacing, flaring, and split estates. However, there has been no collaboration concerning hydraulic fracturing. The division believes that a statewide standard is defined by the divisions hydraulic

fracturing rule would be beneficial rather than several regulations, as proposed.

Those are my statements.

[The prepared statement of Mr. Rogers follows:]

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John C. Rogers

Associate Director of The Division of Oil, Gas and Mining for The State of Utah

July 24, 2013

My name is John Rogers and I am the Associate Director of the Division of Oil, Gas and Mining for the State of Utah (DOGM). The Division manages the permitting, regulation and monitoring of oil and gas drilling, Class II UIC injection wells and oil and gas disposal facilities in Utah. This includes hydraulic fracturing which it has regulated for many years, which is the primary purpose of this hearing.

Hydraulic fracturing (HF) has been an operational practice for completing and stimulating oil and gas wells in Utah since the 1960's. State government regulation of the oil and gas industry commenced with creation of the Utah Oil and Gas Conservation Commission in 1955. In all of the historical records of DOGM, there has never been a verified case of hydraulic fracturing causing or contributing to contamination of water resources. The Division has always had very stringent rules concerning well bore construction and the protection of water resources. However, to make the the process of hydraulic fracturing more transparent and alleviate the recent public fear of hydraulic fracturing, the Division adopted a formal hydraulic fracturing rule in October 2012. This rule combined many of the Division exiting rules concerning overall best management practices for oil and gas production as related to safe and efficient operations, as well as a public disclosure of chemicals used in the hydraulic fracturing process.

There are three major concerns that have come to the forefront concerning hydraulic fracturing. The BLM has presented these in their proposed rule and Utah has also addressed them historically and with their current hydraulic fracturing rule.

(1) Provide public disclosure of chemicals used in hydraulic fracturing

(2) Include regulations to insure well-bore integrity

(3) Address issues related to flowback water

PUBLIC DISCLOSURE

The Utah rule requires operators to report to fracfocus.org within 60 days of completion of the hydraulic fracturing operation of the chemicals used in the process. The primary purpose of fracfocus.org is to provide factual information concerning hydraulic fracturing and groundwater

protection. FracFocus is the national hydraulic fracturing chemical registry accepted by both industry and government. It is managed by the Ground Water Protection Council (GWPC) and the Interstate Oil and Gas Compact Commission (IOGCC), 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 at specific well locations. 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.

This reporting process that The Division uses and is also proposed by the BLM rule.

WELL BORE INTEGRITY

Existing rules were already in place to insure well bore integrity and construction. This included detailed rules on:

- Casing and cementing programs
- Blowout prevention and uncontrolled flow
- Protection of freshwater aquifers
- Casing pressure tests

The Utah hydraulic fracturing rule emphasizes the the use of already existing rules that have manage oil and gas production in Utah for many years. The regulatory processes of The Division (that include permitting, inspection, compliance, and enforcement) are effective in ensuring the responsible development of Utah's resources with due regard for and protection of the environment. This begins with well bore integrity. The professional staff of DOGM has the local knowledge and expertise to address the technical and scientific challenges posed by Utah's unique geology and geography. A nationwide process of hydraulic fracturing rulemaking would be no more effective in achieving better oversight of hydraulic fracturing operations than exits at the state level in Utah and other states with similar rules. In addition, substantial cost of manpower and time for both government and the private sector organizations would be incurred.

On-site inspection of oil and gas wells are a key component of The Division's regulatory program. All wells drilled on state or private lands in Utah are subject to a rigorous inspection program that includes: inspection and witnessing of well control equipment tests, casing/cementing operations, follow up to third party complaints, general compliance verification, drilling operations, emergency response, final land restoration/bond release, well plugging, production/environmental, and workover/recompletion. In 2012, 8,983 such on-site inspections were performed by DOGM field operations staff.

Through a detail and very comprehensive geologic study, the depth to the usable ground water has been mapped in the primary oil and gas producing area of Utah, the Uintah Basin. Recognizing the usable water and its protection is the primary concern when developing a casing program for a potential well.

MANAGEMENT OF FLOWBACK WATER AND SURFACE PROTECTION

The Division's rules state that the operators shall take all reasonable precautions to avoid polluting lands, streams, lakes, reservoirs, natural drainages and underground water. Prior to any drilling operations all drill sites have on-site inspections and are analyzed for surface conditions and best practices are employed to prevent any contamination of surface water or ground water. The Division's Board has recently approved (July 1, 2013) a revised set of rules entitled "Waste Management and Disposal" These rules update methods and restraints for disposal of RCRA (Resource Conservation Recovery Act) exempt waste from oil and gas production. This would include the the management of hydraulic fracturing fluid flow back.

Utah production water is dispose of by two methods:

- UIC Class II injection wells (94%)
- Evaporative disposal ponds (6%)

DOGM has primacy from EPA region 8 to permit Class II injection well on all non-Indian Country. The Division just recently went under an extensive review of the process from EPA and was found to be in compliance with their rules and regulations.

The Board at DOGM has recently approved new rules that revised the regulations concerning surface disposal facilities that accept hydraulic fracturing flowback. This includes:

- Chemical testing as needed
- Surface and sub-surface geology
- Size and depth limited to 10 acre-feet
- Protection of drinking water, flood plains and ground water
- Duel liners with leak detection system
- Bermed area to contain any catastrophic failure

- Safety and emergency plans
- Increased and escalated bonding.

The management of hydraulic fracturing flow back is monitored through both surface disposal and UIC Class II wells as directed by the EPA. No other regulation is necessary.

FEDERAL / STATE INTERACTION

The Division has worked very well with federal agencies when concerned with spacing, flaring and split estate issues. However, there is no collaboration concerning hydraulic fracturing. The Division believes that a state wide standard as defined by The Division's hydraulic fracturing would be beneficial, rather than several regulations as proposed.

STATE AND INDUSTRY

State and industry have worked very well together to establish a win–win situation concerning hydraulic fracturing flowback that is injected into the ground for water floods. Facilities, both permanent and temporary have been used to clean flowback water and use it in the water flood of an oil field. This recycled water greatly reduces the amount of fresh water that is used in hydraulic fracturing. In addition, water flow lines have been constructed in order to greatly reduce truck traffic and improve air quality.

CONCLUSION

I believe that Utah DOGM does an excellent job in monitoring hydraulic fracturing in Utah. Also, it is my experience that other States also perform at a similar exceptional level. In the ongoing EPA study on hydraulic fracturing in order to insure public and stakeholder confidence, it is my opinions that the EPA may raise issues concerning possible impacts of hydraulic fracturing on drinking water resources. Those risks should identified and analyzed based on probability and possible perceived consequences. The current risk management as defined by modern technology as utilized by industry should be taken into account as to the true nature of those risks and quantified as actual or perceived risks.

John Rogers is the Associate Director of the Division of Oil, Gas and Mining for the the Department of Natural Resources in Utah. He manages the petroleum section that permits, monitors and regulates oil and gas production in Utah. This includes the Class II injection program and produced water disposal in Utah. He hold a BS in geology, MS in Geology and a MBA with an emphasis in finance from Brigham Young University. He has 15 years of experience in oil and gas exploration, reservoir analysis and economic analysis of oil and gas fields. Research has included deposition and litholgic studies of deep water shales of Western Utah.

Chairman STEWART. Thank you, Mr. Rogers.

And I am sure, like you, both of us look forward to getting back to our beautiful State. So thank you for being with us today.

Our final witness then is Dr. Rahm. Dr. Brian Rahm is a post-doctorate associate at Cornell University's Department of Earth and Atmospheric Studies in New York State Water Resources Institute. Dr. Rahm is engaged in education and research of shale gas development on water resources and waste infrastructure. He previously worked in New Zealand engaging in climate change policy analysis. Dr. Rahm received his Ph.D. from Cornell University. Dr. Rahm.

TESTIMONY OF DR. BRIAN RAHM,
NEW YORK WATER RESOURCES INSTITUTE,
CORNELL UNIVERSITY

Dr. RAHM. Good morning and thank you for inviting me to be a part of this discussion.

My name is Brian Rahm and I work for the New York State Water Resources Institute at Cornell University. My job is to develop understanding of unconventional gas extraction and its interaction with and impact on water resources. My goal is to act as a neutral source of information to the public—people are very excited in New York about this activity—and to policymakers at local, state, and Federal levels. I have therefore been following EPA's investigation with interest from a New York perspective.

Unconventional gas development, not just hydraulic fracturing per se, involves multiple activities that can and do impact water resources. We know accidents happen. Accidents present risks and have impacts. Figure 2 of my written testimony shows the prevalence of violations issued by Pennsylvania Department of Environmental Protection to unconventional gas operators over the last few years. Spills of various kinds, often of waste fluids, occur relatively frequently. Many of these spills are small and contained. Less frequently, they are larger and pose risks to nearby surface and ground waters.

Apart from accidents, we also know that cumulative impacts are possible. Cumulative impacts result from multiple individual events occurring across the landscape. For example, waste fluids need to be treated if they are to be discharged. Waste from a single well might be diluted or treated, but if waste from dozens or hundreds of wells is discharged, negative impacts can occur. This is true even when single activities are conducted within established rules and regulations.

A study in the proceedings of the National Academy of Sciences, which I have here, observed elevated salt concentrations in rivers downstream from treatment facilities accepting unconventional gas waste in Pennsylvania over the last decade.

What role do the EPA investigations play? The EPA investigations in Pavillion, Dimock, and Parker County can address the complaints that prompted them and demonstrate responsiveness to the community. They can determine if contamination is present and if there is an immediate risk to environmental or public health. They can also provoke thinking and discussion as the Pavillion investigation did for me on the following points: 1) Design

and scope of research into gas development impacts needs to be carefully thought through, adhered to, and communicated; 2) regional differences matter. Geology practices and policy can vary by State and by gas play; 3) critical issues to acknowledge, discuss, and plan for include the management of waste fluids, the management of well integrity via casing and cementing, and the disclosure of chemical additives; and 4) oversight of both gas and water well construction is needed when target formations contain aquifers. A more complete commentary can be found on our website.

An equally important question regarding these investigations is what can't they do? They cannot act as risk assessments of water resource impacts from gas development accidents in general. This is because investigations occur within the context of specific geological, historical, and regulatory conditions. These also cannot address the risks presented by cumulative impacts. Broad risk assessments that incorporate cumulative impacts need data on a regional or national scale and not just from places where complaints have been lodged or where contamination has occurred. It is just as important to know when things go right as it is to know when things go wrong.

From what I understand of the ongoing EPA study of the potential impacts on drinking water resources, they are asking many good questions. It is a welcome response to the need for assessments able to identify a set of shared and/or cumulative risks that transcend local conditions and that are beyond the purview of any single operator or state agency to manage. I am looking forward to the results of their studies.

One big study, however, does not mean we will have perfect answers. No single study can do that. The nature of research is to build understanding through repetition and consensus. This requires patience and willingness to adapt to new information. Lack of perfect information doesn't mean that activities should stop but, like other activities that pose risks to water resources, treatment and discharge of sewage, for example, unconventional gas development does require oversight to minimize risk.

What does this mean for the regulation of shale gas in states and the country as a whole? What is clear to me anyway from the EPA investigations is that local characteristics will vary. This suggests that states should continue to be the leaders in day-to-day regulation since state agencies are most familiar with local conditions. Indeed, many states already regulate gas development like Utah to varying levels and stringencies. This is explored in detail in a recent Resources for the Future study, part of which I have included as figure 3 in my testimony.

That being said, the need for broad assessment of some risks, along with cumulative impacts that we know can happen, means that a broad examination and perspective is needed. In response to these general risks and cumulative impacts, it may make sense to establish basic standards at the regional or Federal level.

In closing, we should be working thoughtfully toward understanding both the benefits and the risks of our energy choices and how they interact with our valuable water resources. To not know the benefits and risks of unconventional gas development while the activity is new is fair enough. We have not had time to fully under-

stand, but it is my hope we can continue to learn through research, experience, and dialogue so we increase our energy and water resource literacy in the years to come.

Thanks for this opportunity. I am happy to take questions.

[The prepared statement of Mr. Rahm follows:]

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Testimony before the
U.S. House of Representatives Subcommittees on Environment and Energy of the
Committee on Science, Space, and Technology
July 24th, 2013

Lessons Learned: EPA's Investigations of Hydraulic Fracturing

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Good morning Chairman Stewart, Ranking Member Bonamici, and members of both subcommittees, and thank you for inviting me to be a part of this discussion.

Today I provide testimony on behalf of the New York State Water Resources Institute (NYSWRI), a federally authorized research entity established by the The Water Resources Research Act of 1984, designated by the New York State legislature to reside at Cornell University. We receive base funding through the United States Geological Survey. We also receive funding from, and collaborate with, the New York State Department of Environmental Conservation and Hudson River Estuary Program. Additional funding for NYSWRI comes from the College of Agriculture and Life Sciences, as well as the David R. Atkinson Center for a Sustainable Future, both at Cornell University. Our federal and state mandates direct us to undertake research and perform outreach with the goal of improving water resources management in the state of NY and across the nation. We seek to identify and explore water resource issues of emerging interest in order to provide and disseminate information to State agencies, water resource managers, the academic community, and citizens and stakeholders in general.

Shale gas development, particularly of the Marcellus Shale, has been a topic of great interest in NY for the past several years. Currently there is a moratorium on high-volume hydraulic fracturing related to shale gas development while NY State agencies complete environmental and public health impact assessments. In the meantime, NYSWRI has taken the opportunity to learn from unconventional resource extraction occurring in other states across the country. We have therefore been following EPA's investigations with interest, seeking to understand how the events investigated may and may not be applicable to NY, what they might reveal about environmental risks, and how policy influences water resource impacts. Our goal is to use that understanding to inform prudent policy-making, and to act as a neutral and informed voice within a polarized and contentious discussion. A sample of our most relevant research and activity, including peer-reviewed publications, can be found at the end of this testimony.

In this testimony, I will:

- Discuss the main water resource-related risks associated with shale gas development
- Discuss what the EPA investigations in question can and cannot do
- Summarize the lessons learned

What are some of the main water resource-related risks associated with shale gas development?

I'd like to describe what I have come to understand about water resources risks associated with shale gas development. This will serve to illustrate the scope of what water resource managers and researchers think and care about with respect to shale gas. Although the title of this hearing specifies hydraulic fracturing, I wish to be clear that I will be discussing shale gas development as a whole, of which hydraulic fracturing is just a part.

Please look at **Figure 1**, which is a simplified cartoon of activities commonly associated with shale gas development. These activities include land clearing for the establishment and construction of well pads; vertical drilling – often through potable groundwater supplies; horizontal drilling through the target formation; water acquisition from surface or ground sources; transportation, storage and mixing of chemicals with water for use in hydraulic fracturing; and storage, transportation, treatment and disposal of waste fluids. These activities necessarily draw the attention of water resource managers and regulators whose job it is to minimize any associated negative environmental impacts. Given all of this, it is fair to ask: what are the main risks to water resources that arise from this development, and are they substantially different from risks we already face from the activities around us?

The answer to this question is complicated, can change from one location to another, and evolves over time. But to illustrate a part of the answer I'd like to share some information NYSWRI has gathered from our neighboring state of Pennsylvania (PA), where Marcellus Shale development has been occurring in earnest for several years.

Figure 2 demonstrates the prevalence of certain violations issued by the PA Department of Environmental Protection to unconventional gas operators over the last few years. While this information is only one way to assess risk, you can get a sense of where problems may lie, at least in the eyes of PA law and the inspectors that enforce it. According to our analysis, the most common types of violations are related to spills of various kinds at the surface (often of waste fluids), erosion control and site restoration issues, and proper cementing and casing practices below the surface. From this data, we observe no violations or impacts related to hydraulic fracturing, per se. That being said, it is clear from this information that things can and do go wrong, often times at the surface, and that the frequency of these events (or the conditions that make events possible) can be high.

Some of these risks are familiar to us. Construction and agricultural activities in particular share many risks with shale gas development. They involve clearing of land and subsequent risk of erosion via storm water runoff. They involve the use of fuels or chemicals that can be transported to and stored onsite, with a subsequent risk for spills. Cementing and casing activities resemble conventional oil and gas practices, as does the production of waste fluids with complex chemistries that need to be collected, stored, transported, treated, and sometimes discharged.

What is different, however, is the pace, scale, and sometimes location of shale gas development across landscapes. Well pads are larger in order to accommodate bigger rigs. The volumes of water that need to be acquired from surface and ground waters is substantially greater than for conventional drilling and fracturing operations, leading in turn to larger volumes of waste fluids requiring treatment and discharge. Perhaps most importantly, these activities are quickly accelerating in places where historical activity may not have occurred, and where policies and practices have not had the chance to evolve over time. Northeastern PA is an example of this, as are parts of the southern tier of NY State where development is likely to proceed.

Making the distinction between planned and unplanned environmental risks

Looking again at **Figure 1**, one of the important distinctions made in this cartoon is the difference between planned and unplanned events. This distinction is important because these types of events get assessed, studied, and regulated differently. Planned events are certain to occur because they are a necessary part of the shale gas development process. Operators, regulators, and surrounding communities know that well pads need to be constructed, water needs to be obtained, and waste fluid will be produced and processed. The magnitude of these events is also directly related to the pace and scale of development in general: the more wells, the larger the cumulative impact of planned events.

Much of my work at NYSWRI has focused on planned events and how the cumulative impact of a collection of individual activities might have negative consequences for water resources. Water withdrawals for hydraulic fracturing operations provide a case in point. Individual withdrawals, say for a single well, generally do not result in environmental impact when they are taken from medium to large rivers. When multiple withdrawals are made within the same river system, however, the potential for negative impact is greatly increased. Because we know, or can approximate, how much water is required for hydraulic fracturing, as well as the flow of the river or stream, it is possible to plan withdrawal activities in such a way as to minimize negative impacts. This, of course, requires oversight, and an institution or agency capable of understanding and analyzing the system. Other researchers have also estimated and observed negative cumulative impacts associated with planned events during shale gas development[1].

[1] For example:

- R. Vidic *et al.*, Impact of Shale Gas Development on Regional Water Quality, *Science* **340**, 2013. DOI: 10.1126/science.1235009
- S. Olmstead *et al.*, Shale Gas Development Impacts on Surface Water Quality in Pennsylvania, *PNAS* **110**(13), 2013. DOI: 10.1073/pnas.1213871110
- B. Rahm & S. Riha, Toward Strategic Management of Shale Gas Development: Regional, Collective Impacts on Water Resources, *Environmental Science & Policy* 17, 2012. DOI: 10.1016/j.envsci.2011.12.004

Unplanned events are accidents. These can be anticipated only in the sense that they are likely to occur at some rate over time, although their occurrence and consequences at any given location are difficult to predict. The likelihood and potential impact of unplanned events must be inferred or estimated using data from similar activities over time and across space. Risk assessments related to unplanned events inform decision-makers who need to balance the benefits of an activity against the potential negative consequence that might occur if something were to go wrong. There is often room to invest in protective measures against likely or catastrophic risks while still realizing benefits from the activity. That being said, risk cannot be avoided altogether, and some tolerance of unplanned events is necessary.

EPA investigations in Pavillion, WY; Dimock, PA; and Parker County, TX: what they do and don't do

From my perspective, the EPA investigations in Pavillion, Dimock, and Parker County are dealing with unplanned events. That is to say they are responses to complaints regarding alleged impacts that were unintended. Furthermore, the events and impacts in question would have been difficult to predict with spatial and temporal accuracy ahead of time. I bring this up because I think it is critical to understanding what types of questions such investigations can and cannot address.

These investigations of unplanned events can address the question of whether or not contamination of some kind is present, and whether or not this represents an immediate risk to environmental or public health.

Given sufficient resources, these investigations might be capable of determining the possible causes of contamination in the past, and what the levels of contamination may look like in the future. What I can tell you from my experience in working with chloroethene-contaminated groundwater sites is that to achieve a high degree of certainty with respect to contamination cause and its evolution in the future can require extensive study and substantial resources.

What these types of investigations cannot do, by virtue of their design, is act as definitive risk assessments of water resource impacts from shale gas development in general. They cannot do this because individual investigations occur within the context of a specific set of conditions - local geology, a specific operator or set of operators, a unique site history, and a local regulatory environment. More general risk assessments – or better yet, risk assessments that are robust enough to account for variability of the characteristics I just mentioned – require a different, broader approach. I will revisit this concept in a moment.

Despite the limitations of these investigations, I believe they can provide valuable information, as well as spark important discussions about risk, best management, and policy. That being said, I'd like to relate some key points I take away from the investigation in Pavillion, Wyoming, which is the most developed of the three in the sense that EPA has drafted a report. A more complete NYSWRI commentary on the Pavillion investigation can be found on our website at http://wri.eas.cornell.edu/Comment_on_EPA_Pavillion_Study.pdf.

- Investigation and research design must be well thought-out and articulated – The stated objective of the investigation was to determine whether ground water contamination had occurred and, if possible, to differentiate between shallow sources of potential contamination – such as surface pits - and deep sources – such as gas production wells. It was not the intent of the study to evaluate the extent of contamination, nor was the objective to evaluate the hydraulic fracturing process itself as a route of potential contamination.

- P. Drohan *et al.*, Early Trends in Landcover Change and Forest Fragmentation Due to Shale-Gas Development in Pennsylvania: A potential outcome for the Northcentral Appalachians, *Environmental Management*, 2012. DOI 10.1007/s00267-012-9841-6

While the investigation's speculative conclusions are open for debate, the data collected was still useful so long as its purpose is kept firmly in mind. This suggests that the design, scope, and outreach related to future EPA investigations and studies should be carefully thought through, adhered to, and communicated.

- Regional differences matter – Each gas play has its own characteristics and challenges, its own regulatory environment, and its own mix of land use, industry, and infrastructure that will influence environmental risk and industry best practice. Regulatory agencies need to be aware of this local character and develop management strategies that are effective and appropriate. In some ways, this illustrates the critical role of state-level regulation. In other ways, the variability in the coverage of regulations from state to state suggests the need for at least some form of oversight at an interstate, regional, or federal level.

- Management of waste fluids is a critical issue – Although this investigation does not definitively link ground water contamination with the use of open, unlined waste pits, it does place the practice into the spotlight for critical evaluation. In New York, regulators have chosen to move toward the requirement of closed-system waste containment as a way to minimize contamination risks associated with wastewaters that have complex and sometimes toxic chemistries. Although wastewaters will vary across the country as a result of differences in fracturing strategies and geology, it is prudent for state and federal agencies to closely assess the risks of waste pits. On-site and centralized wastewater management and treatment technologies have evolved rapidly and provide the industry with alternatives that may not have been available in the past, but which should be encouraged or required in the future. The high prevalence of waste fluid spills (at least in PA, **Figure 2**) indicates that waste fluid storage is a potential area in which general basic standards are worth implementing.

- Cement quality and gas production well integrity are essential – Again, this investigation does not demonstrate a direct link between cementing practices and ground water contamination. However, it does show that cementing in the area of study was often done poorly in terms of quality, and insufficiently in terms of depth and coverage relative to the screened depth of local domestic water wells. Best practice with respect to cementing, bond-logging, and gas well integrity has received significant attention in recent years, particularly in the Marcellus Shale where public scrutiny and criticism has been intense. State agencies should examine their own guidelines, while federal agencies should consider basic standards.

- Chemical additives need to be on record – Situations in which contamination is thought to occur, but for which the exact nature of the contamination source is unknown, highlight the need for better documentation of chemical additives used during the drilling and hydraulic fracturing processes. At the very least, there is a need to make information regarding chemical additives and their volumes available to state or federal regulatory personnel and emergency responders, regardless of location or purpose. Replacing the most toxic additives is, and should continue to be, a priority. **Figure 3**, taken from a study by Resources For the Future, a nonprofit, nonpartisan research organization, illustrates the variability in fracturing fluid disclosure requirements from state to state. Again, this suggests a role for basic federal standards on this important issue.

- Targeting of formations containing an underground source of drinking water (USDW) should elicit strict regulation – Whether by mistake, or through the fault of one or more involved parties, gas production wells in Pavillion were allowed to contain surface casing that did not extend below nearby domestic water wells. I know it is common in some cases, such as coal bed methane, to target gas-bearing formations that also act as an USDW. However, to do so without strict oversight of both gas and water well construction seems irresponsible. In cases where such development occurs on federal land, this is an opportunity for the Federal government to lead the way in ensuring that development occurs safely or not at all.

The investigation in Pavillion demonstrates both the importance of state regulation in dealing with local conditions, as well as the need to constructively discuss the role of federal agencies in regulating activity on federal lands, and setting basic standards for activities that are cause for concern across states and gas plays. It is fair to mention that many states, particularly those with a long history of regulating oil and gas extraction, would meet or exceed any basic standards likely to be set. Still, there is significant variability in state approaches on at least some issues of broad concern. And, as development spreads into new plays, some of which lie outside historic regions of development, a basic threshold for safety becomes more important. Using PA as an example, states that face rapid unconventional development should be able to respond with appropriate regulations within a few years. It is during this initial period, however, when activity is occurring even as new policies are being worked out, that communities may benefit from basic regional or federal protections.

What kind of approach would address stakeholder concerns regarding water resources – a role for the EPA study on drinking water resources?

The investigations in Pavillion, Dimock, and Parker County have value insofar as they are able to respond to complaints and identify contamination if it exists. With additional resources, they might provide insight regarding the origin and evolution of contamination. But I think that what we are all after are risk assessments robust enough to be used in general, not just in one location at a time. So, the question becomes: if single investigations are not sufficient, what more is needed to assess risk in a comprehensive way?

It is difficult to answer this question, but I can offer my opinion on what would be needed. First, more data, research, and analysis is needed on the events that we know occur and which transcend local conditions, such as spills and erosion at the surface, and poorly designed casing and cementing below the surface. Such data should come from academic research, industry, state and federal agencies, and should encompass a representative sampling of development sites, not just places where complaints have been lodged, or where known contamination events have occurred. It is just as important to know how often things go right, as it is to know when things go wrong, so that we can determine the proper balance between precaution and mitigation.

Of course data alone is not sufficient for developing a risk assessment. Analysis must be conducted on a large enough scale to address the general concerns raised by our communities. Industry has a wealth of data and expertise, but is not structured so as to collect data from competing operators, and is not incentivized to provide results in a transparent fashion. This is understandable. State agencies are often intimately familiar with local conditions, but do not have staff, time, or mandate to engage in analyses which stretch beyond their jurisdictions. Institutions or agencies with broad interstate, regional, or federal missions are needed so that a transparent analysis can be conducted with the input of all involved stakeholders.

Another important reason to involve entities with broad mandates is the potential for cumulative impacts to dominate risk once a certain pace and scale of development is achieved. As I discussed previously, cumulative impacts may arise even when each individual activity is conducted safely and in accordance with rules and regulations. Water resource impacts from the combustion of coal provide a case in point. The cumulative impact of coal-fired power plants throughout the Midwest, initially unforeseen, is exacerbation of acidification and nutrient contamination of water resources in the Northeast.

The EPA study on the potential impacts of hydraulic fracturing on drinking water resources is an example of a broader risk assessment. In theory it is designed to identify a set of shared and/or

cumulative risks that transcend local conditions, and that are beyond the purview of any single operator or state agency to manage. I am keen, as I'm sure the Committee is, to see that the drinking water study is designed and performed effectively, and I am curious to know what will be found.

What are the lessons learned?

- There are a variety of risks and impacts to water resources as a result of activities and events associated with shale gas development. Many have little to do with hydraulic fracturing itself but are nevertheless important to water resource managers. Some of these risks are similar to those we face from conventional oil and gas development, and construction and agricultural activity in general. Still, the pace and scale of development, particularly in areas unaccustomed to shale gas development, necessitates a fresh look at how we undertake, manage, and regulate this activity.

- Local differences in geology, hydrology, policy, infrastructure, and industrial capability mean that states are still the appropriate level at which much of the regulation of shale gas development should occur.

- Best practices exist (and are promulgated by industry) that help to provide environmental protection as development continues; some operators observe them and others do not.

- Planned events, such as the withdrawal of water and the treatment and discharge of waste fluids, are certain to occur and have the potential to impact water resources, especially if cumulative impacts over time and space are not properly understood. Therefore, planned events and their cumulative impacts must be studied, planned for, and considered within regulatory frameworks.

- Unplanned events, or accidents, are also certain to occur, but in locations and with impacts that are difficult to predict. Analysis of a wide range of data, conducted on an interstate, regional, or federal scale, should help in development of assessments of risks that are shared across states and shale plays.

- The EPA, and/or other relevant agencies, can and should play a role in regulating and investigating complaints on federal lands. More broadly, federal agencies should continue developing approaches that identify shared risks across states and plays, regardless of local differences, so that basic standards may be justified, agreed upon, and established. Issues regarding chemical disclosure, proof and maintenance of well integrity through cementing and casing, and the storage, treatment and discharge of waste fluids, are candidates for shared risks. States with a history of oil and gas development are likely to meet or exceed these basic standards, while a regulatory floor is critical in states experiencing new development.

Lastly, I'd like to acknowledge that the presence of risk does not necessarily mean that an activity should not proceed. Like other activities that pose risks to our water resources in one way or another (the treatment and discharge of sewage, for example), shale gas development requires oversight, some aspects of which are most appropriately local, while other aspects of which require broader perspectives, abilities, and mandates. It is critical that we – scientists, industry, policymakers, and communities - acknowledge and continue to discuss risks from unconventional oil and gas development, even as development continues on a large scale. The nature of scientific research is to build understanding over time through repetition and consensus. This requires patience, the ability to articulate and discuss alternatives, and most importantly, a willingness to accept new information over time, sometimes at the expense of old paradigms. Polarized discussions on hydraulic fracturing are rarely constructive. We should be working more thoughtfully toward understanding the benefits and

risks of our energy choices and how they interact with our valuable water resources. To not know the benefits and risks of shale gas development while the activity is new is fair enough – we have not had enough time to fully understand. But to not know them a decade from now because we either ignored the issues or refused to address them, would be irresponsible.

Thank you again for this opportunity. I'd be happy to take any questions.

Figure 1. A simplified cartoon of shale gas development events associated with potential water resource risks and impacts

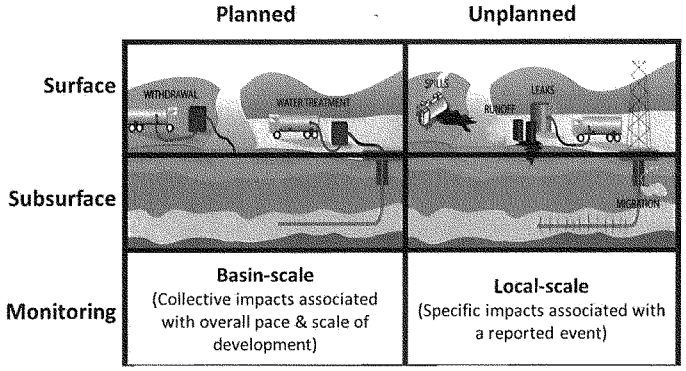


Figure 2. Prevalence of environmentally-relevant violations issued to operators in Pennsylvania since 2007 - data for analysis taken from PaDEP online database found at: http://www.portal.state.pa.us/portal/server.pt/community/oil_and_gas_compliance_report/20299

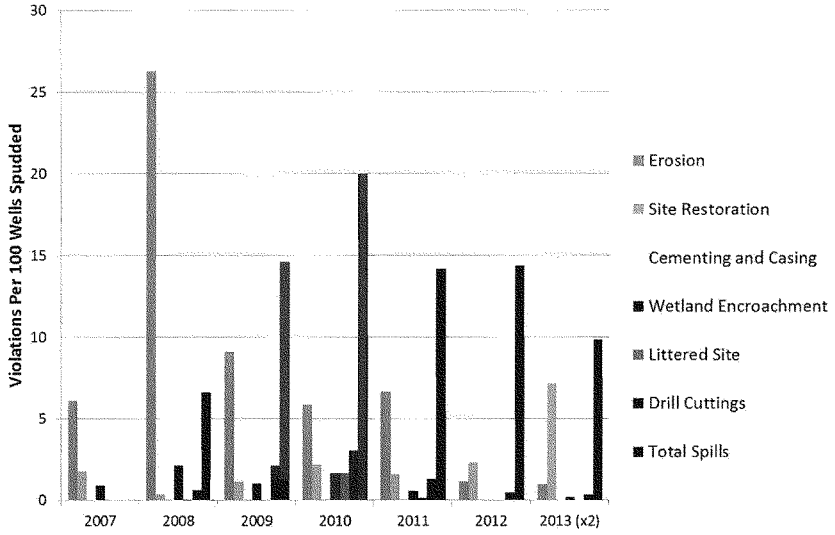
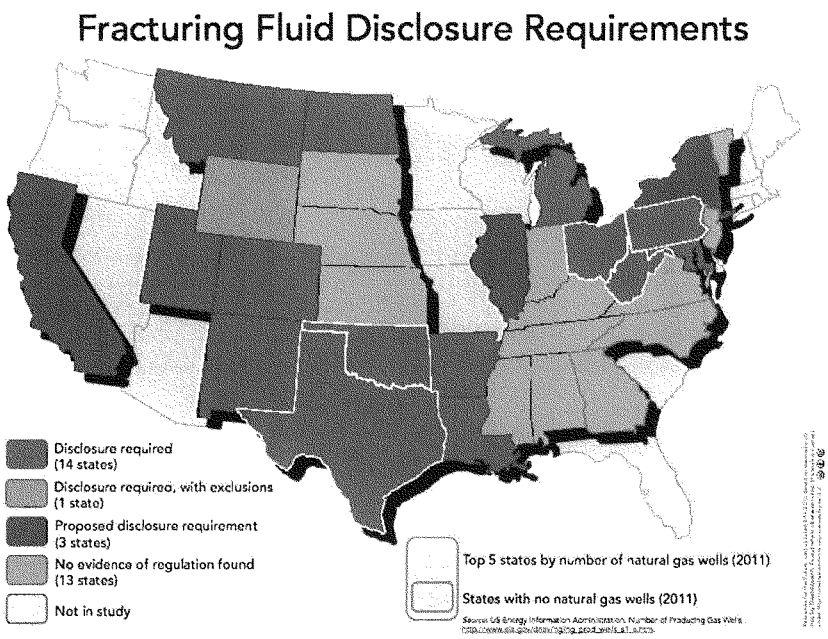


Figure 3. Source of graphic – Richardson et al., The State of State Shale Gas Regulation. Resources for the Future. June, 2013. Accessed at: http://www.rff.org/centers/energy_economics_and_policy/Pages/Shale_Maps.aspx



Relevant NYSWRI research and activities:

Peer-Reviewed Publications

- **Rahm, B.G.**, Vedachalam, S., Shen, J., Woodbury, P.B., Riha, S.J. "A watershed-scale goals approach to assessing and funding wastewater infrastructure" *J. Environ. Manage.* In press
- McPhillips, L.; Creamer, A.E.; **Rahm, B.G.**; Walter, M.T. "Spatial analysis of dissolved methane in central New York groundwater" submitted to *Water Resources Research*. In review
- **Rahm, B.G.**, Bates, J.T., Bertoia, L.R., Galford, A.E., Yoxtheimer, D.A., Riha, S.J. "Wastewater Management and Marcellus Shale Gas Development: Trends, Drivers, and Planning Implications" *J. Environ. Manage.* (120) 2013. 105-113
- **Rahm, B.G.**; Riha, S.J. "Toward strategic management of shale gas development: Regional, collective impacts on water resources" *Environ. Sci. Policy*. 2012. 17. 12-23

Other Publications

- Abdalla, C.; Drohan, J.; **Rahm, B.G.**; Jacquet, J.; Becker, J.; Collins, A.; Klaiber, A.; Poe, G.; Grantham, D. "Water's journey through the shale gas drilling and production processes in the Mid-Atlantic region" Penn state Cooperative Extension. 2012
- **Rahm, B.G.**; Ford, L.; Rukovets, B.; Meriwether, M.B.; Riha, S.J. "Protection of Surface Waters Associated with Shale Gas Drilling and Related Support Sites" NYWEA white paper. May 16, 2011
- Riha, S.J.; **Rahm, B.G.** "Framework for assessing water resource impacts from shale gas drilling" NYWEA *Clear Waters*. 2010, 40 (Winter), 16-19
- **Rahm, B.G.**; Riha, S. "Framework for Assessing Water Resource Impacts from Shale Gas Drilling" *Green Choices*, website of Cornell University's Department of City and Regional Planning, December, 2010

Invited Panel & Testimony

- "Farm Foundation Forum: Natural Gas Extraction – Impacts on rural America," Farm Foundation panel held at the National Press Club, Washington, DC, April 3, 2013. http://www.farmfoundation.org/forums.aspx?year=2013
- "Shale Gas Development & Water Resources Planning & Management" Municipal Law and Planning: A Local Perspective on Hydrofracking. Albany Law School. Albany, NY, September 28, 2012
- "Waste Water and Cuttings as they Pertain to Hydraulic Fracturing" New York State Senate Standing Committee on Environmental Conservation, Canandaigua, NY, December 12, 2011
- "USDA Agricultural Landscapes Forum" Northeast Regional Meeting, Panel on water security. Cobleskil, NY, March 10, 2011
- "Hearing on the Continued Examination of Hydraulic Fracturing Including the NYSDEC and DRBC Processes" New York City Council Committee on Environmental Protection, New York, NY, March 1, 2011

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Brief Bio:
Dr Brian Rahm received his masters from UC Berkeley and doctorate from Cornell University, where he worked on remediation of groundwater contamination. Since then, he moved to New Zealand and spent a year engaged in climate change policy analysis for the capital city, Wellington, and has also performed research on greenhouse gas emissions from wastewater treatment plants. He is currently with the New York State Water Resources Institute where he is engaged in education and research on a variety of topics, including the impact of shale gas development on water resources, and aging waste water infrastructure.

Chairman STEWART. Thank you, Dr. Rahm.

I recognize that each of you have written testimony and that will be included in the record after this hearing. And then I also review that for the members of the panel will each have five minutes to question members of the panel of witnesses. And I now recognize myself for five minutes as the Chairman.

There are a couple things that I would love to talk with each of you about, and I want to go strategic rather than tactical. Dr. Hauchman and Dr. Dzombak, I appreciate your testimony, but I want you to know that I disagree with you on some of the elements of it. And I don't believe the Agency has been responsive. I believe the evidence supports this concern that I have. And I hope you understand that it is not helpful for us in trying to develop a working relationship when we feel like you are not being responsive and honoring the charter that we have in order to provide answers to this Committee regarding some of these, what we think are very, very important issues.

But putting that aside, again, I would like to talk about, you know, kind of the bigger picture on some of these elements. And, Dr. Hauchman, let me begin with you if I could, just quickly. And I don't think we want to discuss this for a long time, but I would like you to respond to this.

I mentioned in my opening statement the EPA's experience in Wyoming, Texas and Pennsylvania where, in my opinion, they clearly put the politics ahead of the science in some of these public statements that they made and then had to withdraw and to backup from some of those. And I would just ask can you see how this episode makes Congress and frankly the American people skeptical of EPA's willingness to be fair and unbiased in these studies as they try to draw these connections between any fracking activity and pollutants in groundwater?

Dr. HAUCHMAN. Thank you for your question, Congressman Stewart. I appreciate the nature of your question. My focus is on the drinking water study. And I stand here—I sit here with confidence in telling you and assuring you that we are conducting a rigorous study that will be following all appropriate procedures.

Chairman STEWART. And I appreciate that, but can you see how with the previous experience that that there would be some people that would be skeptical of that?

Dr. HAUCHMAN. I appreciate your comment. Yes.

Chairman STEWART. Okay. Thank you. Let me, if I could, maybe, Mr. Rogers, if I could ask you to respond. I was an Air Force pilot for many years and before we flew a mission or before we trained in our training or whether those who actually fly in combat, you analyze the threat, you try to measure those threats, you try to analyze which are the most important, which are the most critical, and you try to mitigate those. And then you go fly the mission. And if we had a threat matrix where we had to eliminate every possible threat, then we would simply never fly.

And I think that there is a parallel to some of the language or some of the intents of this study and that is EPA searching for what is possible without paying attention to what is probable or what is likely. For example, the primary goals of the study is to answer such question as what is the possible impacts of hydraulic

fracturing fluid surface spills on or near well pads or drinking water resources, again, looking at every conceivable possibility and not measuring those or attaching a matrix to those that are much more likely? And I guess I would ask is a mere possibility of an event occurring sufficient to justify a regulatory action?

Mr. Rogers, again, I would appreciate your opinion on that.

Mr. ROGERS. I think that any activity you take has risks whether it be flying in an airplane, driving a car. There is always a risk involved. Therefore, I think hydraulic fracturing has a risk. There could be a possibility but I think we need to quantify that, put a number on that, and find out what exactly that risk is.

For example, in the State of Utah, we have done a study where we have measured in our oil-and-gas producing area, the Uinta basin, where the depth and moderately saline water, any water that could possibly be used. So when we know where that is, we put casing, we cement down to that level below it so that we know that we are protecting that. Could something happen? Possibly, but most likely no because we have gone, we have analyzed, and we have addressed the risk and we think the risk has been minimized if not just by the application of good science.

So I think what your statement is true that there always is an opportunity that something could happen but I think you need to quantify that and put a real number on that on what the reality of that happening.

Chairman STEWART. All right. Thank you.

Dr. Hauchman and Dr. Dzombak, will you reply to that? I mean in your study are you doing a quantitative analysis and attaching a quantitative measure to these risks and helping the readers of this study understand that some of them are significantly less risk than others or do you treat most of them as if they are equal?

Dr. HAUCHMAN. I will respond first. As we have stated, this study is not a quantitative risk assessment. We are focused on the research questions and we feel that by answering these questions, we will have information that will be very useful.

But I want to be clear that we are not simply producing a report that will have a statement that says it is possible or it is not. We are doing a robust, a thorough analysis of the available literature. We have requested information from the public, from all the different sectors, and any findings or conclusion we make will be made in proper context. They will be made with attention to the quality of the information and so forth. So I am confident that this will be a very useful report.

Chairman STEWART. And again, I just want to make sure I understand. But you will not attach a quantitative assessment to each of these concerns that the study will address?

Dr. HAUCHMAN. It has not been our intention to design this study to develop a quantitative risk assessment.

Chairman STEWART. Okay. Do you view that as a weakness in the study?

Dr. HAUCHMAN. I would say it would be highly desirable to have, as was very elegantly stated by Dr. Rahm, the perfect study, but that doesn't discount the value and I would say a very high value of the study that we are conducting.

Chairman STEWART. And I agree that there is value in the study but I also agree with you that it was—it is not ideal, and in fact in some ways it may be far from ideal because of that lack of a quantitative assessment.

But my time is expired. I now recognize Mr. Swalwell for his 5 minutes.

Mr. SWALWELL. Thank you, Mr. Chair. And as I alluded to earlier, in my home State in California, we are beginning an expansion of fracking for shale gas that may create an economic boom for the State. But one of the main concerns that I hear from my constituents and scientists in my community is the concern that fracking can be tied to and cause induced earthquakes tied to the disposal of the wastewater produced after fracking. And based on reports of a recent internal study on the issue, my understanding is that the EPA is now considering recommendations for states on how to avoid the possibility of induced seismic activity from these injection wells.

So, Dr. Hauchman, the study described in your testimony will look at the treatment of wastewater prior to disposal, is that correct?

Dr. HAUCHMAN. We will be looking at the treatment of wastewater prior to disposal, that is correct.

Mr. SWALWELL. And is the EPA examining deep well injections to reduce or avoid the possibility of induced earthquakes?

Dr. HAUCHMAN. That particular aspect of disposal is not within the scope of the study. We are focused on the—examining the potential association or impact on drinking water resources.

Mr. SWALWELL. Are you familiar with any EPA studies that would deal with induced earthquakes?

Dr. HAUCHMAN. Any EPA research studies? No, I am not.

Mr. SWALWELL. Okay. Is that something that concerns you that perhaps we should be looking at that area?

Dr. HAUCHMAN. Well, this is certainly a concern that we have heard from many stakeholders, and as you mentioned, the EPA has developed or is developing a set of guidance—steps being handled out of the regulatory office in coordination with the U.S. Geological Survey.

Mr. SWALWELL. In California, we are also continuing to experience droughts and they are common in many places throughout the State, and local officials have been implementing water conservation measures just to conserve adequate drinking water supplies during certain times of the year. Still, fracking requires large, large volumes of water to successfully release shale gas.

Dr. Rahm, in your written testimony, you note that states should take into consideration different regional—take into consideration regional differences to determine best practices, which, of course, I think makes sense. As I mentioned earlier, what may be good for State A may not be good for State B. But to be a little bit more specific, are you saying that states should consider the relationship between the scale of fracking operations and the impacts on local drinking water supply?

Dr. RAHM. I would say that is fair, that the scale would be important in terms of determining when—where certain water sources should be used for hydraulic fracturing. I guess I would point out

an example of the Susquehanna River Basin Commission as a regional body that has the authority to regulate water withdrawals in multiple states. They have a policy for how they determine when the flows and the streams and rivers are high enough and, you know, when and where the companies, which need a permit to do so, can take water from those streams and rivers. And I think it works out pretty well. It involves environmental protection but at the same time the companies are allowed to take the water from the streams. So everybody seems relatively happy in that situation.

Mr. SWALWELL. Dr. Hauchman, can you tell us whether your study will make recommendations relevant to State policymakers so they can make informed decisions about the appropriate scale of operations, particularly near active fracking sites that we have in California?

Dr. HAUCHMAN. Thank you for your question. It is not the intent of the study to make recommendations specifically. What we are doing is developing some scientific perspectives on the issue.

Mr. SWALWELL. And, Dr. Hauchman, how has the EPA engaged industry stakeholders to ensure that the Agency stays current on data and advances in technology as the study plan has progressed?

Dr. HAUCHMAN. Thank you for your question. It is a very important one and we have heard that from a number of our stakeholders about the importance of this particular issue. We have, from the very beginning of this study, been reaching out to stakeholders and sticking strictly to the technical aspects of the study. We have had numerous roundtables and workshops. In 2011 we had a series of technical workshops where we invited in experts from industry, from nongovernment organizations, from academia, et cetera, to work with us to exchange information. I was able to attend one of those meetings and it was excellent. It was highly collegial. It was sticking to the science. There were no policy discussions at all. That is the nature of the discussions we had in 2011.

We have had roundtables with a range of stakeholders focused on technical issues in 2012, and we are completing another round of technical workshops this particular year. And I will add one other item. We have been reaching out in a variety of ways to make sure we are current on innovations in technology and other developments. We have just extended the public in the federal register the period for receiving information and data from the public on anything related to the technical aspects of the study, and we are very much interested in receiving whatever can be provided.

Mr. SWALWELL. Great. Thank you, Dr. Hauchman. Thank you, Dr. Rahm. And I yield back.

Chairman STEWART. Thank you, Dr. Swalwell.

The Chair now recognizes the Chairwoman of the Subcommittee on Energy, my friend from Wyoming.

Chairman LUMMIS. Thank you, Mr. Chairman.

And before I start my questions, I want to tell you a story about why I think this is so important. I am a rancher in Wyoming, grew up next to a refinery, ranched right next to an oil refinery. And over a period of time the migration of hydrocarbons off that refinery property and onto our ranch and into our water that our cattle drink and that we irrigate with became terrible. So under RCRA,

the EPA dealt with the refinery, entered an Order on Consent, and required the refinery to clean it up.

And for 17 years that refinery did not turn a shovel to meet the requirements of that Order on Consent. And we had to fight as the neighboring ranchers to try to get the enforcement of the consent order with our own money while our own land was being polluted by this refinery.

So I was grateful when the EPA stepped in and helped us. Without the EPA stepping in and helping us, we never would have gotten it cleaned up. So it is unusual for a constitutional conservative Republican to want to be an advocate and thank the EPA. Okay. Full stop.

I come out here. EPA's science is so bad when it comes to Pavillion, Wyoming, that it has embarrassed me as a previous defender of the EPA. It humiliated and destroyed a lot of opportunities for fracking by industry in Wyoming. We have a very sophisticated, world-class oil and gas industry in Wyoming because we are such an enormous producer, and to have that kind of science released as a draft study when it was so faulty that it was probably the EPA itself that polluted the wells when they did the tests. It just completely shattered my ability as a Republican who is trying to defend the EPA. I can't do it anymore. You destroyed my ability to be a defender.

So, Dr. Rahm, when you said Pavillion made you think, I will tell you Pavillion was a big lie. I believe that it was leaked to the New York Times so they could sensationalize it so it could be used as an excuse by the EPA to regulate and to scare people and to make Wyoming look bad.

And so I am angry with the very agency that I came here with difficulty trying to defend as a Republican. I can't defend it anymore.

Okay. Given that scenario, Dr. Hauchman, shouldn't you wait until any decisions on the merits of regulatory actions, until after the study is complete? I mean you are kind of getting the cart before the horse when you throw out a bad study, completely tainted, then say, oh, we need to regulate but we will do a longer study and it is going to be credible this time. So why not wait? Why not regulate—wait until after the study is done that can be peer-reviewed and can be blessed as credible and then decide whether to regulate?

Dr. HAUCHMAN. Thank you for your question, Chairman Lummis.

First of all, I do want to state that I respectfully do not agree with your statements about the quality of EPA's science.

But having said that, we were charged in the Office of Research and Development of conducting this study, and that is exactly what we are doing with attention to all the appropriate scientific policies, protocols, and procedures. What we do in the Office of Research and Development is of course related to but distinct from the activities of the regulatory arm of EPA.

Chairman LUMMIS. So—

Dr. HAUCHMAN. So——

Chairman LUMMIS. But—so why wouldn't the EPA's regulatory arm wait until—whether the science is good or not—I hope it will

be. I hope it will be. That said, why don't—why isn't the regulatory arm waiting until the science is available?

Dr. HAUCHMAN. I am not able to respond to that question. I would be happy to get back to for the record.

Chairman LUMMIS. Thank you. I yield back, Mr. Chairman.

Chairman STEWART. We would look forward to your response on that, Dr. Hauchman. All right. Thank you, then. Thank you, Mrs. Lummis.

The Chair now turns to Mr. Takano from California.

Mr. TAKANO. Thank you, Mr. Chairman.

Dr. Rahm, could you comment briefly on the charge that the Pavillion study was somehow bad science or flawed?

Dr. RAHM. I don't necessarily have a comment because I am not an expert in drilling wells according to some of the allegations about what made that study good or not good. I think what I would want to say maybe as a third-party observer of that study, I don't think the intent of the study, as stated, was to make a statement about hydraulic fracturing, though some speculative comments were concluded at the end, which you—I think are debatable, given the evidence.

I think it was a very limited study. And I think that it is useful to see the results that people publish and to potentially use those results in the context of other results that may be available. And to that extent, I think those studies can be valuable.

And again, like I said, they made me think about issues that may be important. Whether or not that proved one thing or the other, it at least brought to the discussion some things that we thought were important in New York. So I thought it was valuable in that way.

But as far as whether or not it was good science, I think it was—there were some results and that I think a lot of the conclusions were very—were debatable and a lot of science works that way.

Mr. TAKANO. Help me understand. I am very much a layman myself in this area. Is there enough research, body of research to really design any kind of quantitative risk assessment I mean in a broad sense? I mean are we at that point yet? It is a relatively new industry.

Dr. RAHM. So I am not necessarily an expert on risk assessment. I am more of an expert on water resources. But I think that it is difficult in the sense of some of my earlier comments, conditions vary from location to location, and so if you are doing—if you are getting, for example, results in Pavillion, whether they are good or not, they may or may not be relevant at all to what is happening in New York or Pennsylvania for that matter.

And so I think it is difficult because conditions change over time, and what I would say is that I am in support of more study and research and data that we can get on these questions, the better, because I think we will hopefully be able to identify whether or not there are some of these shared risks that might be relevant everywhere regardless of what the conditions are and that we might have a better sense of when these conditions change, are there—how do conditions change from State to State or from place to place that might be relevant for what the risks and the benefits might be.

Mr. TAKANO. Thank you. Dr. Hauchman, would you have anything to say about the state or the progress we have made in understanding hydraulic fracturing to the point that we can really establish quantitative risk assessment evaluations?

Dr. HAUCHMAN. I would tend to agree with Dr. Rahm on this point that we are relatively early in terms of the peer-reviewed literature, which we rely upon quite heavily for conducting quantitative—rigorous quantitative risk assessments. There is new information that has been forthcoming. We are, as we speak, pulling together a lot of information that will be very informative. But again, the quantitative risk assessment is relying upon quite an amount of information and we are—in my perspective at least, we are not quite there yet.

Mr. TAKANO. So you would—was it fair to say that our knowledge is fairly formative at this point I mean as far as what we know about hydraulic fracturing?

Dr. HAUCHMAN. Well, I think there are many things we do know about hydraulic fracturing with respect to the technology, with respect to geology and so forth, a lot of the technical issues that we are in fact looking at. But in terms of putting the information together to answer the types of questions that we are asking I would say we still are in a developing stage.

Mr. TAKANO. Thank you. Dr. Dzombak?

Dr. DZOMBAK. I would just comment that the Science Advisory Board is providing peer review for this study and to Chairman Stewart's point on risk assessment and yours, this was a question that was—the question of how far to go in risk assessment was a question that was raised in both the review of the study plan and in the consultation for the progress report. And our members of the panel—both panels queried the ORD project leaders about that.

And I would note that the studies arw being conducted in a risk framework, there is not performance of a quantitative risk assessment group that is really a site-specific activity.

Mr. TAKANO. Um-hum.

Dr. DZOMBAK. But in terms of understanding the sources, understanding the transport that could occur from the sources, understanding potential impacts, that is all in a risk assessment framework. Our panel members ask very pointed questions about that of the Office of Research and Development, and they committed to in the final report putting the various components of the study in a risk framework. And that will be a quantitative risk assessment but I would argue the entire study is in a risk framework, and that will not—the ORD is committed to make that clear in the final report.

Mr. TAKANO. All right. Thank you, thank you, Mr. Chairman.

Chairman STEWART. Thank you, Mr. Takano.

We now turn to Mr. Weber of Texas.

Mr. WEBER. Thank you, Mr. Chairman.

You said the EPA had been guilty in your opening statements of putting the regulatory cart before the scientific horse, and I think Chairman Lummis probably echoed that.

Dr. Hauchman, I want to ask you a couple of questions. State impact—a state impact NPR article on July 3, 2013, not necessarily your most conservative Republican group, NPR, stated that to the

effect that the EPA had withdrawn from a number of areas, the Pavillion case, of course I am from Texas, the Texas case, the Pennsylvania case. After a multimillion dollar—I would call it investigation—I don't think that is the word they used—study, whatever, are you privy to the exact numbers of taxpayer dollars spent on those three studies before the EPA began to backtrack?

Dr. HAUCHMAN. Thank you for your question. I am not able to respond with figures. This was an investigation that was led by the EPA regional office in Denver, and I was not part of those discussions.

Mr. WEBER. Do you have any knowledge—does the EPA ever consider the impact on industry by creating a nightmare of legal loopholes—legal maneuvers they have to make and the amount of industry it holds up and the jobs it kills? Are you all—does anyone in the EPA to your knowledge take that into consideration?

Dr. HAUCHMAN. I am quite confident that there is a thorough consideration of the implications of any decisions that come out of the EPA. I am not part of that particular part of the Agency in terms of the policy, but yes, I think that there is consideration given to impacts.

Mr. WEBER. So you don't deal with policy per se?

Dr. HAUCHMAN. I do not. I am not part of the policy offices, that is correct.

Mr. WEBER. Right. And how long have you not been part of the policy offices?

Dr. HAUCHMAN. I started my career as a risk assessor in the Office of Air and Radiation many, many years ago.

Mr. WEBER. Um-hum.

Dr. HAUCHMAN. But since that time, I have been part of the science arm of the EPA.

Mr. WEBER. Okay. I have an article from Inside EPA quoting you as saying, "we are doing a pretty comprehensive look at all the statutes trying to find holes to allow additional regulations" in March 2012. Did you make that comment?

Dr. HAUCHMAN. Congressman Weber, excuse me, I am very happy to have this opportunity to clarify that comment.

Mr. WEBER. Good, that is why you are here.

Dr. HAUCHMAN. I am glad to have this opportunity to provide clarification. This was a statement that appeared in the newsletter, Inside EPA. It was taken out of context. I stated at the beginning of my talk, which was on the study, that I was with the Office of Research and Development. I reiterated this point in the brief comments I made about the various other activities in EPA. I specifically stated that I was not part of the policy arm of EPA, and I directed the audience to the EPA website to get an understanding of the variety of activities that we are conducting as an agency under the various statutes.

Mr. WEBER. Okay. So you do make some policy determinations it sounds like.

Let me jump over to Dr. Rahm for just a minute. Dr. Rahm—and I don't want to put words into your mouth—I believe that you said fracking and unconventional drilling practices can and do impact water sources in your comments.

Dr. RAHM. Yes, sir.

Mr. WEBER. Specific examples?

Dr. RAHM. Well, again, I think we have from—looking at some of the violations and incidents happening in Pennsylvania, we see, for example, spills on sites, again, many of them very small, commonplace, it could be you spill a gallon of diesel, or whatever it might be, construction—similar types of——

Mr. WEBER. Okay. That is where I want to go.

Dr. RAHM. Okay.

Mr. WEBER. Do you think those small spills, accidental spills, justify millions of dollars of EPA activity and holding up industry and putting them in the courts?

Dr. RAHM. I don't think I am in any position to make a claim about what—about the amount of money EPA should be——

Mr. WEBER. Well, they have already established that people in the scientific community can opine on policy here this morning, so don't be afraid. Do you think it justifies the amount of money spent?

Dr. RAHM. I really don't want to make any comments about the amount of money spent.

Mr. WEBER. Okay.

Dr. RAHM. I agree that policy——

Mr. WEBER. I got you. I am running out of time.

Dr. RAHM. Yes.

Mr. WEBER. All right. You also said regional differences matter.

Dr. RAHM. Sure.

Mr. WEBER. And then you also said states should continue to be the leaders.

Dr. RAHM. I think that is right.

Mr. WEBER. Are you saying that one size policy doesn't fit all or are you yielding to the idea that states, particularly Texas—I am from Texas——

Dr. RAHM. Um-hum.

Mr. WEBER. —has got the experience—who, by the way, produces more oil than the next four oil-producing states combined—have the experience—our TCEQ, we all want clean air and clean water—

Dr. RAHM. Um-hum.

Mr. WEBER. —and a good environment, but we don't want to do it the—you know, we don't want to spend all this money, taxpayers' dollars, holding up the process to have the EPA backpedal after having spent multimillions of dollars in holding up industry and causing them to spill—spend multimillions of dollars. And by the way, that drives the price of gasoline up at the pump, okay. So when you said that states should continue to be the leaders——

Dr. RAHM. Um-hum.

Mr. WEBER. —and that is based on your evaluation of how this—and you said in your comments that I think NYU—is that right?

Dr. RAHM. Cornell.

Mr. WEBER. Cornell, thank you. I am sorry.

Dr. RAHM. No problem.

Mr. WEBER. That you were to be impartial?

Dr. RAHM. I am trying my best.

Mr. WEBER. I get that.

Dr. RAHM. Yes.

Mr. WEBER. Unlike some others. But—did I say that out loud? So your impartial analysis end game is that the states really need to be the leaders?

Dr. RAHM. I think that is fair. And I think it is fair to say that many states, particularly ones like Texas who have a long history of this type of regulation and activity, sometimes do a very good job of regulating and overseeing it.

Mr. WEBER. Thank you. I am aware of my time. Mr. Chairman, thank you. I yield back.

Chairman STEWART. Thank you, Mr. Weber.

We now return to our returning minority Ranking Member, Ms. Bonamici.

Ms. BONAMICI. Thank you very much, Mr. Chairman.

And thank you to the witnesses for your time here today and certainly for bringing your expertise. And even though I needed to leave briefly for votes and a markup, I assure you, I have read all of your testimony.

Dr. Rahm, you state clearly in your testimony that the EPA should play a role in setting standards for states to follow and you identified some areas or issues that are common across the country. Can you please discuss why the country should adopt some minimum practices or standards and in what areas?

Dr. RAHM. Well, and again, what I was getting at there is that if common risks and cumulative impacts are found, which we see—which we are seeing some evidence of, that we really should consider, for example, regional, interstate, or Federal basic standards. Again, these basic standards might be around such issues like chemical disclosure. They might be around issues of well casing and cementing, also, for example, wastewater management and treatment, all of which are very important issues.

I think if basic standards were to be established, again, on an interstate, regional, and Federal level, many states would already meet or exceed those standards. And it is my hope that there would be a way that that would not be onerous to those states, but that is not my field.

Ms. BONAMICI. Thank you.

Dr. RAHM. Yes.

Ms. BONAMICI. And I have another question. I want to ask you about something that was frequently mentioned this morning, and those are the three groundwater investigations. It is important that we try to understand the scope of those investigations at Pavillion, Parker County, and is it Dimock?

Dr. RAHM. Dimock.

Ms. BONAMICI. Dimock. You state very clearly in your written testimony that these investigations were limited in design. In fact, you talk about how these were in response to unplanned events. So can you elaborate further on that because the way I looked at it these investigations were very different from the actual study that the EPA is doing. And I just want to clarify it in the record that—what these investigations were.

Dr. RAHM. So yes, again, maybe just reiterating some of my written and oral testimony, I think these investigations had a very limited scope. If you were only to read, for example, the first page of the Pavillion investigation, it would claim that it was not the in-

tent of the investigation to study hydraulic fracturing, for example. Now, on the last pages, they speculate—the authors of those studies do speculate perhaps more broadly, and again that is—that could be debatable. But I think that several of these studies were as a result of specific complaints, and my reading of some of these investigations—I am not familiar with the Texas case at all so I can't speak for that, but for Dimock and Pavillion, that specific complaints were made that the EPA was brought in to investigate.

And I think they were capable of addressing those, but in terms of broader questions and the ideas of risk assessments that we have been talking about today, I don't think those investigations were capable of addressing those types of issues.

Ms. BONAMICI. Thank you very much.

And, Dr. Hauchman, do you agree with that statement about the limited nature of those investigations?

Dr. HAUCHMAN. Thank you for the question. I do agree. These were investigations that were led by the regional offices of EPA for very specific purposes, and they are distinct from our study.

Ms. BONAMICI. And they were—just to follow up—more in response to complaints from individuals or——

Dr. HAUCHMAN. That is correct.

Ms. BONAMICI. —requests from individuals to investigate a particular situation?

Dr. HAUCHMAN. That is exactly correct.

Ms. BONAMICI. Dr. Hauchman, after reading your testimony and the stages of the fracking water cycle that the study covers, I recognize that there is a considerable amount of analysis related to the use of chemicals, groundwater evaluations, geological and surface evaluations that will all take a considerable amount of time and data. So how much is the EPA depending on the industry for access to data needed to perform these types of evaluations, and what steps are you taking or is the EPA taking to be assured that the industry is providing the EPA with the full scope of relevant data? And I was interested to hear Mr. Rogers talk about how in Utah all the chemicals are disclosed on a website. So can you talk a little bit about how you are dealing with proprietary claims by industry and whether you are taking steps to assure that you have the full scope of the relevant data?

Dr. HAUCHMAN. Yes, thank you for your question. We are conducting a very robust evaluation of all available information, regardless of where it comes from. We have a set of criteria that we are using and applying to ensure that the data are usable, that they are sound, that they do their best. We will characterize uncertainty to the extent possible.

We are working closely with industry. For example, we have had a number of meetings, conversations with them about the FracFocus database, which we are using. We are evaluating as much information from that database and other sources. We are also very mindful of the issue of confidential business information, and that is another example of where we have been working closely with industry to assure them that that confidentiality will not be compromised. However, we want to be able to use as much information as we can, staying within the rules with respect to the confidentiality.

Ms. BONAMICI. Thank you very much. And I see my time is expired. I yield back. Thank you, Mr. Chairman.

Chairman STEWART. Thank you, Ms. Bonamici.

Mr. Rohrabacher.

Mr. ROHRABACHER. Thank you very much, Mr. Chairman, and thank you for holding this hearing and simulating a national discussion on fracking, as well as the whole concept of regulation and of energy, et cetera.

You know, over the years, it hasn't been hard to see that many people who are engaged in environmental and, say, energy policies have been motivated by whatever—for whatever reason a hatred of the oil industry. Now, let me just note that my family comes from dirt-poor farmers in North Dakota. I mean that is where we come from, but unfortunately, we aren't—there hasn't been any oil on our land unfortunately.

But let's just note that those people that I have seen over the years who just have it in their gut where they don't like the oil industry, never give the oil industry credit for the fact that before we started using oil as a major source of energy, the health of our people was being affected dramatically by mountains of horse manure that were piling up in our urban areas. And our water was being polluted by that same source. By using animal energy, there was a price to pay for that. And the oil industry actually has helped give us a more healthful way of life for everyone who lives in an urban area.

Also, we now are developed—you know, here we are, we are evolving, and we find that the government is here to protect us, and quite often, the government is there to protect us until we—you know, and protecting us to death. The FDA, for example, as we know, has such stringent protections that, quite often, there are many, many deaths that are related directly to keeping drugs off the market for years and then having that same drug approved and then saying, well, look, we are saving 100,000 people this year because we have approved this drug while not even paying attention to the people that that drug was denied. So we can regulate people to death. We are doing that in our country in so many ways.

Let's just note that—let me ask the panel. Is there a production or energy or transportation system that any of you know that is without risk? Can the panel come up with one that is without risk? Do you have any examples of a system of production of goods and services or energy or transportation that has had no accidents? Okay. You can——

Dr. DZOMBAK. I will answer speaking for myself, Congressman—

Mr. ROHRABACHER. All right.

Dr. DZOMBAK. —all energy sources and uses have impacts and risks, and as a society, we manage risks.

Mr. ROHRABACHER. Right. Okay. Well, how does fracking, which comes—how does fracking compare to those other sources of energy, coal, for example, or oil production in the more traditional way? How does fracking compare in terms of accidents and risk? Is it less risky or more risky than traditional drilling or mining for coal, et cetera? Is it—maybe we could just give a short answer right down the line. Is it more risky or less risky than the traditional sources of energy?

Dr. HAUCHMAN. I understand the questions you are asking, and I would have to respond that we don't have the information to make that assessment.

Mr. ROHRABACHER. All right.

Dr. HAUCHMAN. I certainly don't have that information.

Mr. ROHRABACHER. Okay. Don't know. Yes.

Dr. DZOMBAK. Don't know. I believe that is why we are studying it as a society.

Mr. ROGERS. Being both from mining and oil and gas, I would say that oil and gas is less risky than the mining activity.

Mr. ROHRABACHER. And how about fracking as a method of getting the oil? Is that less risky or more risky than traditional drilling?

Mr. ROGERS. My opinion is we have been doing fracking in the United States since 1940 and in Utah since the early '60s, so it is something that has not been—I see as a significant risk.

Mr. ROHRABACHER. Okay. Our men from Cornell?

Dr. RAHM. I don't know—like the others, I don't know. But I might add that I think a lot of the data shows that some of the—you know the—perhaps the risky part of unconventional gas drilling is actually very similar to some of the risky aspects of conventional gas drilling, i.e., not necessarily per se the hydraulic fracturing but the drilling of vertical wells through groundwater tables. So—

Mr. ROHRABACHER. Let me just note——

Dr. RAHM. —shared risks there.

Mr. ROHRABACHER. Let me just note that just from an outsider's point of view, it appears to me that much of what is happening to push for more regulation or push for let's look and try to find something as an excuse to stop this fracking, I think that is what we are experiencing. We are doing it not because there is a motive for there are so many people stepping forward in order to protect us, but instead what we have is a motive for those pushing more and more regulation and to look into this.

The motive is to wean or to force the American people off of an oil and gas industry. And dependency on that is our basic source of energy. And that that motive is based on the idea that oil and gas is changing the climate of the Earth. And I think this all comes back to this and the safety things that we have to go through and the arguments we have to look at and—are basically a product of those who are pushing for another motive rather than just safety. And it is very easy to see, and I hope that what we do is take an honest look at safety and—of the American people for this new thing that we are—new way of producing oil and gas and that we don't approach it based on trying to placate the desire of a fanatic group of people in our country who want to change our system because they believe that the climate of the Earth is being impacted by the fact that we drive automobiles.

Thank you very much, Mr. Chairman.

Chairman STEWART. Thank you.

We now turn to Ms. Edwards.

Ms. EDWARDS. Thank you, Chairman Stewart and Ranking Member Bonamici and also to our witnesses today.

I appreciate that EPA is continuing its investigations of hydraulic fracturing. I think that the EPA's investigations are really critical to the Federal Government's responsibility to ensure that drinking water and groundwater across the United States remains safe. And I do understand the industry's concerns about the investigations and the regulations that accompany efforts to ensure that fracking is conducted safely, but I think it is paramount that these activities be conducted in a manner that does as little risk as possible, understanding, as our witnesses have said, that it is important for us to manage risk, but there is no reason for us to jeopardize the public safety and the safety of our groundwater and drinking water if we can help it. And so that is the spirit in which I look at the efforts of the EPA.

And I don't think it is a negative point that the study in western Pennsylvania found that fracking chemicals didn't pollute the water. That is the job of the DOE and in that instance and the EPA to ensure that constituent concerns, community concerns, consumer concerns are addressed using the best possible science.

Dr. Rahm mentioned in his prepared statement that that study is not conclusive and shouldn't be used to make inferences about fracking broadly. And I take that into consideration when I read all the testimony. I don't think it is highly unusual that EPA has a plan over a period of time which may seem lengthy to us to develop the study, conduct the investigations, peer review the investigations, and publish those studies. I think it is important for us to try to get this is as right as possible.

As the former Ranking Member of the Subcommittee on Investigations and Oversight, I know—I can recall receiving testimony on the lack of disclosure on the chemical mixtures used in fracking and making sure that the industry is transparent. I think some states have tried to move in that direction but I would note that in my State of Maryland where these activities might be pursued in the western part of our State that there has been great resistance and I think even threats from some in industry that if our State regulates the industry more strictly than it wants, then it is going to pull out its economic activity. And I just don't think that is the way quite to do this. I would like to see a greater balance in what it is that the Federal role but ensuring that our states have the capacity to monitor the economic activities in the State.

I just have really one question for Dr. Rahm because I understand that, as you have indicated, the individual investigations and studies that were conducted by EPA and other agencies can't conclude whether fracking is safe or potentially contaminate groundwater and that this is in part due to geological differences, among other reasons. And I wonder if that is even true within a State and within a—among various sites because I think it is important to know that.

And in your written testimony you state that regional differences matter and local character has an impact on management strategies. And I wonder if you could discuss the current regional collaboration and benefits of the kind of partnership to inform an established best practices for identifying potentially harmful impacts of fracking while allowing states to unify their oversight.

Dr. RAHM. I am not quite sure what your question is. Sorry.

Ms. EDWARDS. The question is simply whether current regional collaborations and the benefits of those partnerships inform establishing best practices for identifying potentially harmful impacts on fracking while also allowing states to unify their oversight collectively, and that might be regionally.

So, for example, in Western Maryland, is it important to unify those activities with what is going on in West Virginia, which is our neighboring State?

Dr. RAHM. Sure. So I guess what that makes me think is that, you know, just to reiterate the idea that it is important to involve, I think, all stakeholders when it comes to the data and information that we are collecting. Just to maybe point out that industry and state agencies have a great amount of data and expertise that we should be using, that they are using, when it comes to looking at risks and impacts and assessing those.

I don't know of many examples just personally of a regional sort of effort to try and put that data together, which, I think, is one of the things that we are really missing. There are a few instances, again, the Susquehanna River Basin Commission, which really only has authority over water withdrawal, just that one particular activity. And they do pull in—they do talk to industry and state agencies and I think you can see that when they have the right information from everybody, they can make smart decisions.

But a lot of times I don't think we have—at least as far as I know, many other regional bodies that undertake that kind of exercise where they are putting all the different pieces of information together, and I think that would be valuable.

Ms. EDWARDS. Thanks, Mr. Chairman. I am out of time.

Chairman STEWART. All right. I thank you, Ms. Edwards.

Mr. Hultgren.

Mr. HULTGREN. Thank you, Mr. Chairman. I also want to thank Chairman Hall for allowing me to jump ahead in line here. I have got another meeting I need to run to. But all of you, thank you for being here today.

Safe extraction of our vast domestic energy resources clearly is of paramount concern to policymakers and the public needs to trust the work that the states and EPA are doing to safely regulate these practices. Unfortunately, many of EPA's recent actions, I believe, have severely harmed the public trust necessary for the Agency to accomplish this core mission.

Every weekend when I am back home I am forced to answer questions about an agency many see as running amok. Illinois just recently passed legislation to regulate hydraulic fracturing, and this was a long process leaving my State with some of the most strict rules and regulations for the practice.

What worries me is how EPA appears to have ignored many of the State rules and best practices already in place. I know in 2012 Battelle published a review of the EPA study plan which pointed out the lack of "a description of the full extent of existing federal, state, and local regulatory requirements, standards, and guidelines, and industry best management practice frameworks that already apply to the unconventional natural gas production operations." Why isn't this information considered relevant to the report? And I would direct it to our EPA.

Dr. HAUCHMAN. Right. Thank you for your question. We are not conducting a review or an analysis of state regulations as part of the study. We are focused on answering the scientific questions, which of course could be informative. It is our hope and expectation that it will be helpful in that regard but we are not evaluating regulations as part of our study.

Mr. HULTGREN. And I don't know if we expect you to other than that many of them are working already and I think can be helpful in telling—in coming up to this. And I think it does become even more confusing. I hear it over and over again of conflicting regulatory mandates an appearance to us up here but also to our constituents back home that there isn't an understanding of what the states are doing, what local groups are doing that have been successful. And I think without a firm understanding of what regulations and protocols are currently in place, it is questionable how EPA can plan to assess the relationship between hydraulic fracturing and drinking water.

Mr. Rogers, I wonder if you could discuss with just a few of what I am sure are numerous regulations in place in the State of Utah specifically applicable to hydraulic fracturing?

Mr. ROGERS. The most important would be the casing and cementing of a wellbore. We make a study of where that water is usable, how deep it is, and we make a definite ability in our permitting process to protect that water. And when that well is drilled, we go out there and we have witnesses see that that well is cemented correctly. Then we also do a pre-site before that well is even drilled. We go out there, we survey it, we look at it, depth to groundwater, depth to surface water. Are there drainages or issues? If something did get away from that site, how are we going to protect it, berm it up? So we look at it in great detail how we are going to do that. So that primarily is the well casing is the critical part.

The flow-back is the second part that we manage. We have disposal rules that we use either injection wells or we have disposal ponds that are monitored regularly by our inspectors.

Mr. HULTGREN. So from your answer, to me it is clear there are numerous regulations in place already in the State of Utah. And would you also say that you believe those regulations are working and are accomplishing what they were intended to accomplish?

Mr. ROGERS. Yes, they are. Like I mentioned before, we have had fracking in our State since the 1960s with no incident, and I think our staff did an excellent job monitoring that. The thing we did add about a year ago was a disclosure rule. That is something we were lacking but that is something that we now—we have out there and it is working very well.

Mr. HULTGREN. Okay. Dr. Hauchman, the Battelle study also concluded that giving industries extensive experience and unique expertise in the process of hydraulic fracturing and associated technologies and its wealth of relevant data available to inform this effort, it is a weakness of the study plan and likely its implementation that significant industry collaboration is missing. Do you agree with this conclusion regarding the study's weaknesses?

Dr. HAUCHMAN. We do in fact recognize the value that industry can provide to this study. We have been going out extensively en-

gaging our colleagues in industry with technical expertise, as well individuals from the states.

And in fact I do want to clarify a comment that I made earlier in response to your question. We are, as I said, not looking at regulations but we are asking states for information. We are interested in any information, including technologies, anything that will help us answer the questions with any phase of our——

Mr. HULTGREN. Well, and I think that is very important. I only have 10 seconds left and I will wrap up with this, that I just want to encourage you. I do think there is a wealth of knowledge there from the states, some things that are absolutely working, have been working for decades, and also from industry. And I think it would be a huge mistake if EPA were not to look at this and hopefully embrace many of the things that are working rather than just saying you are going to do this alone and you are going to look until you find problems with it instead reaching out and finding what is working.

With that, thank you, Chairman. Thank you, all of you, for being here. I yield back.

Chairman STEWART. Thank you, Mr. Hultgren.

And we turn to another Congressman from Texas, Mr. Veasey.

Mr. VEASEY. Thank you very much.

I wanted to ask Dr. Hauchman specifically about data that EPA may have collected since 1970s on hydraulic fracturing. You know, a lot of the talk about hydraulic fracturing and the effects that it may have on groundwater and contamination have been pretty recent. You know, it wasn't something that you heard talked about previous to some of the discoveries and the Barnett Shale and what have you.

What sort of data do you have on what hydraulic fracturing may do to groundwater previous, you know, or going back to the 1970s?

Dr. HAUCHMAN. Thank you for your question. I do not personally know the answer to your question. I have not been scouring the literature for that very information, but we will in fact do just that as we prepare our report for 2014.

Mr. VEASEY. Okay. Good. Good. I think that having that may help clear up many of the conversations that we have here.

And one of the other things I wanted to ask you, you know, really I mean to mitigate some of these concerns that people have dealing with groundwater and the environment and what have you, what recommendations have EPA made for what producers should do or what municipalities should do with this sort of new natural gas that many people are finding?

Dr. HAUCHMAN. I am not prepared to answer your question but be happy to get back to you with the answers—

Mr. VEASEY. Okay.

Dr. HAUCHMAN. —for the record.

Mr. VEASEY. Okay. Good deal. Good deal. And I wanted to ask the experts from Utah specifically. I believe it was Mr. Rogers. I wanted to ask you what sort of techniques, devices, you know, have you seen in the last couple years that would help mitigate some of the concerns that people have as it relates to these issues that we are talking about today dealing with hydraulic fracturing and contaminants that may be released into the environment?

Mr. ROGERS. Well, as I spoke earlier, we have a new rule, but the rules take into account things that we have been doing for years. Wellbore integrity, I think, is the most critical part of this so we ensure that that wellbore is designed correctly to protect groundwater. We also have tightened up our disposal rules so that any disposal, any kind of produced water is protected from the environment and they are looked at on a regular basis so we look at that.

Mr. VEASEY. Is there something that you feel that the industry can be doing to help with some of these concerns that may be costly and maybe some producers don't want to implement those safeguards just because they are costly? Is there anything out there that you think is being—that you think is out there and available but it is just not being used because some people think that maybe it is too costly?

Mr. ROGERS. I don't believe so. Hydraulic fracturing operation is very expensive and so they are not going to cut corners just to do that. It is very expensive and a very large investment to even drill that well. It can be millions of dollars so they are not going to cut corners on that end to possibly damage the environment. So I see them doing all they can.

Right now, I think probably the most beneficial thing that industry could do is education and teaching people about hydraulic fracturing rather than the rhetoric we see out there and the fear that is passed on there. To actually understand what it is would be critical for people to know about because once you understand it, you realize the risk is not as severe as what you read about.

Mr. VEASEY. Are there any recommendations that have been made to you specifically that you can think of that maybe you don't agree with would help with the environmental concerns but the recommendations have been made perhaps by the environmental community?

Mr. ROGERS. The thing we did respond to was to have a disclosure role, which we responded to. That was a few years in the coming but we did that. So I think disclosure puts people's minds at ease. And to use fracfocus.org is an exceptional website that can give you a lot of education and you can actually look on and see what is being done in that particular well in your area and throughout the country.

Mr. VEASEY. Thank you. Thank you, Mr. Chairman. I yield back my time.

Chairman STEWART. Thank you, then. We turn now to the former Chair of the full Committee, Mr. Hall.

Mr. HALL. Thank you, Mr. Chairman. [inaudible] differs from all those who have come before us from EPA. When Mr. Rohrabacher's last question to each one of them and it is of record, do you know of anywhere where it has damaged drinking water? Every one of them said no. Now, Mr. Rahm, you seem to know more than all the rest of them put together. Tell me where you are talking about.

Dr. RAHM. I am sorry. What exactly is your question?

Mr. HALL. Tell us where you know that there is evidence and actuality that drinking water has been damaged by fracking.

Dr. RAHM. Actually, what I——

Mr. HALL. What somebody has put in there——

Dr. RAHM. Sorry.

Mr. HALL. —to show it—that fracture itself—damaged the fracture itself.

Dr. RAHM. So to the best of my knowledge I think it is important to make the distinction between gas drilling development and hydraulic fracturing. I have not really seen—I have seen evidence of spills and harmful events from gas development, gas oil development, but to my knowledge I have not seen data that implicates——

Mr. HALL. What about the damage to the drinking water?

Dr. RAHM. To my knowledge, I have not seen that hydraulic fracturing per se is the cause of that.

Mr. HALL. That you have no knowledge of it, is that what you are telling me now?

Dr. RAHM. That is according to what I have seen, yes.

Mr. HALL. You are going to be one of the whole doggone bunch over there that was going to say that you did know of a place where they had damaged the drinking water.

Dr. RAHM. No, I am trying to be very careful about——

Mr. HALL. Please be careful.

Dr. RAHM. —making the distinction.

Mr. HALL. So far, you haven't told us anything but I don't know or I am glad you asked that question.

Dr. RAHM. Try and make the distinction between shale gas development in general and hydraulic fracturing per se.

Mr. HALL. That is your answer?

Dr. RAHM. Yes, it is.

Mr. HALL. Ask it again. Do you know of anywhere where hydraulic fracturing has damaged our drinking water? Yes or no?

Dr. RAHM. As I said, no. Hydraulic fracturing per se I do not have any data that indicates that.

Mr. HALL. And I thank you for that.

Dr. RAHM. Sure.

Mr. HALL. Based on all of the allegations and those that they have had to retract and I really think Mrs. Lummis, the other Chair, really were overly fair with you when they bragged on you there and then were so disappointed in your activity in her own area. And there has been some talk about you all have engaged in info—asking for—begging for information. Dr. Dzombak, you mentioned the high-quality panel that EPA has put together to peer review the study. You are aware of that, aren't you?

Dr. DZOMBAK. Yes.

Mr. HALL. All we know of states like Texas have decades of experience in oil and gas regulation. Other 31 panelists, how many experts from State regulatory agencies were chosen to be peer reviewers no matter where they were from?

Dr. DZOMBAK. Let me say, Congressman, I wasn't involved with choosing the panel.

Mr. HALL. I am not accusing you of that. I am just asking you my question.

Dr. DZOMBAK. But I think we have none—no current state regulators but I am not positive of that.

Mr. HALL. More than a dozen state environmental officials were nominated, including from the State of Texas, from the Texas Com-

mission on Environmental Quality. Why were none of them chosen to provide their expertise to EPA on the study? Why didn't you select one of them?

Dr. DZOMBAK. Well, I can't answer that because I wasn't involved in the selection.

Mr. HALL. Another question you can't answer. All right.

Dr. DZOMBAK. The Science Advisory Board staff office and management selects the committee. They solicit nominations through the Federal Register. Many, many nominations come in. They have a process that they go through, evaluation of ethics, impartiality, look at potential exemptions, but that is their process and I am not involved with it.

Mr. HALL. Dr. Hauchman, let me ask you, why should we trust EPA's conduct in this study based on even the questions that some of the Democrats have asked?

Dr. HAUCHMAN. I—

Mr. HALL. And let me tell you this. You are under oath and it is expected that you—whether you raise your right hand and say you are going to tell the truth, the whole truth, and nothing but the truth. And everybody before you has done that, but a lot of them have come before this Committee and misrepresented the facts on how scientifically they have made their selections. And that can be proved. But you go ahead and answer now what I asked you.

Dr. HAUCHMAN. I am pleased to respond to your question and I will state, as I have stated previously, that I am confident in the scientific integrity of the research that is being conducted. We have a very transparent, rigorous peer review process underway and——

Mr. HALL. You are that but I asked you about us. Why should we trust EPA's conduct in this study because of your past record? Do you differ with those who have come here before us from EPA and testified under oath?

Dr. HAUCHMAN. I am only prepared to speak about the rigors of this particular study, and I sit before you confidently in saying that this is a solid study that we are conducting.

Mr. HALL. Well, let me ask you this question. What has the EPA done to prevent repeating the mistakes made in Parker County, Texas; Pavillion, Wyoming; Dimock, Pennsylvania? What policy and what protocol changes and actions have been taken by the EPA to ensure sound science, if any? Or if you don't know or you tell us you are glad I asked that question or have some other answer for it, just answer me, please.

Dr. HAUCHMAN. We have put in place for this study all the appropriate policies, procedures, and protocols to ensure that the data that we generate, the analyses that we conduct, the methods that we use, and the models that we employ are appropriate and will produce quality results. We are relying on rigorous peer review. We are reaching out in many ways to experts from throughout the country. We are doing everything conceivably possible to ensure that this scientific study will stand on its own merits.

Mr. HALL. All right. I will ask my last question for this particular hearing. If any of you can tell me where and when of your own knowledge or your own investigation or your own study that fracking has damaged drinking water? Can any of the four of you

tell me and give me an answer and tell me date and times and where it was? Now, you mentioned, Mr. Rahm, that it does impact on water. You said like the others, though, I don't know when they ask you information about it when Mr. Rohrabacher asked you. Do you know of anywhere where you know of your own knowledge and your own studies that fracturing has damaged drinking water?

Dr. RAHM. As I said, no.

Mr. HALL. Yes or no? No?

Dr. RAHM. As I said, no.

Mr. HALL. All right.

Chairman STEWART. And the gentleman's time is expired.

Mr. HALL. And how about you? Could I let the other three answer yes or no?

Chairman STEWART. Very quickly, please.

Mr. ROGERS. No, I don't.

Dr. DZOMBAK. Nor I. I haven't been involved in such studies.

Mr. HALL. All right. So what you don't know, then, if you haven't been involved. You don't know if you haven't been involved so you don't know. And do you know?

Dr. HAUCHMAN. I will restrict my response to the peer-reviewed literature. We are aware of some very recent reports——

Mr. HALL. Give me a yes-or-no answer. That is all I asked for. If it is yes, just give me yes.

Dr. HAUCHMAN. There have been some reports. We will be reviewing them.

Mr. HALL. There have then some reports. Do you know of any place where there is damaged water?

Dr. HAUCHMAN. I have not reviewed those reports, those publications.

Mr. HALL. So you don't know?

Dr. HAUCHMAN. At this particular time, no.

Mr. HALL. I yield back. Thank you, Mr. Chairman.

Chairman STEWART. All right. Thank you, Chairman Hall.

I thank the witnesses for your valuable testimony and Members for their questions. And Members of this Committee may have additional questions for you and we will ask you to respond to those in writing. And the record will remain open for two weeks of additional comments and written questions from the Members.

But before we close, there is a couple things that we need to do. Mr. Hauchman and Mr. Dzombak, I need your help and your commitment. I have a timeline here. We have asked multiple occasions for answers from charge questions from this Committee. To date, we have not gotten replies to those charge questions. There clearly has been enough time that there have been opportunity to answer those.

In addition, we have asked at least twice a week to meet with the members of SAB or members of the Administration to try and understand why they won't answer these questions and have been told that they are too busy to meet with us. And I frankly don't understand that. If members of the SAB or members from the Agency are too busy to meet with Members of Congress who we are supposed to be working together on these studies, I think that that generates suspicion and ill will between us. And I think it is bad counsel whoever is counseling those members not to meet with us.

And I need your commitment that you will go back to your agencies and to these individuals and press them and encourage them to answer our questions and to meet with us. Does that seem like a reasonable thing to ask? Yes? Yes, Mr. Dzombak?

Dr. DZOMBAK. Chairman Stewart, I appreciate your concern and your May 2 letter was examined in great detail by the panel and by the SAB management. There are 13 specific queries in there. I think the SAB management responded and I contributed to the formulation of the response letter along with Dr. David Allen, Chairman of the chartered SAB on May 31. Several of those questions were more appropriately directed to the Office of Research and Development. We contacted—we—the SAB management contacted Office of Research and Development and that response letter provided three specific responses to three of the questions. On the other 10, as we outlined in that letter, those are all valid, pointed questions, and some of those were part of the discussion in the consultation on May 7 and 8 and we will be happy and we plan to carry those questions forward for further discussion when the panel meets again in the fall.

Chairman STEWART. Okay. So——

Dr. DZOMBAK. And I can assure—excuse me. I can assure you, Chairman Stewart, that I have been engaged with the SAB management on that and we are giving it all due deference and specific attention.

Chairman STEWART. All right. So thank you. So you are saying we won't have answers to those questions until the panel meets again this fall?

Dr. DZOMBAK. Well, several of the questions, I am saying, were responded to specifically——

Chairman STEWART. Right.

Dr. DZOMBAK. —in the May 31 response and the other 10 specific technical questions we will be engaging with this fall.

Chairman STEWART. Okay. We look forward to that and thank you. I ask unanimous consent then to enter into the record the following two items: a letter from Ranger Resources to the Committee regarding the EPA's investigations of groundwater claims in Parker, Texas; and second, a letter I sent to the Chairs of the EPA Science Advisory Board and Science Advisory Board's Hydraulic Fracturing Research Advisory Panel regarding the SAB review of the EPA's study of potential impacts of hydraulic fracturing on drinking water resources. And without objection, so ordered.

[The information follows appears in appendix II]

Chairman STEWART. And finally, before we close, I wanted to take a moment to acknowledge the work of Ellen Scholl to my left for her outstanding contributions to the Energy and the Environment Subcommittees over the last two years. Ms. Scholl is—this will be your last hearing. In August she is going to be returning to Texas where she will be pursuing her graduate work at the LBJ school of Public Policy. Ellen, we thank you for your great work, for your contributions, and you will be missed. Thank you.

With that then, if no further business, the witnesses are excused and this hearing is adjourned. Thank you.

[Whereupon, at 12:05 p.m., the Subcommittees were adjourned.]

Appendix I

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Dr. Fred Hauchman

Enclosure

EPA Responses to August 26, 2013, Questions for the Record from
July 24, 2013 Hearing, Lessons Learned: EPA's Investigations of Hydraulic Fracturing

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Questions from Chairman Stewart

1. **How much money has EPA spent on this study so far, and how much does the Agency plan to spend before the study is completed? Given that resources are limited, and EPA is carrying out the study with less funding than was requested by the Obama Administration, why has the scope expanded so far beyond the original appropriations language, which directed the Agency to simply study the relationship between hydraulic fracturing and drinking water? Moreover, given work being conducted by other federal agencies (i.e. DOE, USGS) and state agencies, can you provide any "cost savings-cost avoidance" opportunities that taxpayers can realize in your efforts?**

Answer: From FY 2010 through FY 2013, the EPA's budget for the study totaled $18.4 million. The agency has requested $6.1 million for FY 2014. Additional funds will be required to finalize the draft report of results. Sharing information on research activities and coordinating efforts with other federal and state agencies are important mechanisms being used by the EPA to ensure the efficient and effective use of these funds.

The scope of the EPA's *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources* is responsive to Congress' original request and was supported by the agency's Science Advisory Board in their review of the draft Study Plan in 2011. There has been no expansion of the scope beyond the original appropriations language.

2. **Several reviews noted that part of the study EPA is listing the chemicals used in hydraulic fracturing, but have this failed to provide any context, including concentration and dose. Specifically, one reviewer noted "In order to provide information useful to policy makers, EPA needs to have potential exposure information (an assessment of potential "dose"), and knowledge of the characteristics of site conditions that impact the likelihood of a spill and consequences of spills (containment or environmental release) to assess potential to impact water resources." Does EPA feel that simply listing the hydraulic fracturing additives is a useful enterprise without the aforementioned context?**

   a) **Additionally, will the EPA be providing appropriate context and characterization for these additives? For example, many hydraulic fracturing additives can also be found in commonly used household products, yet the public may be unfamiliar with their names and thus suspicious of or even alarmed by their listing.**

   b) **Does the agency have an "education component" in their remit regarding this study? Given that the Administration has an "all of the above" approach towards energy development within the United States, we are interested in how the USEPA is**

approaching external stakeholders on issues around hydraulic fracturing? Given the concerns raised by the public, legislators and other parts of your agency regarding the use of chemicals do you not see a role for your team to place the use of chemicals in context?

Answer: To the extent that data are available, the EPA intends to summarize the purpose, frequency, and concentration of chemicals used in hydraulic fracturing fluids and to provide available chemical, physical, and toxicological properties of these chemicals. This information, considered along with the results of other parts of the EPA study, will provide the agency and stakeholders with a better understanding of the environmental fate and the toxicity of these chemicals. The EPA will provide appropriate context for the findings in the draft study report and in the extensive stakeholder outreach activities associated with the release of the report.

3. **During the EPA's research in Pavillion, Wyoming the USGS conducted an assessment and released two technical reports regarding the EPA investigation and draft report. The USGS report identified, among other things, flaws in EPA's research, including improper monitoring well construction and development and possible cross-contamination of groundwater during EPA monitoring well development. For example, the USGS was unable to sample EPA's Monitoring Well 2. What changes, if any, has the EPA made or assurance can EPA provide to prevent these sorts of errors from being repeated?**

Answer: The U.S. Geological Survey (USGS) did not identify flaws in the EPA's methodology in their reports. The USGS reports were (1) a data report and (2) a methods report describing the consensus approach (developed by EPA, USGS, local Tribes, and the state of Wyoming) used for sampling. No conclusions were drawn about the EPA methods or data. With regard to the EPA's *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*, the agency is committed to ensuring scientific integrity in its research and is conducting the work in line with its Scientific Integrity Policy[1], its Quality Assurance Policies, and with the principles laid out in the request from Congress.

4. **It is well known that, in the case of Pavillion, Wyoming - where EPA alleged hydraulic fracturing caused groundwater contamination in a draft report and press release prior to peer review - EPA failed to follow standard well sampling protocols, including those by USGS and in some cases their own. It is my understanding that this failure likely contributed to EPA's erroneous conclusions and misplaced accusations.**

   a) **Dr. Hauchman, what steps is the EPA taking to prevent similar sampling errors in its work on the broader fracking study, particular with respect to the case studies?**

Answer: As stated above, the USGS did not identify flaws in the EPA's methodology in their reports. The EPA stands behind its work and data from Pavillion while recognizing the state of Wyoming's commitment to conduct a comprehensive review of all the relevant data and to initiate an additional science-based investigation. The EPA's current *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources* adheres to a rigorous application of the agency's quality assurance principles such as audits of data quality and technical systems audits. This approach ensures that results generated are scientifically sound. The methods and standard operating procedures for the case studies are outlined in project-specific Quality Assurance Project Plans.

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[1] U.S. EPA. Scientific Integrity Policy, http://www.epa.gov/osa/pdfs/epa_scientific_integrity_policy_20120115.pdf

5. **What interactions have you or the Agency had with State regulators in the development and execution of this study? Please provide details on how you solicited their input and reactions to the progress report and what you are doing to continue that dialogue with the states?**

Answer: State input has played an important role in the development and execution of the EPA's *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources.* During the development of the study plan, the agency held webinars and in-person public informational meetings in Texas, Colorado, Pennsylvania, and New York to obtain feedback on the EPA's proposed research activities. In the execution of the study, the agency coordinated with states in our fieldwork and in the analysis of data obtained from the states. Webinars, technical roundtables and workshops, requests for information through the *Federal Register*, and public comment periods associated with the Science Advisory Board review of the *Progress Report* continue to provide states and other stakeholders with information updates and opportunities for input on the agency's hydraulic fracturing research activities. The EPA intends to continue engaging the states during the development of the draft study report.

a) **Do you plan to or is there a mechanism to discuss and incorporate the various state regulations in place regarding hydraulic fracturing?**

Answer: The study of the potential impacts of hydraulic fracturing on drinking water resources will not include a review of state regulations. The focus of the study is on conducting research and analyzing data to assess whether hydraulic fracturing can impact drinking water resources and, if so, identify driving factors that affect the severity and frequency of any impacts.

b) **Why were no state regulators included on the hydraulic fracturing advisory panel of the Science Advisory Board?**

Answer: The Science Advisory Board (SAB) Staff Office worked to ensure that the Hydraulic Fracturing Research Advisory Panel is a broad, balanced and diverse panel that includes members with experience and expertise relevant to the EPA's *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*. Disciplines and areas of expertise were identified in a Federal Register Notice released in August 2012 that sought nominations for the panel. In addition to publishing this notice, the EPA SAB staff conducted extensive outreach to seek nominations from professional groups, associations of local, state and tribal representatives, industry, public interest groups and other federal agencies.

Members on this panel were selected from a list of candidates nominated by the public and evaluated against the following criteria: (a) scientific and/or technical expertise, knowledge, and experience; (b) availability and willingness to serve; (c) absence of financial conflicts of interest; (d) absence of an appearance of a loss of impartiality; (e) skills working on advisory committees and panels; and (f) for the committee as a whole, diversity of scientific expertise and points of view. While the list of candidates included experts who work for a range of employers, members were selected based on a consideration of the above criteria, not as representatives of their employer.

Questions from Chairman Lummis

1. **Dr. Hauchman, in June the Agency announced that it would not be pursuing further action on its draft report in Pavillion, including peer review. Does the Agency plan to include any of the data or information from the Pavillion investigation in ongoing hydraulic fracturing study?**

   a) **The EPA website, on a page entitled "Questions and Answers about EPA's Hydraulic Fracturing Study" states the following with regard to groundwater investigations including the one in Pavillion:**

   "Ground water investigations are distinct from the retrospective and prospective case studies conducted as a part of this study, and so they cannot be used as case studies. However; ground water investigations such as these will be considered in this study's analysis of existing data, once they have undergone peer review."

   Given this statement, does the EPA still plan to consider this data as part of the peer review, even though this data will not undergo peer review?

Answer: The EPA does not plan to finalize or seek peer review of its draft Pavillion groundwater report released in December 2011, nor does the agency plan to rely upon the conclusions in the draft report.

Questions from Congressman Bridenstine

1. **In regard to the hydraulic fracturing study, does EPA intend to make all non-Confidential Business Information (CBI) data publicly available that will be used to develop conclusions and recommendations?**

Answer: The EPA will make publicly available data in alignment with the principles outlined in the February 22, 2013, Memorandum from the Office of Science and Technology Policy ("Increasing Access to the Results of Federally Funded Scientific Research"), which includes in its aims to "maximize access, by the general public and without charge, to digitally formatted scientific data created with Federal funds." The agency is developing a draft implementation plan in response to the aforementioned Memorandum. In any such releases of data, Confidential Business Information (CBI), Personally Identifiable Information (PII), data related to National Security, etc. will be excluded from public posting.

Responses by Dr. David A. Dzombak

Response to August 26, 2013 Questions to David Dzombak

1. *Many of the comments from reviewers in the recently published consultation expressed concern that EPA information in the Progress Report did not reflect how the industry had, and will continue to, change over time. How does the Agency plan to account for these changes and keep updating their data accordingly? Realistically, how does EPA plan to ensure the information in its study won't be obsolete by the time it is released?*

Response:

The role of the EPA Science Advisory Board (SAB) is to provide expert review and advice to the EPA Office of Research and Development (ORD) team conducting the research on hydraulic fracturing. Questions about the scope of EPA's current plans for conducting research on the potential effects of hydraulic fracturing on drinking water resources should be directed to ORD. However, I can offer the following observations regarding statements made by EPA staff at the May 7-8, 2013 SAB Hydraulic Fracturing Research Advisory Panel public meeting on this topic.

Statements made by EPA staff at the May 7-8, 2013 public meeting regarding ORD plans to conduct certain activities to stay current on frequently changing hydraulic fracturing industry practices can be found within the meeting minutes that are posted on SAB's website.[1]

For example, at the May 2013 Panel meeting, ORD's Ramona Trovato stated that ORD's stakeholder engagement activities provide a mechanism to stay current on such practices, and noted that ORD also has been conducting webinars to keep the public informed on its activities. ORD's Jeanne Briskin stated that ORD released a Federal Register Notice in November 2012 inviting submittal of information on industry practices from the public, and noted that ORD extended its Federal Register Notice to allow more time for the public to provide such information to EPA. Ms. Briskin noted that ORD has made a public docket available so that companies and members of the public can submit detailed chemical data, including Confidential Business Information, to EPA to assist in its research study on hydraulic fracturing. Ms. Briskin also noted that ORD appreciates receiving information from the public on case studies, and is planning to consider information from the literature as it develops its reports. She urged the public to bring this information to ORD's attention. Ms. Briskin further noted that when requesting information from service companies, ORD asked what trends these companies had in their use of these chemicals. She also noted that ORD was also considering trends identified in the literature data on hydraulic fracturing chemicals in use.

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[1]Summary Minutes of the U.S. Environmental Protection Agency Science Advisory Board Hydraulic Fracturing Research Advisory Panel Public Meeting, May 7-8, 2013,http://yosemite.epa.gov/sab/sabproduct.nsf/MeetingCal/928483ABB4F2A13285257B02004AB250/$File/May+7-8,+2013+meeting-Hydraulic+Fracturing+Research+Advisory+Panel-Minutes-Final.pdf

a. *Do you have any recommendations or did other panelists express any ways the study might be kept as current as possible? How might the study better include the most current practices used by industry?*

Response:

I cannot speak for the Chartered SAB or the SAB Hydraulic Fracturing Research Advisory Panel regarding recommendations associated with EPA's research on the potential impacts of hydraulic fracturing on drinking water resources. The Panel has not yet conducted a peer review resulting in a consensus report, and the Chartered SAB will have final review authority when any such report is developed by the Panel in the future. As Chair of the Panel, it would be inappropriate for me offer personal views of the EPA study. However, I can offer the following observations of fact regarding individual comments raised by SAB panel members at the May 7-8, 2013 SAB Hydraulic Fracturing Research Advisory Panel public meeting. Also, I can provide information about current plans for the Panel to hold an upcoming teleconference to hear testimony from the public about new and emerging information regarding hydraulic fracturing technology, practices, and impacts.

At the May 7-8, 2013 public meeting, and in individual comments submitted after the public meeting, several Panel members suggested or commented on ways that EPA could gather or utilize updated information on current practices or data related to hydraulic fracturing. The statements of individual Panel members can be found within the minutes of the May 7-8, 2013 public meeting[2] and written comments from individual Panel members are found in the compilation of individual Panel member comments on EPA's Progress Report.[3] Although individual Panel members provided their individual suggestions or comments at the meeting and individual written comments, let me emphasize that this is not consensus advice and no report was prepared for consideration by the Chartered SAB. The Panel did not deliberate toward a consensus among the committee members, did not develop materials that can be construed as a product of the Panel, nor did the Panel present a product to the Chartered SAB for consideration.

In addition, the SAB Staff Office plans to announce in the Federal Register that the SAB Hydraulic Fracturing Research Advisory Panel will hold a public teleconference to receive written and oral comments from the public on new and emerging information related to hydraulic fracturing and drinking water resources. The information provided to the Panel will serve as background to assist the Panel in its review of the EPA's draft report on the potential impacts of hydraulic fracturing on drinking water resources that is

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[2]Summary Minutes of the U.S. Environmental Protection Agency Science Advisory Board Hydraulic Fracturing Research Advisory Panel Public Meeting, May 7-8, 2013,http://yosemite.epa.gov/sab/sabproduct.nsf/MeetingCal/928483ABB4F2A13285257B02004AB250/$File/May+7-8,+2013+meeting-Hydraulic+Fracturing+Research+Advisory+Panel-Minutes-Final.pdf

[3] Compilation of Individual Comments from Members of Science Advisory Board Hydraulic Fracturing Research Advisory Panel on EPA's Progress Report: Potential Impacts of Hydraulic Fracturing on Drinking Water Resources – December 2012, http://yosemite.epa.gov/sab/sabproduct.nsf/5F72227CF643BF8785257B9500764E6B/$File/Individual+Comments+from+Members+of+Science+Advisory+Board+Hydraulic+Fracturing+Research+Advisory+Panel+on+EPA.pdf

scheduled for completion in December 2014. The public teleconference will be held on November 20, 2013, from 12:00 p.m. to 5:00 p.m. (Eastern Daylight Time).

b. *Does EPA have a documented change management procedure associated with this Study? Does the Agency reference change management within quality management protocol (e.g., QAPP, QMP)?*

Response:

I am not entirely clear about what is intended by "change management. In any case, questions about procedures being implemented by EPA to enable consideration of changing conditions in the ongoing research on the potential effects of hydraulic fracturing on drinking water resources should be directed to ORD.

I also offer the following observations of fact regarding ORD's plans for quality assurance for its ongoing research on the potential effects of hydraulic fracturing on drinking water resources. EPA has developed a final Study Plan that outlines the scope of EPA's activities for conducting research on this topic.[4] Section 2.6 of the final Study Plan outlines EPA's plans for quality assurance for this research. Section 8 and Appendix C of EPA's December 2012 Progress Report on its research[5] describes the quality assurance process that EPA is following and notes the quality assurance project plans (QAPPs) that EPA has prepared for this research. Current versions of these QAPPs and EPA's Quality Management Plan for conducting this research are available on EPA's website[6].

2. *Would this report be stronger, as suggested by past SAB reviews, if the EPA considered risk assessment as part of their approach?*

a. *In an August 2011 letter to then Administrator Jackson regarding their review of the Study Plan, the SAB recommended that "EPA consider the four steps of the risk assessment paradigm (i.e., hazard identification, exposure assessment, dose-response assessment, and risk characterization) to assess and prioritize research activities." Has EPA provided any documentation or information to the public regarding the risk-based approach claimed to be used by the agency to prioritize research? Is there any evidence EPA follow agency risk assessment guidance/protocols during this process?*

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[4]Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, EPA/600/R-11/122, November 2011, http://www2.epa.gov/sites/production/files/documents/hf_study_plan_110211_final_508.pdf

[5] EPA's December 2012 Progress Report: Potential Impacts of Hydraulic Fracturing on Drinking Water Resources,http://www2.epa.gov/sites/production/files/documents/hf-report20121214.pdf

[6] Quality Assurance & Integrity, EPA's Study of Hydraulic Fracturing and Its Potential Impact on Drinking Water Resources, http://www.epa.gov/hfstudy/qapps.html

Response:

I cannot speak for the Chartered SAB or the SAB Hydraulic Fracturing Research Advisory Panel regarding assessment of EPA's research on the potential impacts of hydraulic fracturing on drinking water resources. The Panel has not yet conducted a peer review resulting in a consensus report, and the Chartered SAB will have final review authority when any such report is developed by the Panel in the future. As Chair of the Panel, it would be inappropriate for me offer personal views of the EPA study. However, I can offer the following observations of fact regarding SAB's review of EPA's research related to this topic, and EPA's plans for researching this topic area.

The SAB has been involved with providing scientific peer review and expert advice since the beginning of the EPA research study. This has included review of the Research Scoping Plan in 2010 and EPA's draft Research Study Plan in 2011. In SAB's August 4, 2011 "Review of EPA's Draft Hydraulic Fracturing Study Plan,[7]" SAB recommended that EPA consider the four steps of the risk assessment paradigm (i.e., hazard identification, exposure assessment, dose-response assessment, and risk characterization) to assess and prioritize research activities for each water lifecycle stage presented in the draft Study Plan, and to focus research questions. The SAB also recommended that EPA first focus on hazard identification and potential human exposure in the current research effort.

Section 2.3 of EPA's final Study Plan[8] outlines EPA's plans to use a risk-based prioritization approach to identify research that addresses the most significant potential risks at each stage of the hydraulic fracturing water lifecycle.

b. *Specifically, is the EPA including those four elements: hazard identification, exposure assessment, dose-response assessment, and risk characterization, as part of the study?*

Response:

Questions about specific current activities in EPA's research on the potential effects of hydraulic fracturing on drinking water resources should be directed to ORD.

I would note that within Section 2.3 of EPA's final Study Plan[9], which the SAB reviewed in 2011, the following discussion outlines EPA's plans to use a risk-based prioritization approach to identify research that addresses the most significant potential risks at each stage of the hydraulic fracturing water lifecycle. Within this Section, EPA notes that:

- For the current study, emphasis is placed on exposure assessment and hazard identification.

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[7] SAB's August 4, 2011 "Review of EPA's Draft Hydraulic Fracturing Study Plan," http://yosemite.epa.gov/sab/sabproduct.nsf/02ad90b136fc21ef85256eba00436459/2BC3CD632FCC0E99852578E2006DF890/$File/EPA-SAB-11-012-unsigned.pdf

[8] Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, EPA/600/R-11/122, November 2011, http://www2.epa.gov/sites/production/files/documents/hf_study_plan_110211_final_508.pdf

[9] Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, EPA/600/R-11/122, November 2011, http://www2.epa.gov/sites/production/files/documents/hf_study_plan_110211_final_508.pdf

- Exposure assessment will be informed by work on several tasks including, but not limited to, modeling (i.e., water acquisition, injection/flowback/production, wastewater management), case studies, and evaluation of existing data.
- Analysis of the chemicals used in hydraulic fracturing, how they are used, and their fate will provide useful data for hazard identification.
- A definitive evaluation of dose-response relationships and a comprehensive risk characterization are beyond the scope of this study.

Thus, the EPA study is being conducted in a risk assessment framework.

c. *Should the EPA's study of hydraulic fracturing ensure that identification of the possible impacts of hydraulic fracturing on drinking water resources be accompanied by a corresponding analysis of risk based on probability and consequence, taking into account the current risk management practices of industry and the states?*

Response:

I cannot speak for the Chartered SAB or the SAB Hydraulic Fracturing Research Advisory Panel regarding assessment of EPA's research on the potential impacts of hydraulic fracturing on drinking water resources. The Panel has not yet conducted a peer review resulting in a consensus report, and the Chartered SAB will have final review authority when any such report is developed by the Panel in the future. As Chair of the Panel, it would be inappropriate for me offer personal views of the EPA study. I would note, however, that EPA finalized its Study Plan, which included consideration of various risks, after considering SAB advice on its draft Study Plan. Various risk topics were discussed in the March 2011 SAB advisory meeting on the Study Plan and in the course of the May 7-8, 2013 SAB Panel public meeting. The SAB Panel has had and will continue to have opportunities to opine on risk issues pertaining to the EPA study. For example, the SAB Staff Office plans to announce in the Federal Register that the SAB Hydraulic Fracturing Research Advisory Panel will hold a public teleconference on November 20, 2013, from 12:00 p.m. to 5:00 p.m. (Eastern Daylight Time).

Given recent comments from the Secretary of the DOE, and prior statements by the former EPA Administrator that there has been no documented impact to drinking water from the actual process of hydraulic fracturing, can you affirm here that the agency has not documented any case where drinking water has actually been impacted by the process of hydraulic fracturing?

Response:

Questions about the findings of EPA's research on the potential effects of hydraulic fracturing on drinking water resources should be directed to ORD. The SAB has not yet reviewed findings of the study, which is not yet completed.

3. *What prevented your panel from responding to the questions in my May 2, 2013 letter on the same timeline as it replied to Dr. Hauchman's charge questions? When and how will panelists be given the opportunity to respond in writing?*

Response:

In its May 31, 2013 letter to Chairman Stewart, the EPA SAB Staff Office responded to the questions raised in Chairman Stewart's May 2, 2013 letter. I participated in the development of the response. Of the thirteen specific queries, three related specifically to activities of the SAB while the other 10 were related to activities of ORD. Detailed responses were provided for the three queries focused on SAB activities, while the other 10 queries were forwarded to ORD as noted in the question-by-question response provided in the May 31 letter. It is my understanding that staff from the SAB and the Committee on Science, Space, and Technology are working on the issue of the process for SAB response to Congress on specific scientific queries.

Responses by Mr. John Rogers

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
. Subcommittee on Environment
Subcommittee on Energy

Hearing Questions for the Record
The Honorable Chris Stewart

Lessons Learned: EPA's Investigations of Hydraulic Fracturing
Mr. John Rogers

1. In the summer of 2012 Battelle released a review of the EPA's Study Plan. In this review, Battelle concluded that given industry's "extensive experience" and "unique expertise in the process of hydraulic fracturing and associated technologies, and its wealth of relevant data available to inform this effort, it is a weakness of the study plan, and likely its implementation, that significant industry collaboration is missing."
    a. Mr. Rogers, in your experience at the state level, do you and your office solicit input and comments from industry?

Response:

Any rule the Division proposes, undergoes a very close examination from both industry and environmentalists. The Division forms a stakeholder's group that allows for very diverse input on the subject in question. Throughout the rule making process, there is continuous opportunity for public comment. Finally, before any acceptance of a rule, the Board of Oil, Gas and Mining revues the process for openness and viability and application of the rule.

2. One SAB reviewer, in individual comments on the Progress Report, specifically noted that EPA data included in the progress report did not reflect or address the fact that different operational areas or fields that are fractured require different chemical compositions to provide optimum performance. What sorts of variability in geology, hydrogeology, and other aspects of the formation exist amongst different basins or producing areas in the State of Utah?
    a. Would you say that for a study of hydraulic fracturing to be accurate and useful, it must reflect, emphasize, and account for the broad diversity and range of conditions across the country?

Response:

The geology of an area has the largest effect of what methodology for hydraulic fracturing will be utilized. This includes the type of rock, depth to the target zones, existing natural fractures, formation pressures, faulting, rock mechanics, depth to usable aquifers, surface conditions and formation chemistry. There are many variable conditions that can change both regionally and within in a basin. One broad rule to monitor the vast variety of geology in an area would not seem practical.

3. What sort of knowledge do State agencies have when it comes to pre-existing or historical groundwater conditions or variability within a basin?

Response:

The Division of Oil, Gas and Mining has contracted with the United States Geological Survey (USGS) to study water quality in the Uintah Basin of Utah for 20 years. The Uintah Basin is the primary oil and gas producing basin in Utah. This study is concentrated in areas surrounding class II water injection wells to insure that injection well's fluid are not migrating into water wells. In addition, the Utah Geological Survey (UGS), USGS and Division of Water Quality (DWQ) and Utah Division of Water Resources have collaborative studies of ground water in various areas of Utah.

Responses by Dr. Brian Rahm

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Response to Hearing Questions for the Record
(See below for reproduction of the questions)

These are good questions. As with all scientific inquiries, it is important to understand what research can accomplish, as well as its limitations. An honest discussion of limitations often paves the way for future research, and helps to bound the conclusions that can and ought to be drawn.

Examination of these questions should be an important part of the EPA's ultimate discussion. As I mentioned in my testimony, no single study – even one as large as the EPAs - can provide all the answers we seek with respect to comprehensive risk assessments associated with shale gas development.

Response to question "a" –

The "threshold" for regional or national data is subjective. By themselves, single case studies should not be used to speculate on national-scale risks. Overall, great care should be taken to present case studies in their proper contexts. That being said, it is possible that the collection of data associated with each case, which may include historical background data, and contextual data from the larger geographical area, may help to provide a regional picture by putting together different information sources in a more coordinated way than has been previously done. If this is done, this effort could reasonably be considered a regional or even national one. Another potential advantage of the study is the possibility of comparing information across regions, which itself may help to highlight and illuminate important differences in regional geology, practices, regulations, and technologies that are useful for understanding how unconventional gas activities may present different risks in different places. Lastly, while the geographic limitations of this study should be acknowledged and carefully discussed, it may aid other regional and national-scale researchers who are seeking to synthesize datasets across studies, using a combination of industry, academic, and government data.

Response to question "b" –

This is also a critical question that needs significant attention in any final discussion of EPA results. The difference between trends (which might be generalizable) and incidents (which may be impactful, but rare and difficult to predict in time and space) needs to be made clear. If not enough is known to make statistically rigorous conclusions, discussion of risk needs to be qualified appropriately.

Prospective case studies, of which a limited number are proposed, should help to provide broader contextual information for the plays in which they are conducted (Marcellus & Haynesville). This seems valuable, but limited. Secondly, it should be possible to use contextual data collected by government agencies, industry, and academics, to provide estimates of the degree to which case studies are generalizable. Let's take, for example, the theoretical case of a well blow out. If this single case was generalized to represent all wells, one would have the impression that drilling for gas leads to tens of thousands of blow outs every year. This is obviously not the case. By incorporating the number of

wells drilled without well blow outs, we can develop a sense of how frequent these accidents happen, and therefore initiate an intelligent dialogue about how to prevent or mitigate such accidents. This effort will not be perfect, especially since many risks are not as immediately detectable as well blow outs. Still, with careful use of contextual data, the EPA study should be able to provide or lead to better assessments than we currently have, even if the EPA themselves do not conduct such an assessment. Whether these assessments are "good enough" will be a matter of debate. More data can always be collected to refine understanding of risk. Finally, we should not view risk assessment as an activity that ends with the publication of a study. Risks assessments are on-going, and need to evolve and adapt along with technologies, policies, and practices.

Thank you for the opportunity to respond. I'm happy to talk further if I can be helpful.

Respectfully,

Brian G Rahm, PhD

Hearing Questions for the Record
The Honorable Chris Stewart

Lessons Learned: EPA's Investigations of Hydraulic Fracturing
Dr. Brian Rahm

1. In your testimony you noted that there were limitations to what specific groundwater investigations, such as the one in Pavillion, Wyoming could do. You stated these investigations could not act as definitive risk assessments of water resource impacts from shale gas development in general. During the hearing you also said that we need data on a regional or national scale, not just data from areas where problems occurred.
    a. Given that EPA's retrospective sites were selected from a small sample size (5 selected out of 60), would you say that this data meets the threshold of data on a regional or national scale?
    b. Additionally, since these sites were chosen based on stakeholder solicitation and were generally skewed toward sites with preexisting issues or problems, does that mean that any data gathered in these case studies cannot be generalized?

Appendix II

Additional Material for the Record

SUBMITTED BY THE COMMITTEE'S MAJORITY

National Human Health Risk Evaluation for Hydraulic Fracturing Fluid Additives

Prepared for
Halliburton Energy Services, Inc.
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May 1, 2013



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Executive Summary

Introduction

Improvements in directional drilling and hydraulic fracturing (HF) technologies have allowed for the extraction of large reserves of natural gas and oil from formerly uneconomical low-permeability formations (*e.g.*, shale, tight sand, tight carbonate). The increasing use of HF in the US and globally to develop oil and gas reserves in these "tight formations" has brought with it heightened attention to its alleged impacts. We have previously examined HF procedures used in the Marcellus Shale and the chemical constituents commonly used during the HF process (Gradient, 2012). That earlier analysis addressed whether adverse human health impacts relating to drinking water could be associated with HF fluids in the Marcellus Shale as a result of their intended use (to aid in fracturing deeply buried hydrocarbon deposits) or in the event that there were unintended surface releases (spills) of these constituents. The purpose of this report is to expand the scope of these prior analyses to address the use of HF fluids and their potential impacts on drinking water in a broad range of shale plays and other tight formations across the contiguous United States.

ES.1 Hydraulic Fracturing Process Overview

Recent advances in well drilling techniques, especially the increased use of "horizontal" drilling in conjunction with high volume hydraulic fracturing, have expanded the capacity of oil and gas extraction from a single well. In addition, it is increasingly common to install multiple horizontal wells at a single "well pad" in order to maximize gas/oil production and minimize the amount of land disturbance when developing the targeted formations.

Hydraulic fracturing is a multi-step process aimed at opening up fractures within the natural hydrocarbon-bearing geologic formations and keeping fractures open to maximize the flow of oil and/or natural gas to a production well. The HF process involves pumping fluid (referred to here as "HF fluid") into the target formation to create fractures, and then pumping proppants (*e.g.*, sand) into the induced fractures to prevent them from closing. After the proppant is in place, all readily recoverable HF fluid is pumped from the well or flows under pressure to the surface along with water from the formation that was hydraulically fractured; this process is referred to as "flowback" and we use the term "flowback fluid" to describe the fluid that flows back out of the well during the initial period following hydraulic fracturing.[1]

The fluids used in the HF process generally consist mostly of water with small amounts of chemical additives, typically comprising approximately 0.5% by weight of the fluid, to enhance the efficiency of the fracturing process. Hydraulic fracturing additives serve many functions in HF, such as limiting the growth of bacteria, preventing corrosion of the well casing, and reducing friction to minimize energy losses during the fracturing phase. The HF additives used in a given hydraulic fracture treatment depend on the geologic conditions of the target formation.

[1] The composition of the fluid that flows out of the well once the HF process has concluded and production begins changes over time. Initially, the fluid is generally a mixture of the fluid used to hydraulically fracture the well and water and other constituents that are naturally present in the formation (sometimes referred to as "formation water"). Over time, the proportion of HF fluid in the fluid flowing out of the well declines, and after a period of time the fluid flowing out is almost entirely formation water. As a matter of convenience, industry generally refer to the fluid that flows out of the well for the first several weeks as "flowback," "flowback water," or "flowback fluid," and the fluid that continues to flow from the well over the longer term production period as "produced water," although there is no bright line separating the two.

Every step in the well development process – well installation, fracturing, fluids management, and well operation – adheres to a carefully designed set of protocols and is managed to minimize the potential for incidents that could result in unintentional releases of fluids and to maximize gas/oil yield. The process is extensively regulated at the federal, state, and even the local level. A detailed description of the HF process can be found in a variety of documents (*e.g.*, CRS, 2009; API, 2009).[2]

ES.2 Scope of This Evaluation

While it is beyond the scope of this report to cover all natural hydrocarbon-bearing formations which use hydraulic fracturing to develop the resource, we have examined a broad range of current oil and gas "plays," focusing on tight formations in the contiguous US, specifically those that occur in deep shales, tight sands, and tight carbonates (Figure ES.1 shows the regional extent of these sedimentary basins across the contiguous US).[3]

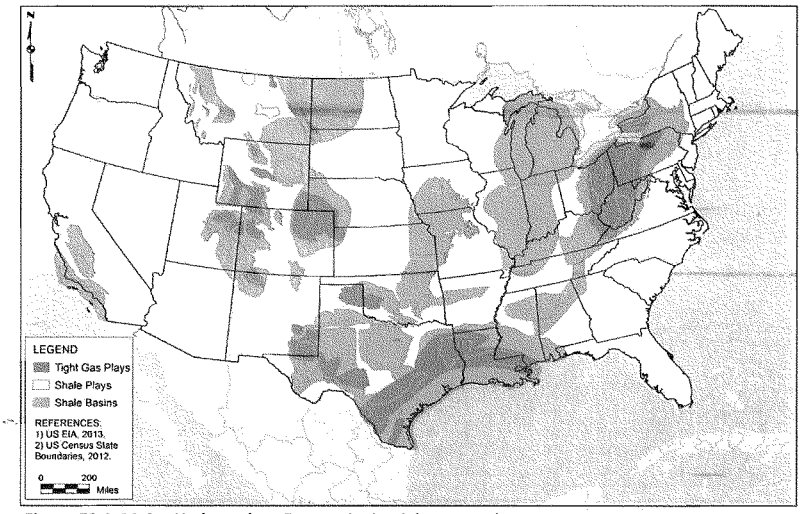


Figure ES.1 Major Hydrocarbon Reservoirs in Tight Formations

Tight formations around the country are estimated to contain significant oil and gas reservoirs (Biewick, 2013). Oil and gas exploration activities are expanding in these formations, thereby attracting interest from multiple stakeholders, including the public, regulators, scientific community, and industry. Concerns have been expressed over the potential for the additives used in the HF process to impact drinking water resources. The United States Environmental Protection Agency (US EPA) is conducting a Congress-mandated study evaluating the potential impacts of HF on drinking water resources which focuses "primarily on hydraulic fracturing of shale for gas extraction" (US EPA, 2012b, p. 6). State

[2] See also web resources: http://fracfocus.org/hydraulic-fracturing-process; http://www.energyindepth.org/; and http://www.halliburton.com/public/projects/pubsdata/hydraulic_fracturing/fracturing_101.html.

[3] The contiguous US has a wide range of sedimentary basins with different characteristics and our analysis applies more broadly to sedimentary basins around the world with characteristics similar to those considered in our report.

environmental agencies are also assessing the potential environmental impacts of HF, including the likelihood of impacts on drinking water supplies.[4]

This report, which Gradient has prepared on behalf of Halliburton Energy Services, Inc. (HESI), presents our evaluation of the potential human health impacts relating to drinking water that are associated with the use of typical HF fluids. We examine the human health risks posed by the "intended" use of these fluids, *i.e.*, the pumping of the fluids into a target formation to create fractures in the formation. Specifically, we note the steps that are taken in well construction to prevent the HF fluids being pumped down the well from escaping the wellbore and coming into contact with drinking water aquifers and to ensure that the HF fluids reach their intended destination, *i.e.*, the formation to be hydraulically fractured ("zonal isolation"). We then examine whether it is possible for HF fluids pumped into tight formations to migrate upward from those formations. We address this concern in this report, although we note at the outset that the New York State Department of Environmental Conservation (NYSDEC) (2011) and other stakeholders have evaluated this issue and concluded that it would not be plausible for the fluids to migrate upward and contaminate shallow drinking water aquifers. We also examine the human health risks associated with "unintended" (accidental) releases of fluids containing HF fluid and flowback fluid constituents, focusing on surface spills. We evaluate the potential for such spills to impact groundwater or surface water and the human health implications of exposure to HF constituents if such water is then used for drinking water purposes.

The possible exposure scenarios evaluated in our risk analysis are illustrated in the figure below, and addressed in turn in the summary that follows.

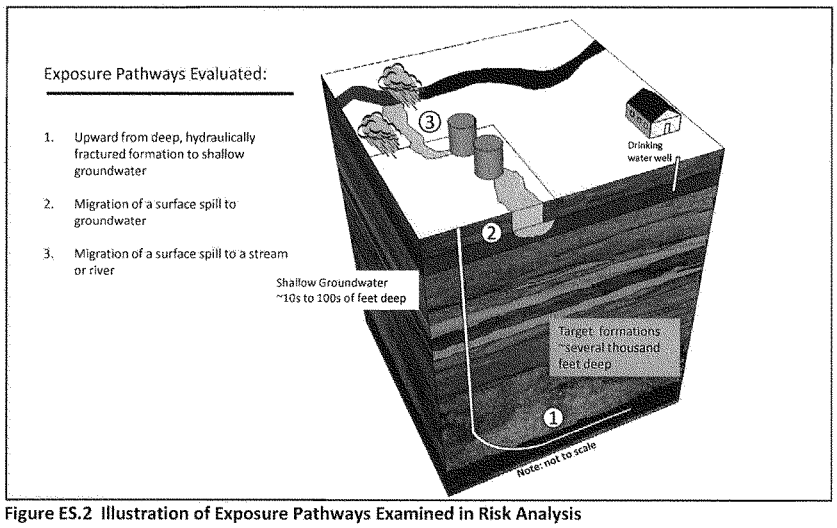


Figure ES.2 Illustration of Exposure Pathways Examined in Risk Analysis

[4] For example, the NYSDEC has prepared several versions of its Supplemental Generic Environmental Impact Statement (NYSDEC, 2009, 2011), which contains generic permit requirements for the development of natural gas production wells utilizing HF in the Marcellus Shale, which underlies significant areas of New York, extending also under large portions of Pennsylvania, West Virginia, and Ohio.

ES.3 Implausibility of Migration of HF Constituents from Target Formations

As part of the HF process, HF fluids are pumped down the well and into the target formation to create fractures that will facilitate the production of oil/gas from the well. Production wells are carefully constructed with multiple layers of casing and cement in accordance with state requirements and industry standards in order to ensure that the fluids in the well do not come into contact with drinking water aquifers or subsurface layers other than the formation being targeted for production; this is often referred to as "zonal isolation" (API, 2009; GWPC and ALL Consulting, 2009).

When installed in accordance with these standards and requirements, casing and cementing are effective in protecting Underground Sources of Drinking Water ("USDWs") from the fluids used in HF operations. As we discuss, NYSDEC concluded, using the analogy of underground injection wells, that the likelihood of a properly constructed well contaminating a potable aquifer was less than 1 in 50 million wells.[5]

Accordingly, the only pathway by which HF fluids pumped into a properly constructed well during the HF process could reach a USDW would be for the fluids to migrate upward from the target formation. We therefore considered whether fluid could migrate upward through intact bedrock, through the fractures created as a result of the HF process ("induced fractures"), or along natural faults.[6]

Our analysis indicates that contamination of USDWs *via* any of these theoretical migration pathways is not plausible. Tight oil and gas formations are set in very restrictive environments that greatly limit upward fluid migration due to the presence of multiple layers of low permeability rock, the inherent tendency of the naturally occurring salty formation water (*i.e.*, brines) in these deep formations to sink below rather than mingle with or rise above less-dense fresh water (density stratification), and other factors, as demonstrated by the fact that the oil, gas, and brines in the formation have been trapped for millions of years. Moreover, the effects of the HF process itself will not cause changes in these natural conditions sufficient to allow upward migration to USDWs for the following reasons.

- During the HF process, elevated pressures are applied for a short duration (a matter of hours to days). This period of elevated pressure is far too short to mobilize HF constituents upward through thousands of feet of low permeability rock to overlying potable aquifers.
- Fluid migration to USDWs *via* induced fractures is also not plausible. An extensive database of measured fractured heights has been compiled from microseismic monitoring of over 12,000 HF stages. These data indicate that even the tallest fractures have remained far below USDWs.
- These same data were used to evaluate potential hydraulic fracture-fault interactions and the potential for fluid movement up natural faults. Our analysis shows that fault sizes activated by hydraulic fracturing are very small (typically < 30 ft in size) and are relatively unimportant for enhancing upward fluid migration.

Overall, there is no scientific basis for significant upward migration of HF fluid or brine from tight target formations in sedimentary basins. Even if upward migration from a target formation to a potable aquifer were hypothetically possible, the rate of migration would be extremely slow and the resulting dilution of the fluids would be very large. Such large dilution under this implausible scenario would reduce HF fluid constituent concentrations in the overlying aquifer to concentrations well below health-based standards/benchmarks. Given the overall implausibility and very high dilution factor, this exposure pathway does not pose a threat to drinking water resources.

[5] Given the very low probability of a properly constructed well impacting shallow aquifers, we did not quantify potential health risks for such a scenario.

[6] We have prepared two scientific papers on these issues which have been submitted for publication. In addition, we had previously considered many of these issues in the context of an analysis submitted to the NYSDEC that focused on the Marcellus Shale (Gradient, 2012).

Various regulatory authorities have evaluated hypothetical upward migration of HF constituents during HF activities and come to similar conclusions. For example, based on its initial analysis in 2009, NYSDEC concluded that "groundwater contamination by migration of fracturing fluid [from the deep fracture zone] is not a reasonably foreseeable impact" (NYSDEC, 2009, p. 8-6). In its revised Draft Supplemental Generic Environmental Impact Statement (dSGEIS), NYSDEC (2011) reaffirmed this conclusion, indicating "...that adequate well design prevents contact between fracturing fluids and fresh ground water sources, and...ground water contamination by migration of fracturing fluid [from the deep fracture zone] is not a reasonably foreseeable impact" (NYSDEC, 2011, p. 8-29).

Thus, our analysis of hypothetical upward migration of HF constituents from tight formations across the US confirms that migration of HF fluid additives from target formations up through overlying bedrock to a surface aquifer is an implausible chemical migration pathway. The thickness of the overlying confining rock layers, and the effective hydraulic isolation that these overlying layers have provided for millions of years will sequester fluid additives within the bedrock far below drinking water aquifers. Neither induced fractures nor natural faults would provide a pathway for HF fluids to reach USDWs, as demonstrated by an extensive dataset on fracture heights and theoretical limits on fracture height growth. Even if such a pathway were hypothetically assumed, the slow rate of migration would lead to very large dilution and attenuation factors, thereby reducing HF fluid constituent concentrations in USDWs to levels that would be well below health risk-based benchmarks, and that would not pose a potential threat to human health even under such an implausible scenario.

ES.4 HF Fluid Accidental Spill Scenario Exposure Analysis

We also examined potential "unintended" fluid spill scenarios to assess whether such spills could lead to the presence of HF constituents in either groundwater or surface water that may be used as drinking water sources at levels that could pose possible human health risks. In this report, we use the term "spills" to encompass various types of accidental releases of fluids containing HF constituents, such as leaks from HF fluid containers, storage tanks, or pipe/valve ruptures during fluid handling, or even possibly cases of wellhead blowouts. As a conservative (*i.e.*, health protective) aspect of our assessment, we have assumed that potential spills are "unmitigated," meaning that any fluid spilled is not recovered, even though it is standard practice at well sites to have measures in place to mitigate spills. Instead, spills are assumed for purposes of this study to wash off of the well pad into nearby streams (assumed to exist in proximity to the pad)[7] and/or migrate into the soil and ultimately impact underlying groundwater resources.

ES.4.1 Overview of Approach to Surface Spill Analysis

We assessed the potential for human health impacts associated with drinking water as a result of potential surface spills of fluids containing HF chemical constituents (*i.e.*, HF fluids and flowback fluid). Our goal was to determine the concentrations at which the constituents of these fluids might be found in drinking water as a result of a spill and then compare those concentrations to concentration levels at which adverse health effects could start to become a possible concern. We also undertook an assessment of the likelihood that a spill of either HF fluids or flowback fluids would occur at a given well site.

The concentration of HF fluid or flowback fluid constituents that could possibly be found in drinking water as the result of a spill or release depends on a number of factors, beginning with the volume of fluid spilled. However, the concentration of the constituents in the fluid spilled would be reduced as a result of dilution in water or soil as it moves through the environment to reach a drinking water source. The extent of this dilution would depend on the conditions accompanying the spill. Therefore, a key part of our

[7] We have not included any dilution that would inherently be provided by precipitation during the transport of material from the well pad to surface water.

analysis was determining the anticipated extent of dilution of constituent concentrations (expressed as "dilution factors" or "DFs").

Given the national scope of oil and gas production using HF, our analysis adopted methods that allow for assessing possible risks associated with a variety of potential spills spanning a wide range of environmental conditions. For example, depending on differences in climate and topography, regional streamflow varies substantially. In the event of a surface spill, such regional variations in streamflow would be expected to lead to variations in the possible HF constituent concentrations potentially impacting surface water – areas with low flows would likely experience higher HF concentrations (less dilution) than areas with higher flows (more dilution). Similarly, differences in local groundwater conditions (*e.g.*, depth to groundwater, differences in aquifer properties, *etc.*) will give rise to differences in the impacts of surface spills possibly impacting groundwater resources used for drinking water.

Given this natural variability, the results from "deterministic," or site-specific, assessment approaches can be constrained by the fact that the results can be difficult to extrapolate more broadly beyond the specific conditions evaluated. To address this limitation, we have adopted "probabilistic" methods that incorporate the wide range of variability that occurs in areas with active oil and gas plays in tight formations. Assessing the possible drinking water impacts associated with HF spills in a probabilistic framework is accomplished by examining a large number of possible combinations ("samples") from a range of conditions that might be encountered in nature. For example, one "sample" might combine a small spill volume with a discharge into a large stream; another "sample" might combine a small spill volume with a discharge into a small stream; while yet another sample could combine a larger spill volume into a small stream. By assessing a large number of repeated (random) "samples," the probabilistic analysis assesses the full range of possible conditions associated with a spill.

In order to use this approach, we needed to determine "probability distributions" for a number of key variables that reflect how likely a particular condition (such as spill size) is to occur. We then needed to combine the probabilities of different conditions occurring in a way that reflected the overall probability that a spill would result in a particular chemical constituent concentration in drinking water. To do this, we used a common simulation technique termed Monte Carlo sampling. The Monte Carlo sampling process involved selecting random samples from the underlying probability distributions that define variables relating to spill size and factors that affect chemical transport/dilution ("input variables"), and then using these random samples to estimate the resulting impacts (*e.g.*, resulting HF constituent concentration in either surface water or groundwater). This process was repeated many times (we selected a million samples) to generate the full range of possible combinations of outcomes spanning the full range of the input variables. The figure below illustrates the Monte Carlo process.

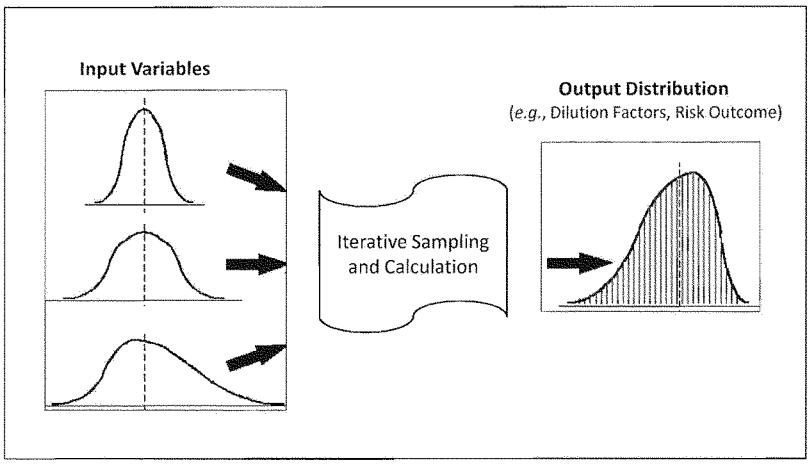


Figure ES.3 Illustration of Monte Carlo Sampling Method Used to Develop a Distribution of Outcomes (*e.g.*, DF values) to Assess Health Risks of HF Spills

Using this approach, we developed distributions of possible outcomes, *i.e.*, distributions of DFs, and resulting constituent concentrations in surface water and groundwater that might result from surface spills. We then assessed the likelihood of possible human health impacts by comparing the range of predicted constituent concentrations in surface water and groundwater with "risk-based concentrations" (RBCs) for drinking water (*i.e.*, concentrations below which human health impacts are not expected to occur) for various chemical constituents that may be found in HF or flowback fluids. Finally, we factored in the likelihood of a spill in order to determine an overall probability of human health impacts associated with spills of fluids containing HF chemical constituents.

Our analysis evaluated a wide range of HF constituents found in 12 typical HESI HF fluid systems used to develop oil and gas resources in tight formations. In addition, we extended our analysis to constituents that have been found in flowback fluid from wells that have been hydraulically fractured even though many of these constituents derive from the naturally-occurring formation water as opposed to the HF fluid pumped into the formation.

ES.4.2 Fluid Spill Distribution

As noted, our Monte Carlo sampling was based on probability distributions for key variables representing a range of conditions. The first of these variables is the possible range of volumes of surface spills during HF operations. The Pennsylvania Department of Environmental Protection (PADEP) Office of Oil and Gas Management (OGM) has compiled information specifically relating to spills during HF activities.[8] Spills associated with HF activities are reported in the PADEP "Oil and Gas Compliance Report" database, which is "designed to show all inspections that resulted in a violation or enforcement action assigned by the Oil and Gas program."[9] We downloaded all of the inspection data for wells tapping

[8] http://www.portal.state.pa.us/portal/server.pt/community/office_of_oil_and_gas_management/20291. For reasons discussed later in this report, we did not use several other state databases because of difficulties in extracting information relating specifically to spills of HF fluid or flowback fluid.

[9] http://www.portal.state.pa.us/portal/server.pt/community/oil_and_gas_compliance_report/20299.

"unconventional" formations (primarily the Marcellus Shale, which is one of the tight formations covered by our analysis). From this information, we compiled all entries for inspections from 2009 through April, 2013 that indicated a fluid spill (with an associated volume, typically reported in gallons or barrels, but sometimes volumes as small as a cup or a quart). A total of 231 inspections reported spills from "unconventional" systems. A summary of the spill volumes associated with different probabilities (percentiles) for this distribution of spill data is provided below.[10]

Table ES.1 Spill Volume Percentiles

Percentile	Spill Volume (gal)
10%	1
25%	6
50%	38
75%	230
90%	1,152
95%	2,999

Note:
Cumulative percentiles based on fitting data to a lognormal distribution and selecting 1 million Monte Carlo samples. The percentiles represent the likelihood spill volumes are less than or equal to the volume at the reported percentiles.

The foregoing information provides a reasonable means to estimate the distribution of HF spill volumes *if a spill occurs*. The PADEP OGM also has compiled information on the number of wells installed each year. For the period 2009 through 2012, a total of 5,543 wells were installed in the Marcellus Shale in Pennsylvania. For this same period, there were 185 spills reflected in the PADEP database (for wells in unconventional formations). This suggests a spill frequency of 3.3% over this 4-year period. This spill frequency is likely a conservative (upper estimate) interpretation of the data, as it includes all spills in the PADEP database, even though some materials spilled were not identified as HF or flowback fluids (*e.g.*, hydraulic oil).[11]

For the purposes of our risk analysis, we have conservatively evaluated potential risks based on two scenarios: a 3.3% spill probability as well as a doubling of this rate to a 6.6% spill probability (*i.e.*, assuming hypothetically spills occur at double the frequency reported in the PADEP data) as a conservative measure. This range of spill probabilities is considered reasonable, if conservative, to use for our risk analysis.

ES.4.3 Surface Spill Impacts

If uncontrolled, HF constituents spilled to the surface could migrate overland *via* surface runoff/erosion to adjacent surface water resources; surface spills could also allow HF constituents to migrate through the soil and impact underlying groundwater resources under certain circumstances. For our exposure and risk analysis, we evaluated two bounding sets of hypothetical conditions, assessing the implications if: (1) 100% of the surface spill leaches to groundwater and (2) 100% of the surface spill impacts surface

[10] The maximum spill reported was 7,980 gallons (Dimock, PA). Our analysis encompasses a spill of this size (it falls in the 99.6th percentile). In fact, because the distribution is unbounded at the upper tail, the largest spill volumes included in our analysis exceeded even this spill size and were well over 100,000 gallons, such that the range included could even account for such events as wellhead blowouts.

[11] Moreover, the way we have conducted this part of the analysis may result in an underestimation of the number of "unconventional" wells drilled to which the number of spills at "unconventional" well sites should be compared – leading to a potential overestimation of the rate of spills at these well sites.

water. These hypothetical scenarios bound the possible fate of surface spills, because the entirety of any given spill could not migrate to both groundwater and surface water (as our worst case analysis assumes), and therefore this approach, adopted solely for the purposes of this study, is considered quite conservative. More likely, even if spills escaped containment measures at the well pad, a portion of the spilled fluid would almost certainly be retained in the soil on or adjacent to the pad such that only a portion would potentially reach any nearby surface water bodies. Similarly, it is unlikely that 100% of the spill volume would leach to groundwater, as we have conservatively assumed. We discuss the development of probability distributions for the key variables with respect to these scenarios, below.

ES.4.3.1 Surface Spill Impacts to Groundwater

As one possible scenario for this study, surface spills of HF fluids or flowback fluids along with their constituents could spread out and soak into the ground in a shallow zone at the soil's surface. The fluid constituents in this surface zone could then be subject to leaching downward through unsaturated soils (herein referred to as the "unsaturated zone") as rainfall percolates into the ground, carrying the HF constituents downward with the percolating water. Given sufficient time, if the constituents in the fluid do not adsorb to soil and/or degrade (both processes are likely to occur), the constituents could reach a shallow aquifer beneath the area of the spill. The process of leaching downward through the soil would lead to spreading of the constituents within the unsaturated zone (dispersion) and mixing of the HF constituents in the leaching water over time. Similarly, if the constituents leach sufficiently and reach shallow aquifers, they could mix within the underlying groundwater ("saturated zone") and potentially migrate with groundwater to drinking water wells. This process would also cause the concentration of the fluid constituents to diminish, or be diluted, as they mix with the groundwater. To account for these inherent dilution mechanisms, we have adopted well-established modeling approaches to provide estimates of the degree of dilution that would likely occur between the point of the surface spill and a downgradient drinking water well. These modeling approaches are outlined below.

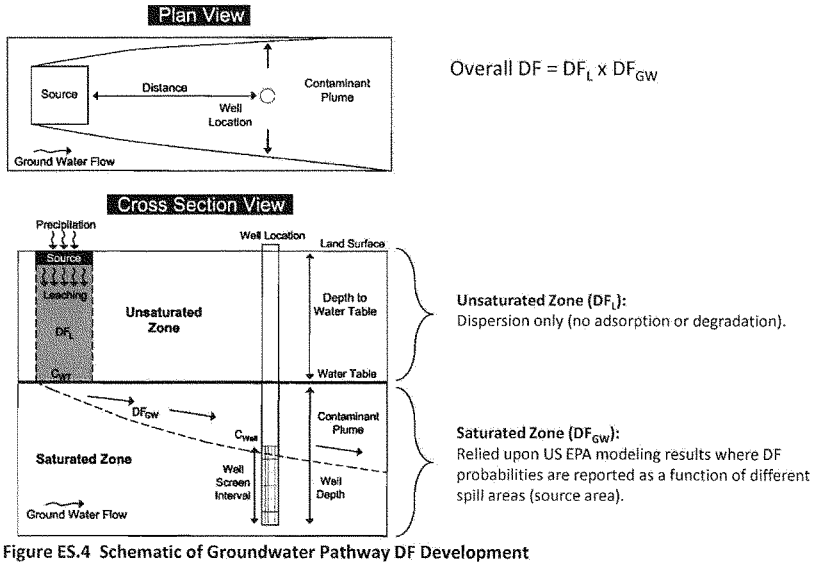


Figure ES.4 Schematic of Groundwater Pathway DF Development

For the saturated zone groundwater exposure analysis, we developed "dilution factors" ("DFs") based upon those developed by US EPA (1996). The US EPA derived groundwater DFs when it developed risk-based chemical screening levels in soil that are protective of groundwater resources (in its Soil Screening Guidance).[12] In its analysis, the US EPA modeled a wide range of possible hydrologic conditions, variable distances to nearby drinking water wells (including wells immediately adjacent to contaminated source areas), and variable well depths (from 15 feet to a maximum of 300 feet). Using a Monte Carlo probabilistic modeling approach to incorporate these types of variable conditions, US EPA determined groundwater DFs as a function of the size of contaminated "source areas."[13] US EPA did not report the full range of percentiles (*e.g.*, probability distribution) associated with their Monte Carlo modeling (US EPA only reported the 85th, 90th, and 95th percentile DFs). Thus, we extended the US EPA analysis to extrapolate a complete distribution of DFs to use in our probabilistic modeling.

In its derivation of groundwater DFs, US EPA adopted simplifying and conservative assumptions that underestimate chemical attenuation in the soil and groundwater; these assumptions included that chemicals do not adsorb to soil, and that chemicals do not degrade, both of which are "attenuation" processes that lead to additional reduction in constituent concentrations. In addition, in deriving the groundwater DFs, the chemical source was assumed to be "infinite." The US EPA adopted these assumptions as conservative measures. While indeed conservative, clearly such assumptions are not realistic if applied to a surface spill of fluids containing HF constituents. In particular, the assumption of an infinite source effectively assumes "steady state" conditions have been reached such that a constant/uniform constituent concentration exists in the unsaturated zone. This assumption thereby does not account for chemical dilution of a finite source within the unsaturated zone that is caused by dispersion. For a finite source, such as a single spill of HF or flowback fluid, the chemical concentration will diminish over time and as a function of depth within the soil as constituents are leached down through the unsaturated zone.

In this assessment, we have not assumed an infinite source because the spill volumes used in our analysis are finite (limited) volumes, based on the spill distribution described above. Consequently, we have accounted for dilution of chemical concentrations in the unsaturated zone before reaching the groundwater table due to chemical spreading (dispersion) within the unsaturated zone.[14] We used well-established, standard techniques (*i.e.*, a chemical advection-dispersion equation) to model constituent dilution within the unsaturated zone.

Using this approach, we calculated an overall DF for the soil-to-groundwater pathway by combining the saturated-zone DFs developed from the US EPA values with the Gradient-derived unsaturated-zone DFs. We emphasize that the soil-to-groundwater pathway DFs used in this analysis are more likely to underestimate than overestimate dilution because both the saturated- and unsaturated-zone DFs were derived assuming no chemical adsorption or degradation. This assumption leads to the conservative result that 100% of the chemicals spilled ultimately migrate to and mix within the drinking water aquifer – an unrealistic premise that adds further conservatism to our exposure analysis. The DFs we used to assess the potential surface spill impacts to a shallow drinking water aquifer are summarized below.

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[12] US EPA referred to them as "dilution attenuation factors" (DAFs). We use the term "dilution factors" because in our analysis, as was also the case in US EPA's DAF development, we have not accounted for "attenuation" processes such as chemical-soil adsorption or biodegradation. These attenuation processes would further reduce the chemical concentrations in the environment in the event of a spill (*i.e.*, leading to larger dilution factors if included).

[13] For example, US EPA determined that a chemical constituent originating from a small source area (~0.1 acre), and migrating in groundwater to a nearby drinking water well would be expected to be diluted at least 55,400-fold in 85% of scenarios, and at least 2,740-fold in 90% of scenarios. For a larger source area of 1 acre, the US EPA-derived groundwater DFs decrease to 668-fold in 85% of scenarios and 60-fold in 90% of scenarios.

[14] A chemical spill at the surface does not migrate downward as a uniform "pulse" but rather spreads out and disperses within the unsaturated zone. This process of dispersion causes a reduction of the chemical concentration within the soil.

Table ES.2 Summary of Spill to Groundwater DFs

Percentile	Unsaturated Zone (DF_t)	Saturated Zone (DF_{gw})	Overall DF
50%	101	1.1×10^{26}	1.1×10^{28}
75%	51	3.0×10^{14}	3.2×10^{16}
90%	28	4.9×10^{7}	5.3×10^{9}
95%	19	17,788	1.9×10^{6}

Notes:
Based on 1 million Monte Carlo samples. The percentiles represent the likelihood of equaling or exceeding the associated DF values.
For any given Monte Carlo sample, the overall DF is the product of the respective values of the unsaturated and saturated zone DFs. However, given that independent random variables govern each component DF, the percentiles of the overall DF are not given by the product of the respective unsaturated- and saturated-zone DFs at the same percentiles.
The saturated zone DFs presented above are not directly comparable to the US EPA-reported values (US EPA, 1996), since the US EPA percentiles are associated with a corresponding spill area, whereas the above values correspond to a range of spill areas, which are a function of the potential spill volume.

ES.4.3.2 Surface Spill Impacts to Surface Water

As another exposure scenario, we also considered the potential impacts of hypothetical surface spills affecting surface water resources. For the surface water exposure analysis, we developed surface water DFs conservatively assuming "low flow" mixing conditions in streams potentially impacted by surface spills.

As noted earlier, the national scope of this assessment extends across regions characterized by differences in climate and topography that in turn affect the distribution of stream flows. In order to account for these regional variations, we based our analysis on the distribution of low-end stream flow values for streams within the major sedimentary basins in the US. Stream flow was obtained from the national database of USGS stream gauging information (see Figure ES.5).

We selected the lowest average daily streamflow for each year of record at each gauging station.[15] From this data set of lowest average daily streamflow measurements (for each year of record), we then took the lowest average daily flow over all years of record at each station to develop the distribution of low-end streamflows for our assessment (low flows yield higher exposure concentrations).

Based on a statistical comparison of the low-end streamflow data, the data for the arid and semi-arid regions of the country were not statistically different, and the data for the temperate and semi-humid regions are also not statistically different. Thus, for the probabilistic analysis we evaluated the possible impacts of HF spills impacting surface waters for two separate climatic regions: arid/semi-arid, and temperate/semi-humid.

As noted previously, our surface water exposure analysis assumed that 100% of the HF fluid or flowback fluid chemical constituents spilled on the well pad reach a surface water body *via* overland runoff. This assumption ignores mitigation measures such as possible well setbacks and spill containment practices. In addition, many well pads will be located too far from streams for this pathway to be possible. Thus, the use of low-end stream flow, coupled with the assumption that 100% of any spilled fluid containing HF additives reach the surface drinking water source, results in a conservative approach that yields "high-

[15] As summarized in our report, we selected stations with a minimum of 5 years of gauging data as one criteria to ensure a reasonable minimum period over which to select "low flow" conditions.

end" estimates of potential human exposure for the surface water exposure pathway that are likely to over predict actual conditions in the event of a spill. Moreover, we have conservatively assumed that all the streams in the database could be used directly as drinking water sources (*i.e.*, with drinking water being taken directly from the stream as opposed to a downstream reservoir), regardless of whether a stream is large enough to serve as a drinking water source.

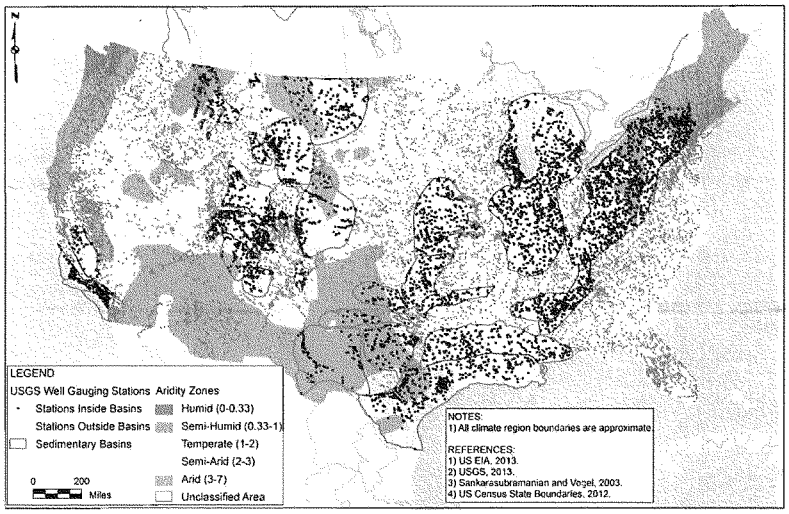


Figure ES.5 USGS Monitoring Stations, Sedimentary Basins, and Aridity Zones

One factor in our surface water exposure analysis was the period over which constituents in potential spills might migrate to and mix into a stream. In selecting the appropriate period for mixing to occur, we considered the likelihood of spill events having direct (immediate/short term) *versus* indirect (longer term) impacts on a nearby stream, and the physical processes that might convey HF constituents from the location of a surface spill to a nearby surface water body.[16]

Based on available data, spills associated with HF activities that directly impact surface water, which might raise concerns regarding short-term impacts, are rare. For example, based on the information in the PADEP OGM violation database (discussed earlier, see also Section 5), only about 6 out of every 10,000 wells (0.06%) experienced a spill that had a direct impact on a stream.[17] The rarity of these events is partly due to the fact that well pads are located some distance from nearby streams and there are only a very limited number of unlikely scenarios in which a spill might migrate quickly over such distances to a stream.

[16] For the groundwater pathway, no mixing period was explicitly included both because groundwater travel would likely have timescales of years or decades, and because for the unsaturated zone component we conservatively selected the "peak" plume concentration (which may not occur for decades), rather than specifying a specific time-frame for the analysis.

[17] This is based on 4 of 234 spills (1.7%) in the PADEP OGM database that indicate direct impacts to a stream. When combined with the overall spill frequency (3.3%), this gives 0.06% probability that HF activities could result in an HF spill directly impacting a stream.

Given the low probability of incidents that might lead to short-term impacts, it was more relevant to focus our analysis on potential long-term effects, *i.e.*, effects that might be caused by (still infrequent) spills that do not reach streams quickly (and that, in reality, may never reach streams at all).[18] From a human health perspective, long-term effects (chronic impacts) are generally defined by exposure periods of seven years,[19] or in some instances one year, or longer.[20] From this perspective, selecting a mixing period that matches the exposure period for potential long term health effects is consistent with risk assessment methodology.

An appropriate mixing period can also be derived from an assessment of physical processes that could transport HF constituents from an area of spill-impacted soil (well pad) to a stream. These include direct overland runoff (*i.e.*, constituents carried with water and/or eroding soil particles that runs over the land surface) and slower migration underground (*i.e.*, movement with groundwater that then discharges into a stream). Direct overland runoff and soil erosion are episodic processes (*i.e.*, not "continuous") that are influenced by the frequency and magnitude of rainfall events. In order for 100% of spilled constituents to migrate to a stream as we have assumed, the surface runoff/erosion process is more likely to occur over timescales on the order of years (rather than days or months). If the migration to surface water is *via* groundwater flow, the timescales could be even longer – in many cases decades or more (Winter *et al.*, 1998). Thus, a time period on the order of years is considered to be a conservatively short transport timescale for all the constituents in a spill area to be transported to a stream.

Based on the foregoing considerations, we selected an averaging period of 1 year as a conservative (*i.e.*, health protective) approach.[21]

Using the spill volume distribution described earlier, and the foregoing methods for developing a distribution of surface water mixing volumes, the range of surface water dilution factors derived in this analysis is summarized below.

Table ES.3 Summary of Spill to Surface Water DFs by Aridity Regions

Percentile	Arid/Semi-Arid DF	Temperate/Semi-Humid DF
50%	1.4×10^8	4.9×10^8
75%	1.5×10^7	5.1×10^7
90%	2.0×10^6	6.7×10^6
95%	592,480	2.0×10^6

Note:
Results are Based on 1 million Monte Carlo samples. The percentiles represent the likelihood of equaling or exceeding the associated DF values.

ES.5 Toxicity Characterization

As reflected in the HESI HF fluid systems, a wide variety of additives and their associated constituents could be used in hydraulic fracturing. A number of these constituents are used as food additives, are present in a wide variety of household/personal care products, or occur naturally in the environment.

[18] We also note that concentrations of chemical constituents which might give rise to possible health concerns due to long term exposure are generally lower (more restrictive) than their corresponding benchmarks based on short-term exposures.
[19] US EPA, 2002.
[20] ATSDR "Minimum Risk Levels" (MRLs) define chronic exposures as 365 days or more. http://www.atsdr.cdc.gov/mrls/index.asp.
[21] Note also that we have not accounted for the additional dilution that would occur due to direct rainfall, nor have we included any dilution if the transport to surface water is *via* groundwater.

Nonetheless, as part of this risk analysis, we evaluated the potential human toxicity of these constituents, regardless of other uses or origin.

We adopted established regulatory methodologies to evaluate the toxicity of constituents of HF fluid and flowback fluid. We used agency-established toxicity criteria (*e.g.*, drinking water standards, or risk-based benchmarks) when these were available. For constituents lacking these agency-established drinking water or health benchmarks, we developed risk-based concentrations (RBCs) for drinking water, based on published toxicity data (when available), toxicity benchmarks for surrogate compounds, or additional methods as described in this report. Use of tiered hierarchies for defining constituent toxicity is a standard risk assessment practice (US EPA, 2003, 2012a).

ES.6 Surface Spill Risk Evaluation Conclusions

As described in Section ES.4, we used the distribution (*e.g.*, percentiles) of groundwater and surface water pathway DFs to derive a distribution of possible HF fluid and flowback fluid constituent "exposure point concentrations" that might be found in drinking water in the event of a surface spill. We compared this distribution of exposure point concentrations to the chemical RBCs and expressed the ratio as a "Hazard Quotient" (HQ).[22] An HQ value less than 1.0 indicates the exposure concentration of a chemical constituent is below a concentration at which adverse health effects are not expected. We also summed the HQs for all chemicals used in particular HESI HF systems to calculate the "Hazard Index" for the entire HF system.

The results of our analysis indicate that potential human health risks associated with exposure to drinking water (derived from surface water or groundwater) potentially affected by spills of typical HESI HF fluids, or flowback fluids, are expected to be insignificant as defined by agency-based risk management guidelines. Our analysis yields this result even though it is based on a number of assumptions, highlighted below, that collectively result in a substantial overestimation of potential risk.

Key Conservative Assumptions

No containment or mitigation measures were included

100% of spill assumed to impact both surface water and groundwater

Distribution of low-end stream flow used for surface water dilution

All streams assumed to be direct sources of drinking water

Selected groundwater dilution factors based on US EPA's methodology which assume continuous and infinite sources (whereas HF spills are more appropriately characterized as short term, singular events)

Adsorption and degradation of chemicals was ignored

Human health risks associated with potential surface spills of fluids containing HF constituents are expected to be insignificant with respect to both impacts to USDWs and impacts to surface waters due to dilution mechanisms which are expected to reduce concentrations in potable aquifers and surface waters to levels below health-based drinking water concentrations in the event of surface spills. Based on the probabilistic analysis presented here, spanning an enormous range of conditions, HQs were below 1.0 even at the upper tails (high percentiles) of the distribution of dilution factors.

[22] Note, the HQ value in our analysis is an indicator of whether the computed exposure concentration exceeds the health-based RBC, regardless of the constituent's toxicity end point or mode of action.

We have summarized the HQ results below for the central tendency (50th percentile) DF values, as well as upper percentiles (*e.g.*, HQs associated with 90th and 95th percentile DF values). For example, at the 95th percentile DF, the highest HQ for surface water in arid/semi-arid regions was 0.04. This means that in 95% of the Monte Carlo simulations, the highest HQs were less than or equal to this value.

When considering the results from this probabilistic analysis, it is important to understand what the results reported for any particular DF percentile represent. The DF percentiles are based on the presumption that a spill has occurred (that is, they are a function of spill volume and other environmental variables). However, as discussed earlier, the likelihood of spills occurring during HF activities, based on the experience in Pennsylvania, is conservatively estimated to be about 3.3%. Using this spill frequency, there is a 96.7% likelihood (probability) that there would be no release of HF constituents at a given well site, and thus 96.7% of the HQs would be zero (no exposure). In order to determine the overall likelihood, or probability, of any particular HQ outcome, the spill probability, and cumulative probability of any particular DF, must be combined using the following expression:

Overall HQ Occurrence Probability = (100% - Spill Frequency) + (Spill Frequency × DF Percentile/100)

For example, at a spill rate of 3.3%, given a typical (50th percentile) amount of dilution there is a 98.4% probability that the HQ for impacts to surface water associated with the use of HF fluids at a well site in an arid or semi-arid region would be less than 0.0002, or several orders of magnitude less than an HQ that would indicate that adverse health effects might be a concern. Even for a low dilution factor – one that would be exceeded in 95% of instances where a spill occurred (*i.e.*, the 95th percentile) – there is a very high (99.84%) likelihood that a well site even in an arid area would not experience an HQ greater than 0.04, which is still at a level where adverse health effects would not be expected to occur.

Table ES.4 Percentiles of Chemical HQs for Maximum Wellhead Chemical Concentrations for HESI HF Fluid Systems

DF Percentile[a]	Surface Water		Groundwater	Spill Frequency	
	Arid/Semi-Arid	Temperate/Semi-Humid		3.3%	6.6%
	Highest HQ at Associated DF Percentile			Overall HQ Occurrence Probability at Associated Spill Frequency[b]	
50%	0.0002	0.00005	2×10^{-24}	98.4%	96.7%
90%	0.01	0.003	4×10^{-6}	99.7%	99.3%
95%	0.04	0.01	0.01	99.84%	99.67%

Notes:
[a] The DF percentiles represent the cumulative probability associated with a particular DF (see Tables ES.2 and ES.3) in the event of a spill.
[b] The overall HQ percentile at any particular DF percentile is: (100% - Spill Frequency) + (Spill Frequency x DF Percentile/100).

ES.7 Overall Conclusions

Based on the foregoing analysis, we conclude that when used in their intended manner in tight oil and gas formations, *i.e.*, pumped into a subsurface formation to induce fractures in the target formation, HF fluids are not expected to pose adverse risk to human health because wells are designed and constructed to prevent HF fluids in the well from coming in contact with shallow aquifers and it is implausible that the fluids pumped into the target formation would migrate from the target formation through overlying bedrock to reach shallow aquifers. Even in the event of surface spills, inherent environmental dilution mechanisms would, with a high degree of confidence (based on our probabilistic analysis covering wide-ranging conditions), reduce concentrations of HF chemical constituents in either groundwater or surface

water below levels of human health concern (RBCs), such that adverse human health impacts are not expected to be significant. Our conclusions are based on examining a broad spectrum of conditions spanning HF operations in tight oil and gas formations across the country. By extension, these conclusions would apply more broadly under environmental conditions (including geologic formations) in other parts of the world that are similar to those we have examined in the US.

SUBMITTED BY REPRESENTATIVE CHRIS STEWART, CHAIRMAN, SUBCOMMITTEE ON ENVIRONMENT



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July 16, 2013

The Honorable Chris Stewart
Chairman, Subcommittee on Environment
Committee on Science, Space, and Technology
United States House of Representatives
2321 Rayburn House Office Building
Washington, D.C. 20616

The Honorable Cynthia Lummis
Chairman, Subcommittee on Energy
Committee on Science, Space, and Technology
United States House of Representatives
2321 Rayburn House Office Building
Washington, D.C. 20616

Dear Chairman Stewart and Chairman Lummis:

On behalf of Range Resources Corporation (Range), I want to thank both of you and your staffs for your continuing emphasis on the important role of sound science in policy decisions relating to our Nation's shale oil and gas development. At your July 24th hearing, your Committee will hear important testimony from state and federal officials involved in groundwater evaluations related to shale development in Pennsylvania, Wyoming, and Texas. Each of these cases highlights the importance of getting the science right before reaching public conclusions. Because Range played a central role in the Parker County, Texas case about which you will hear testimony, I wanted to bring certain facts relating to that case to your attention. Once again, we appreciate your work on holding this hearing and we look forward to working with you as you consider how sound science can best inform public policy decisions so that our Nation is able to reap the benefits of the ongoing shale revolution.

Investigation of Groundwater Claims in Parker County

Despite claims to the contrary, since the first claims of groundwater contamination, the Texas Railroad Commission (the "RRC") thoroughly investigated the applicable water well in Parker County as well as the potential cause of the contamination. The RRC investigation included:

- A two-day evidentiary hearing where a number of highly qualified experts provided testimony as to the cause of the well contamination; and
- A groundwater investigation during which a team of experienced and independent experts in groundwater investigations sampled and analyzed the groundwater from 25

properties in the applicable area (including the water well in question) to determine if the water was safe to drink. The experts tested for the potential presence of over 135 different chemicals, elements, minerals, and other constituents in the water to determine whether there was any concentration that could make the water unsafe to drink or use.

In coordination with the RRC, in late 2010, the groundwater test results were evaluated using the Texas Risk Reduction Program Protective Concentration Level to determine if there was a threat to human health. The test results confirmed that none of the constituents tested for in the water well exceeded the government standards.

Based on the testimony of experts at the evidentiary hearing and the groundwater testing results, the RRC ultimately concluded that Range's natural gas production activities had no impact on the water aquifer or the well in question. This determination by the state agency with the most experience and expertise in the oil and gas industry should have ended the accusations against Range.

Despite the RRC investigation and findings, the U.S. Environmental Protection Agency's (EPA) Region 6 office issued an unprecedented emergency order in December 2010 ordering Range to cease our production activities in Parker County. Despite the media and activist fanfare that greeted this order (most of which was sought out by the then Regional Administrator), the ensuing EPA investigation could not change the scientific facts in the case—that natural gas, predominantly methane, is naturally present in the Trinity Aquifer in the area, and that the presence of methane in the water wells did not result from Range's production activities. After over a year of sampling and testing, in March 2012, the EPA retracted its emergency order.

The most important lesson to be learned based on the Parker County case is that it is imperative that discussions about shale development and public safety, and any consideration of policy proposals, are informed by sound science and accurate information. In that spirit, we look forward to working with you and would be pleased to facilitate a briefing for any Member of the Subcommittee or the full Committee on this matter.

Sincerely,



K. Scott Roy

Corporate Vice President, Government Affairs & Communications

SUBMITTED BY REPRESENTATIVE CHRIS STEWART, CHAIRMAN, SUBCOMMITTEE ON ENVIRONMENT

LAMAR S. SMITH, Texas
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May 2, 2013

Dr. David Dzombach, Chair, Hydraulic Fracturing Research Advisory Panel
Dr. David Allen, Chair, Science Advisory Board
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Dr. Dzombach and Dr. Allen,

As the Environmental Protection Agency's (EPA) Science Advisory Board (SAB) and Hydraulic Fracturing Research Advisory Panel begin examination of the Agency's Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources, I write with additional areas for inquiry by the Panel and Board. The Environmental Research, Development, and Demonstration Act of 1978 states that "[t]he Administrator of the Environmental Protection Agency shall establish a Science Advisory Board which shall provide such scientific advice as may be requested by... the Committee on Science, Space, and Technology...."[1] The Science Advisory Board's Charter also establishes that the Board shall respond to requests from this Committee to "have the SAB address a particular issue."[2] Consistent with SAB's policy that "advisory committees will not accept a charge from the agency that unduly narrows the scope of an advisory activity,"[3] I am writing with additional questions for the Hydraulic Fracturing Research Advisory Panel and SAB.

Purpose & Scope

Within the agency's study plan, EPA clearly defines hydraulic fracturing as "the process of using high pressure to pump fluid, often carrying proppants into subsurface rock formations in order to improve flow into a wellbore." In addition, EPA states "the overall purpose of this study is [to] elucidate the relationship, if any, between hydraulic fracturing and drinking water resources."

- Using the agency's definition for hydraulic fracturing, has EPA expanded its research beyond its stated purpose to non-fracturing oil and gas activities?

[1] 42 USC § 4365.
[2] http://yosemite.epa.gov/sab/sabproduct.nsf/WebBOARD/currentcharter?OpenDocument.
[3] http://yosemite.epa.gov/sab/sabproduct.nsf/WebSABSO/PublicInvolvement?OpenDocument.

- Given EPA's finite resources and time, as noted in the SAB Environmental Engineering Committee's recommendations,[4] would a more focused study have provide more valuable information and scientific evaluation of the process of interest (i.e., hydraulic fracturing) and its relationship, if any, to drinking water?

"Risk characterization at EPA is considered to be a conscious and deliberate process to bring all important considerations about risk, both the likelihood of the risk but also the strengths and limitations of the assessment and a description of how others have assessed the risk into an integrated picture."[5] According to the EPA Risk Characterization Handbook, "[t]he goal of risk characterization is to clearly communicate the key findings and their strengths and limitations so its use in decision making can be put into context." The Agency has acknowledged, however, that the expected study results will have significant limitations in "providing results that can then be used to assess the potential risks to drinking water resources from hydraulic fracturing." Notwithstanding this acknowledgement, the agency is prematurely claiming its results will "provide policymakers at all levels with high-quality scientific knowledge that can be used in decision-making."

- Have all aspects of the hydraulic fracturing study been designed in a manner that will provide an integrated picture and appropriate level of context (i.e., likelihood, severity, human exposure), as described in EPA's Risk Characterization Handbook, necessary for policy-makers to make informed decisions regarding the hydraulic fracturing process?
- Based on EPA's definition of hydraulic fracturing, has the Agency selected research questions and projects that are specific and unique to the hydraulic fracturing process?
- How are water withdrawals associated with hydraulic fracturing different or unique in comparison to potential impacts from water withdrawals by other users?

Earlier this week, EPA announced that it is "extending its deadline for the public to submit data and scientific literature to inform EPA's research on the potential impacts of hydraulic fracturing on drinking water resources from April 30, 2013 until November 15, 2013,"[6] raising concerns about the timeline for the study.[7]

- What impact will this change have on the Board and Panel's review of EPA's ongoing research?
- When does the Board and Panel plan to meet and accept public comments between now and the intended completion of draft study results in December 2014?

Resource Constraints

I strongly support research related to unconventional oil and gas production, including the process of hydraulic fracturing, because it is important to the U.S. economy and energy

[4] http://yosemite.epa.gov/sab/sabproduct.nsf/368203f97a15308a852574ba005bbd01/CC09DE2B8B4755718525774D0044F929/$File/EPA-SAB-10-009-unsigned.pdf
[5] http://www.epa.gov/spc/pdfs/rchandbk.pdf
[6] http://www.oft.gov/(S(3nize4nqzpv0aj1a3ckofzqi))/OFRUpload/OFRData/2013-10154_PI.pdf.
[7] *Inside EPA*, "EPA Delays Fracking Risk Study Until November, Adding to GOP Concerns, April 29, 2013, http://insideepa.com/201304292432520/EPA-Daily-News/Daily-News/epa-delays-fracking-risk-study-until-november-adding-to-gop-concerns/menu-id-95.html.

security. However, the U.S. government is currently facing budget constraints and it is prudent to continually assess allocation of financial resources.

- Considering the SAB Environmental Engineering Committee's past recommendations[1] to EPA to conduct a study specific to hydraulic fracturing and exclude well-understood issues (e.g., site development), what research activities could be removed or effort reduced from the Agency's plan with insignificant impact on achieving the research study's purpose?

Data

EPA acknowledged research data limitations within the 2012 progress report, including in the spill and environmental justice sections.

- How did EPA's lack of a systematic planning process (e.g., Data Quality Objectives) impact its ability to identify, gather and assess appropriate information to answer research questions?

Study Design

- Has EPA provided within the study plans a consistent approach that will be used to describe and calculate uncertainty in a manner that is transparent, reliable and reproducible for all aspects of the agency's hydraulic fracturing research?

Highly Influential Scientific Assessment

A scientific assessment is considered "highly influential" if the administering agency or the OIRA Administrator determines that its dissemination could have a clear and substantial impact on important public policies (including regulatory actions) or private sector decisions with a potential effect of more than $500 million in any one year or that its dissemination involves precedent setting, novel and complex approaches, or significant interagency interest.[8] EPA has designated the 2014 hydraulic fracturing study final report of results as "highly influential."

- If the compilation of the parts is "highly influential", should all study results, parts or components (i.e., individual reports) that are intended to be included in the 2014 final report also be classified as "highly influential?"[9]

Background & Baseline Information

- Has EPA incorporated an appropriate level of background and baseline data collection and assessment activities within the general and project specific study plans? Specifically, based on the retrospective study quality assurance project plans and 2012 progress report, has the Agency designed the study in a manner that will enable it to

[8] http://www.whitehouse.gov/sites/default/files/omb/assets/omb/inforeg/peer_review041404.pdf
[9] Within the Progress Report, EPA has differentiated the "final report of results," which has been designated as "highly influential," from "individual reports and papers." This appears to be a loophole that would allow EPA's results to be finalized and released to the public without undergoing prudent and necessary technical scrutiny.

attribute perceived drinking water impacts to a specific natural or anthropogenic source with an appropriate level of certainty?

- Has EPA designed all aspects of the study in a manner that would enable it, if necessary, to attribute perceived drinking water impacts to a specific phase (i.e., hydraulic fracturing), aspect or factor associated with oil and gas development?

Approach

- Has EPA appropriately integrated its research to describe the relationship between the "hydraulic fracturing water life-cycle" phases? For example, has the Agency considered the operational relationship between fracturing additive properties and quantity, produced water (i.e., formation water and flowback process water) reuse or recycling, and fresh water acquisition?

In accordance with the Environmental Research, Development, and Demonstration Authorization Act and the SAB's Charter, the Panel and Board should consider these questions as it begins its review of EPA's hydraulic fracturing research in May 2013. If you have any questions related to this request, please contact Todd Johnston or Clint Woods, Subcommittee on Environment, at 202-225-8844.

Sincerely,

Rep. Chris Stewart
Chairman
Environment Subcommittee

CC: Edward Hanlon, SAB Designated Federal Officer
Bob Perciasepe, Acting Administrator, EPA
Fred Hauchman, Director, Office of Science Policy, EPA