

REVIEW OF FEDERAL HYDRAULIC FRACTURING RESEARCH ACTIVITIES

JOINT HEARING

BEFORE THE
SUBCOMMITTEE ON ENERGY &
SUBCOMMITTEE ON ENVIRONMENT
COMMITTEE ON SCIENCE, SPACE, AND
TECHNOLOGY
HOUSE OF REPRESENTATIVES
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FRIDAY, APRIL 26, 2013

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**REVIEW OF FEDERAL HYDRAULIC
FRACTURING RESEARCH ACTIVITIES**

FRIDAY, APRIL 26, 2013

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittees met, pursuant to call, at 10:06 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Cynthia Lummis [Chairwoman of the Subcommittee on Energy] presiding.

LAMAR S. SMITH, Texas
CHAIRMAN

EDDIE BERNICE JOHNSON, Texas
RANKING MEMBER

Congress of the United States
House of Representatives

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Subcommittee on Energy
And
Subcommittee on Environment

Review of Federal Hydraulic Fracturing Research Activities

Friday, April 26, 2013
9:30 a.m. -11:30 a.m.
2318 Rayburn House Office Building

Witnesses

Dr. Kevin Teichman, Senior Science Advisor, Office of Research and Development,
Environmental Protection Agency

Mr. Guido DeHoratiis, Acting Deputy Assistant Secretary for Oil and Gas, Office of
Fossil Energy, Department of Energy

Dr. David Russ, Regional Executive, Northeast Area, U.S. Geological Survey

Dr. Robin Ikeda, Acting Director, Agency for Toxic Substances and Disease Registry,
Department of Health and Human Services

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

HEARING CHARTER

Review of Federal Hydraulic Fracturing Research Activities

Friday, April 26, 2013
9:30 a.m. – 11:30 a.m.
2318 Rayburn House Office Building

PURPOSE

On Friday, April 26, at 9:30 a.m. in Room 2318 of the Rayburn House Office Building, the Subcommittee on Energy and the Subcommittee on Environment of the Committee on Science, Space and Technology will hold a hearing entitled *Review of Federal Hydraulic Fracturing Research Activities*. The purpose of this hearing is to review agencies' hydraulic fracturing-related efforts, with a primary focus on examining progress under Executive Order 13605 and the associated interagency Memorandum of Understanding (MOU) and steering committee.

WITNESS LIST

- **Dr. Kevin Teichmann**, Senior Science Advisor, Office of Research and Development, Environmental Protection Agency
- **Mr. Guido DeHoratiis**, Acting Deputy Assistant Secretary for Oil and Gas, Office of Fossil Energy, Department of Energy
- **Dr. David Russ**, Regional Executive, Northeast Area, U.S. Geological Survey
- **Dr. Robin Ikeda**, Acting Director, Agency for Toxic Substances and Disease Registry, Department of Health and Human Services

BACKGROUND

On April 13, 2012, President Obama issued Executive Order 13605, which mandated the creation of a “high-level, interagency working group to facilitate coordinated Administration policy efforts to support safe and responsible unconventional natural gas development.”¹ The stated intent of this effort was to “coordinate the efforts of Federal agencies responsible for

¹President Barack Obama, “Executive Order—Supporting Safe and Responsible Development of Unconventional Domestic Natural Gas Resources,” April 13, 2012. Accessible at: <http://www.whitehouse.gov/the-press-office/2012/04/13/executive-order-supporting-safe-and-responsible-development-unconvention>

overseeing the safe and responsible development of unconventional domestic natural gas resources.”² The Executive Order required the interagency working group include representatives from nine different agencies and four offices of the White House, to support the safe and responsible production of domestic unconventional oil and gas.³

The group is tasked with coordinating agency policy activities and sharing scientific, environmental, and related technical and economic information. The group is also to engage in long-term planning and coordination among the appropriate Federal entities with respect to research, resource assessment, and infrastructure developments, and is required to consult with other agencies and offices as appropriate.

Multi-Agency Collaboration on Unconventional Oil and Gas Research

To execute the Executive Order, the Environmental Protection Agency, Department of Interior (DOI) and Department of Energy (DOE) signed a Memorandum of Understanding (MOU) in which the respective agencies agree to develop a multi-agency program directed toward a focused, collaborative interagency effort to address high priority challenges associated with unconventional shale gas and tight oil resources. The interagency program is also to address and respond to the White House’s 2011 “Blueprint for a Secure Energy Future”⁴ and recommendations made by the Secretary of Energy Advisory Board Subcommittee on Natural Gas.⁵

The agencies will identify research priorities and collaborate to sponsor work that improves understanding of the impacts related to development of our unconventional resources. The collaboration is intended to focus each Agency on its area of core competency, foster collaboration on research topics as appropriate, and bring coordination and consistency to the annual budget process. The core competencies are as follows:

- DOE: wellbore integrity, flow, and control; green technologies; systems engineering, imaging, and materials
- USGS: resource assessment; hydrology and geology; land use, wildlife, and ecological impact
- EPA: air monitoring; environment and human health risk; water quality

The three agencies established a Steering Committee and announced its membership in May 2012. According to the MOU, a research plan was required to be published “within 9 months of

²President Barack Obama, “Executive Order—Supporting Safe and Responsible Development of Unconventional Domestic Natural Gas Resources,” April 13, 2012. Accessible at: <http://www.whitehouse.gov/the-press-office/2012/04/13/executive-order-supporting-safe-and-responsible-development-unconvention>

³The 9 Agencies included in the Executive Order are the Departments of Defense, Interior, Agriculture, Commerce, Health and Human Services, Transportation, Energy, Homeland Security, and the Environmental Protection Agency. The 4 offices of the White House are the Council on Environmental Quality, Office of Science and Technology Policy, Office of Management and Budget, and the National Economic Council.

⁴The White House, *Blueprint for a Secure Energy Future*, March 30, 2011. Accessible at: http://www.whitehouse.gov/sites/default/files/blueprint_secure_energy_future.pdf

⁵Secretary of Energy Advisory Board Shale Gas Production Subcommittee, *Second Ninety Day Report*, November 18, 2011. Accessible at: http://www.shalegas.energy.gov/resources/111811_final_report.pdf

formation” of the Steering Committee—however, the resulting January 2013 deadline was missed. A formal research plan is yet to be released. Additionally, in January EPA’s Science Advisor informally announced that the Department of Health and Human Services would be joining the Steering Committee.⁶ While there has been no formal announcement or confirmation that HHS has joined the steering committee, the Agency does conduct hydraulic fracturing research initiatives in various areas, particularly within the Agency for Toxic Substances and Disease Control Registry.

To this end, the President’s Fiscal Year (FY) 2013 budget request allocated \$38 million among DOE (\$12 million), EPA (\$8 million) and DOI’s U.S. Geological Survey (USGS) (\$18 million) to carry out the interagency initiative.

The President’s FY 2014 budget request includes funding to continue this initiative. However, the budget requests did not include additional details regarding the steering committee research plan, which has not yet been released.

- DOE requests \$12 million for the interagency collaboration. DOE’s total request for Natural Gas Technologies was \$17 million for FY 2014, the same as the FY 2013 request.
- USGS requests \$18.6 million to support the interagency collaboration in FY 2014.⁷
- EPA requests \$8 million in FY 2014 to “expand work with DOE and the USGS under a memorandum of agreement on hydraulic fracturing research which will analyze the potential impacts of hydraulic fracturing on air, ecosystem and water quality.”⁸ This is to be managed primarily by the Office of Research and Development.

Additional Reading:

- Executive Order, Supporting Safe and Responsible Development of Unconventional Domestic Natural Gas Resources, April 13, 2012. Accessible at: www.whitehouse.gov/the-press-office/2012/04/13/executive-order-supporting-safe-and-responsible-development-unconvention
- Memorandum 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>
- Multi-Agency Collaboration on Unconventional Oil and Gas Research. Presentation accessible at: http://unconventional.energy.gov/pdf/Multi-Agency_ResearchPlanPresent.pdf

⁶ Agencies Expand Fracking Research Panel To Add HHS, Weigh GHG Impacts, Inside EPA, January 14, 2013. Accessible at: <http://insideepa.com/201301142421426/EPA-Daily-News/Daily-News/agencies-expand-fracking-research-panel-to-add-hhs-weigh-ghg-impacts/menu-id-95.html>

⁷ U.S. Geological Survey, *President’s 2014 USGS Budget Proposal Strengthens Science*, April 10, 2013. Accessible at: <http://www.usgs.gov/newsroom/article.asp?ID=3556&from=rss#.UWwvS8pLkXg>

⁸ Environmental Protection Agency, FY 2014 EPA Budget in Brief, P. 21. Accessible at: <http://www2.epa.gov/planandbudget/fy2014#budget>

Appendix A



MEMORANDUM

APR 13 2012

TO: Assistant Secretaries, National Laboratories
Department of Energy

Assistant Secretaries, Bureau Directors
Department of the Interior

Assistant Administrators, Regional Administrators
Environmental Protection Agency

FROM: Arun Majumdar, Acting Under Secretary of Energy
Department of Energy

David J. Hayes, Deputy Secretary
Department of the Interior

Bob Perciasepe, Deputy Administrator
Environmental Protection Agency

SUBJECT: Multi-Agency Collaboration on Unconventional Oil and Gas Research

OVERVIEW: In March 2011, the White House released a "Blueprint for a Secure Energy Future" (Blueprint) - a comprehensive plan to reduce America's oil dependence, save consumers money, and make our country the leader in clean energy industries. The Blueprint supports the responsible development of the Nation's oil and natural gas, with the specific goals of promoting safe practices and reducing energy imports. The Department of Energy (DOE), the Department of the Interior (DOI), and the Environmental Protection Agency (EPA) each will have a critical role to play in this mission.¹

To this end, the DOE, DOI, and EPA will develop a multi-agency program directed toward a focused collaborative Federal interagency effort to address the highest priority challenges associated with safely and prudently developing unconventional shale gas and tight oil resources. The goal of this program will focus on timely, policy relevant science directed to research topics where collaboration among the three Agencies can be most effectively and efficiently conducted to provide results and technologies that support sound policy decisions by state and Federal agencies responsible for ensuring the prudent development of energy sources while protecting human health and the environment. This program responds to the Blueprint and to relevant recommendations of the Secretary of Energy Advisory Board Subcommittee on Natural Gas.²

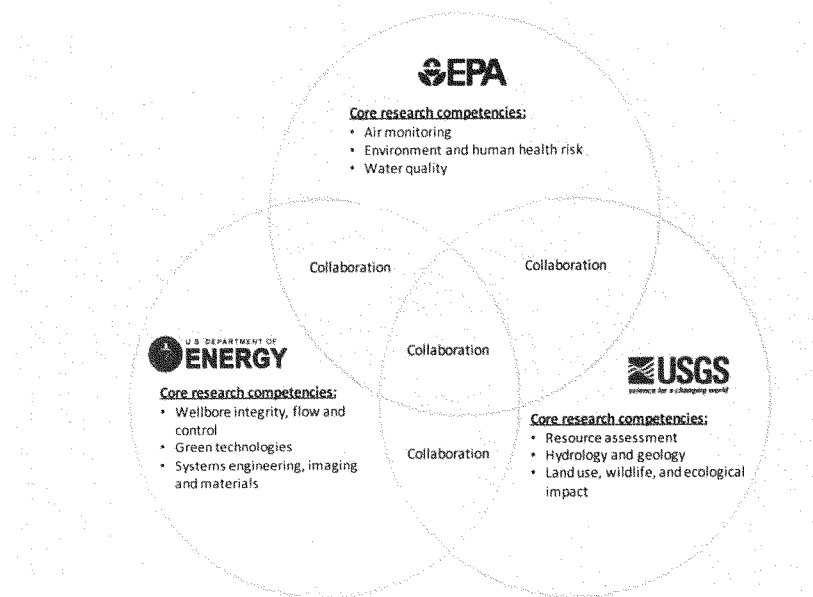
¹ The 31 March 2011 *White House Blueprint for a Secure Energy Future* instructed the Federal Government to "conduct research to examine the impacts of fracking on water resources," directing the EPA and DOE to sponsor research ..."

² The Secretary of Energy Advisory Board recommended that "the federal government has a role especially in basic R&D, environment protection, and safety" and recommends that the DOE, DOI and EPA "all have mission responsibility that justify a continuing, tailored, Federal R&D effort." http://www.shalegas.energy.gov/resources/081811_90_day_report_final.pdf

Interagency Collaboration

The DOE, DOI, and EPA will identify research priorities and collaborate to sponsor research that improves our understanding of the impacts of developing our Nation's unconventional oil and gas resources and ensure the safe and prudent development of these resources. Through enhanced cooperation, the Agencies will maximize the quality and relevance of this research, enhance synergies between the Agencies' areas of expertise, and eliminate redundancy. The Agencies remain responsible for implementing their own authorities and internal priority-setting processes. The goals of this interagency collaboration are as follows:

1. Focus each Agency on its area of core competency. Each Agency has a different combination of experiences, research strengths, personnel, resources, and mission mandates leading to complementary research core competencies.



The Venn diagram summarizes the core research competencies of each of the three Agencies. Further details can be found in the appendix to this memorandum.

2. Collaborate on research topics as appropriate. While each Agency will focus on its areas of core research competency, there will be tasks for which the combined capabilities of more than one Agency will be necessary to address a particular research topic.

An example of collaboration is research on water use for hydraulic fracturing, in which the EPA focuses on the impacts and effectiveness of current technology, DOE focuses on improvements that future technological innovations may yield, and USGS focuses on stream gage and groundwater monitoring to determine water availability, use, and groundwater flow modeling. Another example is the ongoing prospective case study in the Marcellus Shale that the three Agencies are currently collaborating on in support of the EPA's congressionally mandated study on hydraulic fracturing. Where practical and advisable, efforts will be made among the Agencies to apply common and/or consistent monitoring, sampling, and analytical protocols. These and other topic areas are represented by the green areas in the Venn diagram and will be further defined in the research plan discussed in the section below.

3. **Bring coordination and consistency to the annual budget process.** Effective research requires a sustained, well-planned effort. The three Agencies will work to ensure that the annual budget process is part of a coordinated multi-year effort with targeted results.

Forming the Partnership

The three Agencies will take the following steps:

Interagency management structure: The three Agencies will create a Steering Committee to coordinate the Agencies' activities for unconventional oil and gas research. Each Agency will contribute two members to the Steering Committee: one member focused on policy and one member focused on research and technology. The Office of Science and Technology Policy (OSTP) will also provide a member to serve on the Steering Committee. The lead agency of the Steering Committee will rotate annually among the three Agencies in alphabetical order: DOE, DOI, EPA. The Steering Committee will provide leadership, coordinate the activities of the three participating Agencies, and reach out to other relevant Federal, state and local organizations.

Formalizing a research plan: Within 9 months of formation, the Steering Committee will publish a formal multi-year Research Plan that will:

- a. analyze and synthesize the state of knowledge of unconventional oil and gas research to assist in identifying and prioritizing new research directions;
- b. identify, categorize, and prioritize research topics relevant to the safety and environmental sustainability of unconventional oil and natural gas exploration and production;
- c. identify gaps in available data and appropriate activities to address these topics;
- d. identify research milestones and deliverables;
- e. describe steps to promote transparency and maximize stakeholder participation and notification;
- f. establish specific mechanisms for cooperative relationships among the three member Agencies in planning and conducting research and reviewing the results; and
- g. determine future plans, goals and objectives.

Within 6 months of formation the Steering Committee will have a draft of the research plan prepared for public comment.

As part of establishing the research plan, the Steering Committee will solicit comments from the scientific community, public and relevant stakeholders and will hold periodic workshops for this purpose, as appropriate.

Ongoing collaboration: The Steering Committee, augmented by appropriate staff, will meet on a quarterly basis to discuss research efforts being conducted under the research plan, track key milestones, identify and address any implementation challenges, and ensure that work in the priority areas is carried out efficiently and effectively.

Initial engagement: The Steering Committee will hold its inaugural meeting within one month of the effective date of this memorandum. In this meeting, the three member Agencies will nominate members to serve on the Steering Committee, and will further refine as necessary the steps outlined in this memorandum.

Progress Report: The three Agencies will issue an annual public progress report in conjunction with the budget process providing an update on the status of research under way in the previous year, including significant findings, progress toward milestones set forth in the research plan, and any changes in research direction or focus planned for the following year.

Appendix: Agency Roles and Core Competencies

- **Department of Energy**

The DOE has research experience and capabilities in wellbore integrity, flow and control; green technologies; and complex systems, imaging, materials, earth science and engineering. Practices employed by companies engaging in exploration and production of shale gas evolve rapidly. An understanding of these technologies and practices is critical if the Federal Government is to accurately quantify the risks of these activities.

Wellbore integrity, flow and control: The DOE capabilities in this area include experience and expertise in quantifying, evaluating, and mitigating potential risks resulting from the production and development of the shale gas resources, to include multi-phase flow in wells and reservoirs, well control, casing, cementing, drilling fluids, and abandonment operations associated with drilling, completion, stimulation and production operations. The DOE has experience in evaluating seal-integrity and wellbore-integrity characteristics in the context of protection of groundwater.

Green technologies: The DOE has experience and expertise in the development of a wide range of new technologies and processes, to include innovations which reduce the environmental impact of exploration and production such as greener chemicals or additives used in shale gas development, flowback water treatment processes and water filtration technologies. Data from these research activities assists regulatory agencies in making a science-based cost-benefit analysis of requiring producers to adopt new technologies to mitigate environmental risks.

Systems engineering, imaging and materials: The DOE specializes in the development of complex, engineered systems, high-speed computing and predictive modeling, and has experience in quantifying and mitigating low-frequency, high-impact risks. This includes evaluating human factors which potentially contribute to failures. The DOE has developed and evaluated novel imaging technologies for areal magnetic surveys for the detection of unmarked abandoned wells, and for detecting and measuring fugitive methane emissions from exploration, production, and transportation facilities. The DOE also has experience in understanding of fundamental interactions caused during the drilling process, such as the equation of state research that investigates the relationship between pressure, temperature, and viscosity of multi-phase fluids at the high temperatures and pressures associated with deep drilling and hydraulic fracturing. The DOE's experience in engineered underground containment systems for CO₂ storage brings capabilities that are relevant to the challenges of safe shale gas production, such as evaluating cement-casing integrity in corrosive environment to characterize long-term wellbore integrity for CO₂ sequestration.

- Department of the Interior:

The United States Geological Survey (USGS) has research experience and capabilities in resource assessments; natural systems, geology, hydrology; and evaluation of effects on land use, wildlife and ecological systems.

Resource Assessment: The USGS conducts research and assessments of the undiscovered, technically recoverable oil and gas resources of the United States (exclusive of the Federal Outer Continental Shelf). The USGS assessments use a geology-based assessment methodology that characterizes the total petroleum system considering source rock richness, petrophysical properties, thermal maturation, petroleum generation, migration, and reservoir rock as important factors in evaluating the hydrocarbon accumulation. Assessments incorporate uncertainty, are fully risked, and are reported as statistical estimates of gas, oil, and natural hydrocarbon liquids content. They support analyses to determine those resources that are economically recoverable. These assessments play an important role in Federal policymaking and land management and also support decision making at tribal, state and local levels.

Geology and Hydrology: Understanding the stratigraphy, physical trapping mechanisms, petroleum geochemistry, and stress conditions of unconventional basin gas and oil-bearing formations is critical to determining local and regional variations in gas and oil abundance, composition, and quality that identify rock formation targets and guide operational plans for drilling and hydrofracturing, and for understanding and forecasting the composition of produced waters. The USGS expertise in earthquake seismology, geothermal systems, and geologic carbon sequestration is appropriate for induced seismicity evaluation. Down hole rock composition, native and flowback fluid composition, borehole temperature and pressure, and in situ stress levels are used to generate groundwater flow models and geochemical models that provide estimates of solute transport and rates and the potential fate of injected waters and their constituents. The USGS operates more than 7,700 of the Nation's surface water streamgages and groundwater monitoring wells each of which provide data critical for assessing and modeling water availability and water quality important to understanding water use, contaminant occurrences, flood hazards, and ecological flows. Cooperative agreements with state and local agencies provide additional data. Water quantity and quality are potentially affected by energy production activities. The USGS maintains an extensive, nationwide water monitoring capability and conducts assessments of surface and groundwater availability throughout the Nation, including both fresh and brackish groundwater resources.

Land Use, Wildlife, and Ecologic Impact: The USGS has diverse capabilities to evaluate potential impacts to biological resources and the water resources available to sustain them due to activities associated with shale gas and tight oil production. Landscape scale research is important to quantifying the response of key species and habitats to land disturbance, contaminants, and other potential impacts resulting from development of shale gas and tight oil resources and to develop best management practices to mitigate impacts. Remotely sensed airborne imagery is used to assess forest fragmentation and effects of shale gas activities on land use patterns, wetlands, and migratory bird populations. The USGS also assesses the effects of habitat change on key aquatic species including endangered species affected by hydrocarbon production.

- Environmental Protection Agency:

The EPA has research experience and capabilities across a wide range of scientific and technical disciplines that support the Agency's mission of protecting human health and safeguarding the environment. This includes core competencies in the areas of environmental and human health risk assessment, air quality, and water quality. The EPA has the unique ability to conduct research that spans the characterization of sources and emissions, to pollutant fate and transport, to ecosystem and human exposures, health effects and risk assessment, and to the prevention and management of environmental risks.

Environmental and Human Health Risk: The EPA has extensive capabilities to characterize the effects of contaminants and environmental stressors on ecosystem integrity and human health for air and water contaminants and mixtures associated with gas extraction practices. Ecological research capabilities that support risk assessments focus on evaluating potential physical, chemical, and biological changes to ecosystems, disruptions of ecological flows in headwater rivers, and impacts on terrestrial wildlife, stream macrobenthos, and fish. The Agency also has the expertise to evaluate landscape pattern changes in terms of available habitat and changes in vulnerability for rare or unique ecosystems. The EPA research capabilities that support human health risk assessments include conducting field measurements and other types of studies to characterize exposures, performing laboratory and computational toxicology studies for hazard identification and dose response assessments, and developing and applying risk assessment methods to evaluate human health risks posed by environmental contaminants.

Air Quality: The EPA possesses expertise in the measurement and modeling of air pollutants from sources related to all phases of gas extraction, processing, storage, and distribution. This includes using mobile and fixed air monitoring systems to estimate local, regional, and national exposures to air pollutants.

Water Quality: Groundwater protection research capabilities at the EPA include quantifying the effects of exploration and production activities on ground water quantity and quality, conducting subsurface hydrogeological and geochemical modeling, evaluating well integrity issues, and assessing the potential for releases to groundwater from wells or surface impoundments during drilling, completion, operation or post closure.

Chairman LUMMIS. Good morning. We are small in number, but mighty in commitment this morning. We welcome you to this morning's hearing. It is a "Review of Federal Hydraulic Fracturing Research Activities." This is the fourth meeting of the Energy Subcommittee this Congress, and today we welcome our friends from the Environment Subcommittee to discuss this cross cutting issue. Some of them are still at a classified briefing on Syria and North Korea. We expect them to join us any minute. The reason we are starting on time and not waiting for them is we are tremendously time-constrained this morning due to votes coming up, and we want to have an opportunity to take advantage of the expertise you are providing here today.

A primary recurring theme from our earlier hearings, which focused on energy markets and related technology subsidies, was the incredible transformation of the U.S. energy sector as a result of hydraulic fracturing-enabled shale production.

So today we are building on this theme and drilling down into the science of hydraulic fracturing. Pun intended.

In April of 2012, President Obama signed an Executive Order creating a senior level task force charged with coordinating Federal actions related to the development of unconventional natural gas. Concurrent with the President's announcement, EPA, DOE, and the Department of Interior signed a memorandum of understanding committing to development of an interagency plan to guide implementation of the Administration's \$45 million budget request to study environmental impacts associated with unconventional oil and gas production.

The agencies committed to release a draft of the research plan by October of last year, and to complete the final plan by January of this year. Today, a year after the President's original announcement, the Administration has not even released a draft version of its plan for public comment.

So Congress and the public have very few details regarding the Administration's ongoing activities in this area. In addition to last year's \$45 million request, the President is seeking an additional \$38 million in Fiscal Year 2014. Our concerns regarding these activities are simple and straightforward: before Congress redirects tens of millions of dollars for this research effort, the Administration must tell us what it wants to spend the money on.

Bringing sunlight to these activities is especially important, given the Administration's terrible track record of unsubstantiated allegations when it comes to hydraulic fracturing. Pavillion, which is in my home State of Wyoming, is at the center of this storm. In late 2011, EPA put Pavillion in the national spotlight with a "draft" report implying that fracking was somehow responsible for the quality of water in the areas near town.

However, in the days and weeks that followed this announcement, the State of Wyoming, industry, and other Federal agencies exposed EPA's study as deeply flawed. Former Administrator Jackson even admitted to me during questioning at another committee that the EPA was not confident it had discovered groundwater contamination in Pavillion related to fracking. And she further said we have definitely not discovered it in ground—rather, in drinking water.

Given its serious flaws, I have called on the agency to abandon the report and return to a collaborative effort with the State of Wyoming on how to resolve these issues around Pavillion. The people of Pavillion deserve resolution, and the State of Wyoming deserves deference for the hard work it has done to ensure that oil and gas development in our state is done safely. I certainly plan to follow-up with EPA and ensure that they get it.

Policymaking related to fracking should be driven by open public debate based on peer-reviewed science, not political agendas. That is why we are here today, to ensure the Administration's fracking-related research activities are appropriate, balanced, and transparent.

On a related note, I do want to express frustration with the lack of cooperation from EPA in planning this hearing. More than 4 weeks ago, we invited Bob Sussman to testify at this hearing on behalf of the agency, and despite this extended advance notice, and Mr. Sussman's role as EPA's senior policy representative on the interagency group that we are here to discuss, the agency refused to allow him to participate or to provide an explanation for its refusal. And we appreciate Dr. Teichman—now did I pronounce that correctly? We do appreciate your presence here today. But EPA's lack of cooperation is just unacceptable, and only raises further questions regarding the agency's transparency and ultimate intentions regarding fracking.

I do, again, want to thank all of our witnesses for being here, and look forward to today's discussion.

[The prepared statement of Mrs. Lummis follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENERGY
CHAIRMAN CYNTHIA LUMMIS

Chairman Lummis: Good morning and welcome to this morning's hearing, A Review of Federal Hydraulic Fracturing Research Activities.

This is the fourth meeting of the Energy Subcommittee this Congress, and today we welcome our friends from the Environment Subcommittee to discuss this cross-cutting issue. A primary recurring theme from our earlier hearings—which focused on energy markets and related technology subsidies—was the incredible transformation of the U.S. energy sector as a result of hydraulic fracturing-enabled shale production.

Today we will build on this theme by (figuratively) drilling down into the science of hydraulic fracturing.

In April of 2012, President Obama signed an Executive Order creating a senior level task force charged with coordinating federal actions related to development of unconventional natural gas. Concurrent with the President's announcement, EPA, DOE, and the Department of Interior signed a memorandum of understanding committing to develop an interagency plan to guide implementation of the Administration's \$45 million budget request to study environmental impacts associated with unconventional oil and gas production.

The agencies committed to release a draft of the research plan by October 2012 and complete the final plan by January 2013. Today, a year after the President's original announcement, the Administration has not even released a draft version of its plan for public comment.

Consequently, Congress and the public have very few details regarding the Administration's ongoing activities in this area. In addition to last year's \$45 million request, the President is seeking an additional \$38 million in fiscal year 2014. Our concerns regarding these activities are simple and straightforward: before Congress redirects tens of millions of dollars for this research effort, the Administration must tell us what it wants to spend this money on.

Bringing sunlight to these activities is especially important given the Administration's embarrassing track record of unsubstantiated allegations when it comes to hy-

draulic fracturing. Pavillion, a small town in my state of Wyoming, is at the center of this storm. In late 2011, EPA put Pavillion in the national spotlight with a “draft” report implying that fracking was somehow responsible for the quality of water in the areas near town.

However, in the days and weeks that followed this announcement, the State of Wyoming, industry, and other federal agencies exposed EPA’s study as deeply flawed. Former Administrator Jackson even admitted to me during questioning at another committee that the EPA was not confident it had discovered groundwater contamination in Pavillion related to fracking.

Given its serious flaws, I have called on the Agency to abandon the report and return to a collaborative effort with the State of Wyoming on how to resolve the issues around Pavillion. The people of Pavillion deserve resolution, and the State of Wyoming deserves deference for the hard work it has done to ensure that oil and gas development in our state is done safely. I certainly plan to follow-up with EPA to ensure they get it.

Policymaking related to fracking should be driven by open public debate based on peer-reviewed science, not political agendas. That is why we are here today—to ensure the Administration’s fracking—related research activities are appropriate, balanced, and transparent.

On a related note, I want to express my great frustration with the lack of cooperation from EPA in planning this hearing. More than four weeks ago, we invited Bob Sussman to testify at this hearing on behalf of the agency. Despite this extended advance notice, and Mr. Sussman’s role as EPA’s senior policy representative on the interagency group we are here to discuss, the Agency refused to allow him to participate or even provide an explanation for its refusal. While we appreciate Dr. Teichman’s presence here today, EPA’s lack of cooperation is unacceptable, and only raises further questions regarding the agency’s transparency and ultimate intentions regarding fracking.

I thank our witnesses for being here, and look forward to today’s discussion.

I now recognize the gentleman from California, Mr. Swalwell, for five minutes.

Chairman LUMMIS. And now I would like to recognize the gentleman from California, Mr. Swalwell, for five minutes.

Mr. SWALWELL. Thank you, Chairman, for holding this hearing today, and I also want to thank our witnesses for being here. I appreciate the opportunity to examine the important topic of hydraulic fracturing, often called fracking, in greater detail.

I agree with those who say that when it comes to our country’s energy resources, we should take 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, my state, to create jobs and diversity energy options for both consumers and industry over the next several years. I believe that wherever it is possible, if we can make it environmentally safe, we can make it happen. However, when it comes to fracking, I believe we need to proceed with extreme caution. We have to be careful that if we are to extract this resource safely without inadvertently polluting either our drinking water or the environment, and in California, of particular concern is what fracking can do to cause earthquakes or to activate or reactivate previous fault lines. It would be very short-sighted to produce energy in California via fracking, only to find out later that it could cause such damage, which also means that maybe perhaps fracking may be better for one state than it is for another, and that is also a conversation and a topic I am interested in exploring further.

But for that reason alone, it is imperative that we know as much now as early as possible about what fracking can do to our fault lines in California before pursuing short term gains. And this is why I think this multi-agency effort is so important, and I applaud President Obama and the Administration for leveraging its diverse

areas of expertise to determine the best practices for hydraulic fracturing going forward.

I understand that the agencies testifying today have met their internal goal of submitting a draft plan before the end of 2012, and the final plan is now in the last stages of coordination with the Office of Management and Budget.

In the meantime, this draft has already informed the President's budget request for each of these agencies, and the important research priorities that you have collectively identified are being addressed, even before the release of the final report, as you continue to work in close coordination with each other.

I look forward to learning more about each of your efforts, discussing these important issues with you today, and reviewing the final report.

And with that said, 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 Lummis and Chairman Stewart for holding this hearing today, and I also want to thank the witnesses for being here. I appreciate the opportunity to examine the important topic of hydraulic fracturing, often called fracking, in greater detail.

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 inadvertently polluting either our drinking water or the environment. Of 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.

This is why I think this multi-agency effort is so important, and I applaud President Obama and his Administration for leveraging its diverse areas of expertise to determine the best practices for hydraulic fracturing going forward.

I understand that the agencies testifying today have met their internal goal of submitting a draft plan before the end of 2012, and the final plan is now in the last stages of coordination with the Office of Management and Budget.

In the meantime, this draft has already informed the President's budget request for each of these agencies, and the important research priorities that you've collectively identified are being addressed even before the release of the final report as you continue to work in close coordination with each other.

I look forward to learning more about each of your efforts, discussing these important issues with you today, and reviewing the final report.

Chairman LUMMIS. Thank you, Mr. Swalwell. And as you know, this is a joint hearing so the Chair now recognizes the Chairman of the Subcommittee on Environment, Mr. Stewart, for his opening statement.

Mr. STEWART. Thank you, Madam Chairman, and welcome to the witnesses. Thank you for your being with us today, and to the Chair, thanks again for holding this hearing on what I think is a very important issue.

Unconventional oil and gas development enabled by hydraulic fracturing is a rare bright spot in our otherwise gloomy economy over the last few years. Given the importance of this issue, I too am disappointed that the EPA declined to send the witness we had invited, Mr. Bob Sussman, the Senior Policy Counsel to the EPA Ad-

ministrator, to testify. While I hope the Agency had a good reason for its refusal to make Mr. Sussman available, they did not share this reason with us, and that troubles me. I think it invites suspicion and it begs to be answered why. I can only hope that this will prove to be an exception rather than a trend. This is especially concerning, as EPA's past and ongoing hydraulic fracturing studies and investigations demonstrate a cart-before-the-horse approach to the science that should make members think seriously about whether a blank check for the Administration is good policy.

The shale gas revolution has not only brightened our economic prospects and created sorely needed jobs, it has strengthened our energy security. And as a former Air Force pilot and officer, I understand how important that is, as I am sure do most of you. Thanks to fracking, the U.S. is now poised to surpass Saudi Arabia and Russia as the world's largest oil and gas producer in just the next few years. This could dramatically alter the geopolitical landscape to the great benefit of American interests.

Yesterday, we held a hearing to examine the science of climate change. And whatever one's position is on this issue, there is no denying that fracking is helping drive reductions in carbon emissions. U.S. greenhouse emission gasses are at their lowest level since 1994, and have dropped 12 percent since 2005. In fact, from 2005 to 2011, the U.S. decreased its carbon dioxide output more than any other nation, including those countries that have implemented aggressive green energy agendas, such as Germany and Spain. In light of these facts, it is both ironic and troubling that many of the most passionate advocates for action on climate change also oppose fracking. I wish that I understood this, but frankly, I don't.

This should give pause to the EPA and any other agency that seeks to hinder the development of our unconventional natural gas resources. To do so not only negatively impacts our economy, but it increases emissions and undercuts major advances toward energy security. Rather than search for problems that do not exist, the EPA and this Administration should recognize that shale gas is a solution. It is not the problem. Production, not regulation, has led to a reduction in greenhouse gases, and market forces, not restrictions, quotas, and carbon trading schemes, those are the things that have positioned the U.S. as a global leader in oil and gas production. Again, market forces, not restrictions.

I again thank the witnesses for joining us today, and I look forward to your testimony. I hope that you recognize, as I do, that searching for a problem as a pretext for regulation rather than focusing on the science is a waste of time and a waste of resources, and it runs counter to all of our interests, as well as to the national interest.

And with that, I thank the gentlelady for the opportunity to be here, and I yield back the balance of my time.

[The prepared statement of Mr. Stewart follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ENVIRONMENT
CHAIRMAN CHRIS STEWART

Good morning and welcome to today's joint Energy and Environment Subcommittee hearing, A Review of Federal Hydraulic Fracturing Research. I want to thank Chairman Lummis for holding a hearing with me on this important issue.

Unconventional oil and gas development enabled by hydraulic fracturing is a rare bright spot in our otherwise gloomy economy over the last few years. Given the importance of this issue, I too am disappointed that the EPA declined to send the witness we had invited, Mr. Bob Sussman, the Senior Policy Counsel to the EPA Administrator, to testify. While I hope the Agency had a good reason for its refusal to make Mr. Sussman available, they did not share this reason with us. I can only hope this will prove to be an exception rather than a trend. This is especially concerning, as EPA's past and ongoing hydraulic fracturing studies and investigations demonstrate a cart-before-the-horse approach to the science that should make Members think seriously about whether a blank check for the Administration is a good policy.

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This should give pause to the EPA and any other agency that seeks to hinder the development of our unconventional natural gas resources. To do so would not only negatively impact our economy, but increase emissions and undercut major advances toward energy security. Rather than search for problems that do not exist, the EPA and this Administration should recognize that shale gas is a solution rather than a problem. Production, not regulation, has led to a reduction in greenhouse gases, and market forces, not restrictions, quotas, or carbon trading schemes, have positioned the U.S. as a global leader in oil and gas production.

I thank the witnesses for joining us today, and look forward to their testimony. I hope they recognize, as I do, that searching for problems as a pretext for regulation rather than focusing on the science is a waste of time, a waste of resources, and runs counter to the national interest.

I thank the gentlelady, and I yield back.

Chairman LUMMIS. Thank you, Mr. Stewart.

The Chair now recognizes Ms. Bonamici.

Ms. BONAMICI. Thank you very much, Chair Lummis and Chair Stewart, for holding this hearing. I am pleased to have representatives from the Federal agencies appearing before the joint Subcommittees today to discuss their multi-agency plan to research hydraulic fracturing and unconventional oil and gas.

Hydraulic fracturing has led to a significant expansion of drilling for gas and oil in the United States, unlocking huge natural gas reserves that have reduced the cost of natural gas domestically and resulted in economic improvement across many industries. The successful development in application of this technology, however, has been accompanied by an insufficient understanding of the potential impacts that hydraulic fracturing, or fracking, might have on our environment and our health. The debate about environmental health and human safety issues has escalated as we have heard concerns related to groundwater contamination, induced seismicity events—and I share Mr. Swalwell's concerns as someone who has constituents along the Cascadia's adduction zone—well integrity and potential negative impacts to the health of workers, just to name a few.

According to the Energy Information Administration, it is estimated that shale gas will supply almost 50 percent of our gas in 20 years. If that prediction is accurate, it is even more critical that

this boom in natural gas production be accompanied by a clear development of best practices to identify and curb potential negative impacts.

It is my hope that the multi-agency research plan will address these very important questions in order to ensure the continued prosperity of the industry, while preserving the health and safety of the general public.

Hydraulic fracturing emerged as a commercial success in large part because of Federal investment in fracking technologies. The success the government had in aiding the fracking industry is an example of how public-private partnerships can work to advance science and engineering, and turn nascent technologies into an economic driver.

Although I am a strong proponent of reducing our country's dependence on conventional gas and oil, I hope we make similar commitments to developing clean energy technology, with a similar focus on preserving human and environmental health. Diversifying our energy supply and protecting public health go hand in hand.

In closing, I am pleased that the Administration is calling upon the expertise of our Federal agencies to ensure that we have the best scientific information available, use cutting edge technology, and develop best practices for extracting this plentiful resource in a manner that is safe for our workers and the environment. I look forward to hearing how the agencies plan to research and address these issues, and with that, I yield back and look forward to the testimony. Thank you, Madam Chair.

[The prepared statement of Ms. Bonamici follows:]

PREPARED STATEMENT OF SUBCOMMITTEE ON ENVIRONMENT
RANKING MEMBER SUZANNE BONAMICI

Thank you, Chair Lummis and Chair Stewart. I am pleased to have representatives from the federal agencies appearing before the joining Subcommittees today to discuss their multi-agency plan to research hydraulic fracturing and unconventional oil and gas. Hydraulic fracturing has led to a significant expansion of drilling for oil and gas in the United States, unlocking huge natural gas reserves that have reduced the cost of natural gas domestically and resulted in economic improvement across many industries.

The successful development and application of this technology, however, has been accompanied by an insufficient understanding of the potential impacts that hydraulic fracturing, or "fracking," might have on our environment and our health. The debate about environmental health and human safety issues has escalated over the years, as we have heard concerns related to groundwater contamination, induced seismicity events, well integrity, and potential negative impacts to the health of workers, just to name a few. According to the Energy Information Administration, shale gas is estimated to supply almost 50 percent of our gas in 20 years. If that prediction is accurate, it is even more critical that this boom in natural gas production be accompanied by a clear development of best practices to identify and curb potential negative impacts. It is my hope that the multiagency research plan will address these very important questions in order to insure the continued prosperity of the industry while preserving the health and safety of the general public.

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Chairman LUMMIS. Thank you, Ms. Bonamici.

I now recognize the Chairman of the Full Committee, Mr. Smith.

Chairman SMITH. Thank you, Madam Chair, and I have a very brief opening statement.

It is difficult to overstate the incredible benefits of the fracking energy revolution that is underway across America.

A recent report found that the Eagle Ford shale development in Texas is now producing 700,000 barrels of oil and natural gas liquids every day, up from zero just three years ago. The economic benefits and job opportunities associated with this shale boom, not just in Texas but across the Nation, is arguably the brightest spot in an otherwise still stagnant economy.

Unfortunately, a widely publicized handful of unsubstantiated charges that fracking pollutes groundwater has led many to question the safety of this practice. The EPA is at the center of this debate, linking fracking to water contamination in at least three cases, only to be forced to retract their statements after further scrutiny.

It is against this backdrop that we are here to consider the Administration's request to spend nearly \$40 million across several agencies studying the safety of hydraulic fracturing that would be carried out under a long-delayed and still unreleased research plan.

We all want to ensure safe and responsible production of oil and natural gas, but the combination of the Administration's track record on fracking and the delays associated with developing these plans provide cause for concern.

I look forward to hearing how we can support this energy revolution and avoid any unnecessary delay in its evaluation by the Federal Government.

Thank you, Madam Chair, and I yield back.

[The prepared statement of Mr. Smith follows:]

PREPARED STATEMENT OF FULL COMMITTEE CHAIRMAN LAMAR S. SMITH

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I look forward to hearing how we can support this energy revolution and avoid any unnecessary delay in its evaluation by the federal government.

Chairman LUMMIS. Thank you, Chairman Smith.

Now for a little housekeeping. In front of each member are packets containing the written testimony, biographies, and Truth in Testimony disclosures for today's witnesses. As always, we will alternate between the Majority and Minority members in terms of asking questions. 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 order of arrival. One more little thing. If there are members who wish to submit additional opening statements, your statements will be added to the record at this point.

Mr. ROHRABACHER. Madam Chairman?

Chairman LUMMIS. Yes? I recognize—

Mr. ROHRABACHER. Madam Chairman, I have—I am Chairman of a hearing that is about to happen in a few minutes from now, and I would just like to thank you for your leadership in calling this hearing today, and I will be submitting questions for the record and reading the testimony of the witnesses, but have to leave and I am sorry for that.

Chairman LUMMIS. I thank the gentleman. Mr. Rohrabacher is a long-distinguished member of this Committee, and we appreciate his presence here this morning, and look forward to the submittal of your questions and the responses to them from the agencies here present. Thank you, Representative Rohrabacher.

If there are additional opening statements, we will accept them now.

Very well. That being said, it is now time to introduce our panel of witnesses. Our first witness is Dr. Kevin Teichman. Now did I get that right? It is Teichman. I had it right the first time, didn't I? Would you please say it again?

Dr. TEICHMAN. Teichman.

Chairman LUMMIS. Teichman, all right. Thank you. Dr. Teichman is the Senior Science Advisor for the Office of Research and Development at the EPA.

Our second witness is—now here we go. I am going to give it a shot, and please correct me. Mr. DeHoratiis?

Mr. DEHORATIIS. DeHoratiis.

Chairman LUMMIS. DeHoratiis. Welcome. Mr. DeHoratiis is the Acting Deputy Assistant Secretary for Oil and Gas in the Office of Fossil Energy at the Department of Energy.

Our third witness is Dr. David Russ—did I get that right?

Dr. RUSS. Perfectly well. Thank you.

Chairman LUMMIS. Thank you. Regional Executive of the Northeast Area for the United States Geological Survey.

And our final witness is Dr. Robin Ikeda—

Dr. IKEDA. Ikeda.

Chairman LUMMIS. Ikeda, all right. Dr. Ikeda is the Acting Director of the Agency for Toxic Substances and Disease Registry at the Department of Health and Human Services.

We are, again, grateful for your presence here today. As our witnesses should know, spoken testimony is limited to five minutes each, after which, members of the Committee have five minutes

each to ask questions. Your written testimony will be included in the record of the hearing.

And now, I would like to recognize our first witness, Dr. Teichman, for five minutes.

**TESTIMONY OF DR. KEVIN TEICHMAN,
SENIOR SCIENCE ADVISOR,
OFFICE OF RESEARCH AND DEVELOPMENT,
ENVIRONMENTAL PROTECTION AGENCY**

Dr. TEICHMAN. Good morning Chairmen Lummis and Stewart, and other distinguished Subcommittee Members. I appreciate the opportunity to talk with you today about EPA's research activities related to hydraulic fracturing.

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

In April 2012, DOE, DOI, and EPA signed a memorandum of agreement to develop a research program devoted to unconventional oil and gas production. Under this MOA, the three agencies are collaborating to provide information that will support sound policy decisions by Federal agencies, state, tribal, and local governments, the oil and gas industry, and others to ensure prudent development of these sources while promoting safe practices, human health, and the environment. The three agencies are coordinating their research planning, focusing on each agency's areas of core competency and collaborating on research with each other and others.

Last July, the tri-agency steering committee held webinars for three different groups of stakeholders, industry, state and tribal governments, and not-for-profit organizations. At that time, we described the research areas we thought should be studied and asked each group what the most important research questions that can be addressed in the short term and in the long term? What would be the most useful research products, and what research is your organization pursuing?

In addition, the members of the steering committee and its technical subcommittee continue to participate in technical conferences, meetings, and workshops devoted to this topic, at which we have presented them our research areas and asked the above questions.

Specifically, EPA has taken steps to coordinate with other Federal agencies throughout the development and implementation of our drinking water study. For example, DOE and DOI are participants in the technical workshops related to our study. These workshops are devoted to analytical chemical methods, well construction and operation and subsurface modeling, wastewater treatment, water acquisition modeling, and hydraulic fracturing case studies.

In the MOA, the three agencies committed to the development of a research plan that would, in brief, synthesize the state of knowledge; identify data gaps; prioritize research topics; and determine future goals and objectives. The research plan is still under development. Work to date to develop the plan has been very helpful in

both coordinating the research efforts of the three agencies, and developing the President's 2014 budget request.

In Fiscal Year 2012 and 2013, EPA's research related to hydraulic fracturing is focused on carrying out the Congressionally requested Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources. This research is focusing on assessing any potential impacts, as well as identifying the factors that may affect the severity and frequency of such impacts.

Work is underway to answer the research questions listed in the study plan for this effort. EPA released a progress report in December 2012 which provided an update of the ongoing research. A draft report of results is expected in late 2014, which will synthesize our research results together with the available scientific literature to inform answers to the research questions listed in the study plan.

As shown in the study plan, there are important questions outside the scope of the current study that are of high priority to stakeholders. Therefore, the tri-agency research plan will include research on potential impacts on air quality, human health effects, water, and ecosystems. This broader perspective is reflected in the Fiscal Year 2014 budget request.

The Fiscal Year 2014 budget request is \$14.1 million and \$24.9 million FTE for EPA to conduct UOG research. Resources are requested for the drinking water study; water quality and ecological studies; and air quality studies. These research areas are among those identified as high priority research topics in the tri-agency effort and represent EPA's 2014 contribution to that effort.

As mentioned earlier, a draft report of the drinking water study results is expected in late 2014, and additionally, Fiscal Year 2014 resources will be used to revise the report as needed to reflect public and peer review comments.

The remaining Fiscal Year 2014 requested resources will be used to better characterize the composition of wastewater and wastewater treatment residuals, including solids from hydraulic fracturing and UOG operations, and air emissions from these operations.

In conclusion, I believe 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 maximizes the positive impacts and minimizes the potential negative ones. We are pursuing this work with the best available science and the highest level of transparency, and will continue to collaborate with our Federal partners and work with our stakeholders to address the highest priority challenges to safely and prudently developing unconventional shale gas and tight oil resources.

Thank you.

[The prepared statement of Dr. Teichman follows:]

TESTIMONY

Kevin Teichman, Ph.D.
Senior Science Advisor
Office of Research and Development (ORD)
U.S. Environmental Protection Agency (EPA)

Joint Hearing on Review of Federal Hydraulic Fracturing Research Activities
before the
U.S. House of Representatives
Committee on Science, Space, and Technology
Subcommittee on Energy
and
Subcommittee on the Environment
April 26, 2013

Good morning, Chairman Lummis, Chairman Stewart, and other distinguished members of the two Subcommittees. My name is Kevin Teichman, and I am the Senior Science Advisor in the Office of Research and Development at the U.S. Environmental Protection Agency (EPA).

I appreciate the opportunity to talk with you today about EPA's research activities related to hydraulic fracturing, and progress made under Executive Order 13605 and the associated interagency Memorandum of Agreement (MOA) between the Department of Energy (DOE), the Department of Interior (DOI), and the EPA.

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. The extraction and development of these energy sources must be done safely, responsibly, and be guided by the best available science.

The Executive Order, the MOA, and Tri-Agency Coordination

On April 13th of last year, Executive Order 13605 was signed by President Barack Obama to enhance coordination among the Federal agencies responsible for overseeing the safe and responsible development of unconventional domestic natural gas resources and associated infrastructure to reduce U.S. dependence on foreign oil.

Also in April 2012, DOE, DOI, and EPA signed a MOA to develop a tri-agency research program devoted to unconventional oil and gas (UOG) production. Under this MOA, the three agencies are collaborating to provide information and technologies that will support sound policy decisions by Federal agencies; State, Tribal, and local governments; the oil and gas industry; and others to ensure prudent development of these energy sources while promoting safe practices, human health, and the environment. Under this agreement, which is broader than the scope of EPA's current study of the potential impacts of hydraulic fracturing on drinking water resources, the agencies are coordinating their research planning efforts, focusing on each agency's areas of core competency, and collaborating on research with each other and others as much as possible. For example, EPA's areas of core competency are: water quality assessment, air monitoring and assessment, and human health and environmental risk.

Last July, the Tri-agency Steering Committee, described in Dr. Russ' testimony, held webinars for the three different groups of external stakeholders: industry, State and Tribal governments; and non-profit organizations, including environmental groups. At that time, we described the research areas we thought should be studied, and asked each of these groups the following questions:

- In each of the seven potential research areas, what are the most important research questions that can be addressed in the short-term? In the long-term?
- Are there other potential research areas that should be considered?
- What would the most useful research products be in the short-term? In the long-term?
- What research is your organization pursuing, and how do you intend to share your research results?

In addition, the members of the Steering Committee and its Technical Subcommittee continue to participate in technical conferences, meetings, and workshops devoted to this topic, at which we have presented the seven research areas and asked the above questions.

Specifically, EPA has taken steps to coordinate with other Federal agencies throughout the development and implementation of our drinking water study. For example, DOE and DOI are participating in the technical workshops related to our study. These workshops are devoted to analytical chemical methods, well construction/operation and subsurface modeling, wastewater treatment, water acquisition modeling, and hydraulic fracturing case studies.

EPA is also working with the Department of Energy's Lawrence Berkeley National Laboratory to explore the potential for both liquids and gases to move from hydraulically fractured zones to drinking water aquifers. Additionally, EPA's principal investigators remain in frequent contact with their counterparts at DOE and DOI (principally the U.S. Geological Survey (USGS)) regarding research devoted to this important topic.

Collaboration among the three agencies helps to maximize the impact of the research resources available to all of the groups that are working on this important topic, and ultimately ensure that our efforts are coordinated to support the development of our country's oil and natural gas resources in a safe and responsible way.

Tri-Agency UOG Research Plan

In the tri-agency MOA, the three agencies committed to the development of a research plan that would, in brief, synthesize the state of knowledge; identify data gaps; prioritize research topics; describe steps to maximize stakeholder participation; establish mechanisms for cooperation among the three agencies, and determine future goals and objectives. The tri-agency research plan is still under development.

Work to date to develop the plan has been very helpful in both coordination among the three agencies' research efforts and the development of the President's FY 2014 Budget Request.

EPA Research Activities in FY 2012 and 2013 – The EPA Drinking Water Study

In FY 2012 and FY 2013, EPA's research efforts related to hydraulic fracturing are focused on carrying out the Congressionally requested *Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources*. This research has focused on assessing the potential impacts of hydraulic fracturing on drinking water resources, if any, as well as identifying the driving factors that may affect the severity and frequency of such impacts.

Work is underway to answer the research questions listed in the "Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources" (Study Plan) available at www.epa.gov/hfstudy.

EPA released a Progress Report in December 2012 that provides an update of the ongoing research. A draft report of results is expected in late 2014. The 2014 draft report will synthesize the results from the research projects together with the available scientific literature to inform answers to the research questions listed in the Study Plan.

As shown in chapter 13 of the Study Plan, there are important questions outside the scope of the current work that are of high priority to stakeholders and merit further investigation. Therefore, the tri-agency research plan will include research needs on potential impacts beyond those of the EPA drinking water study, i.e., on air quality, human health effects, water, and ecosystems. This broader perspective is reflected in the President's FY 2014 Budget Request for EPA and our partner agencies.

FY 2014 Request for EPA

The President's Budget for FY 2014 requests a total of \$14.1 million and 24.9 FTE for EPA to conduct UOG research. Resources are requested in three research areas: (a) continuing work on the drinking water study (\$6.1 million and 14.9 FTE); (b) water quality and ecological studies (\$4.3 million and 5.5 FTE); and (c) air quality studies (\$3.8 million and 5.5 FTE). These research areas are among those identified as high priority research topics as part of the tri-agency effort and represent EPA's FY 2014 contribution to that effort.

With respect to the drinking water study, as mentioned earlier, a draft report of the study results is expected in late 2014. FY 2014 resources will be used to revise the report as needed to reflect the comments received during public comment and peer review.

The remaining FY 2014 requested resources would be used to better characterize: (a) the composition of wastewater (flowback and produced waters) and wastewater treatment solids from hydraulic fracturing and UOG operations across the United States and (b) air emissions from hydraulic fracturing operations including methane, combustion byproducts, and volatile organic compounds.

Conclusion

In conclusion, I believe 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 maximizes the potential positive impacts and minimizes the potential negative impacts -- on human health, air quality, water, and ecosystems. We are pursuing this work with the best available science and the highest level of transparency. 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 developing unconventional shale gas and tight 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.

Dr. Kevin Teichman Bio

Dr. Kevin Teichman is the Senior Science Advisor in the Office of Research and Development (ORD) at the U.S. Environmental Protection Agency. In addition to providing advice on all aspects of ORD's research programs, Dr. Teichman coordinates ORD's research efforts with other Federal agencies and organizations. Most recently, he has been working to coordinate interagency research devoted to hydraulic fracturing, net zero environmental impact buildings, and applications and sensors for air pollutants.

Prior to assuming his current position, Dr. Teichman served as the ORD Deputy Assistant Administrator for Science, where he led the planning of ORD's research program and supervised the office's National Program Directors. The ORD research program covers all aspects of environmental research, including research devoted to air, climate, and energy; safe and sustainable water resources; chemical safety for sustainability; sustainable and healthy communities; human health risk assessment; and homeland security.

Dr. Teichman also previously served as the Director of the Office of Science Policy (OSP) within ORD. In this capacity, he coordinated ORD's participation in EPA's policymaking in all media (air, water, waste, pesticides and toxic substances) to ensure the Agency's policies reflected sound science. Prior to this, he managed EPA's indoor air quality research program, including research devoted to characterizing indoor pollutants sources, assessing indoor exposures, studying associated health effects, assessing potential risks, and developing prevention / mitigation approaches to indoor air pollution.

Dr. Teichman has B.S. and M.S. degrees from the Massachusetts Institute of Technology and a Ph.D. degree from the University of California at Berkeley, all in Mechanical Engineering. He lives in Derwood, Maryland, where he and his wife Marsha are proud "empty nesters" of three children.

Chairman LUMMIS. Thank you, Dr. Teichman.

Now I am going to try one more time. I love these American last names of global derivation. They are so much fun, and I think have Dr. Teichman and Dr. Ikeda down, so I am going to make one more run at Mr. DeHoratiis.

Mr. DEHORATIIS. That is correct.

Chairman LUMMIS. Did I get it right?

Mr. DEHORATIIS. That is correct.

Chairman LUMMIS. Great. The Chair now recognizes our next witness, Mr. DeHoratiis.

**TESTIMONY OF MR. GUIDO DEHORATIIS,
ACTING DEPUTY ASSISTANT SECRETARY
FOR OIL AND GAS, OFFICE OF FOSSIL
ENERGY, DEPARTMENT OF ENERGY**

Mr. DEHORATIIS. Thank you. I want to thank the Chairs, the Ranking Members, and the Members of the Subcommittees for inviting me before you today to discuss the critical role that the Department of Energy, Office of Fossil Energy, in collaboration with the Department of the Interior and the Environmental Protection Agency, is playing to improve the safety and environmental performance of our Nation's unconventional oil and natural gas resources.

Federal coordination and collaboration is critical to successfully addressing the challenges associated with the development of unconventional oil and gas resources. To this end, the President signed an Executive Order, which has already been referenced this morning. On the same day, our three agencies signed a related memorandum of agreement on collaborative research to better identify and address the highest priority issues associated with the safe and prudent development of unconventional oil and gas resources.

This collaboration will address a subset of unconventional resources, namely shale gas, tight gas, shale oil, and tight oil, and a robust Federal research and development plan is under development. Each of the three agencies has a unique set of core capabilities relevant to this effort and will focus on those tasks that are most relevant to their respective skill sets. At the same time, the agencies will work together on tasks that require collaboration. The President's 2014 budget request includes \$12 million for DOE to fund this effort.

Shale gas development has brought new options to American consumers, along with new environmental concerns. This is a period of great opportunity for the prudent development of our country's resources which could make a positive contribution to our economy, jobs, and balance of trade. But to get these benefits we must do this right. Through targeted research and development, DOE can work with our agency partners, industry, and other stakeholders to help ensure that we are meeting our shared goal of safe and responsible development of these resources.

The successful application of horizontal drilling and hydraulic fracturing technologies has enabled production to be extended to vast volumes of unconventional resources that were previously un-

economic to produce. To help ensure that development of our resources is done in a safe and responsible way, DOE is implementing research in areas that will include water quality and availability, air quality, induced seismicity, and mitigating the impacts of development.

The Department is carrying out research directed at quantifying and understanding the environmental and safety risks of shale gas and shale oil development, improving our understanding of emerging and developing shale plays, and increasing the efficiency of technologies for treating hydraulic fracture flowback water.

Our partnership with Altela to successfully treat hydraulic wastewater, which I detailed in my written statement, is a good example of the kind of projects we are pursuing. We are also focused on improving environmental performance by mitigating impacts related to well bore integrity and zonal isolation to protect the shallow groundwater resources and reducing water usage, air emissions, and resource degradation through improved unconventional resource stimulation that appropriately matches that technology to local geologic and hydrologic conditions.

This work is a critical component of DOE's portfolio to advance the environmentally sound development of unconventional natural gas and oil resources and will support ongoing programmatic efforts.

DOE has research experience and capabilities in drilling and production technologies, green technologies, complex systems, imaging, materials, earth science and engineering.

DOE capabilities in drilling and production technologies include experience and expertise in quantifying, evaluating and mitigating potential risks resulting from the production and development of shale oil and gas resources that includes multi-phase flow in wells and reservoirs, well control, casing, cementing, drilling fluids, and abandonment operations.

The Office of Fossil Energy is committed to developing the science and technology that will allow the Nation to use its abundant fossil energy resources in a way that meets its energy needs, including sustaining a robust economy and ensuring environmental responsibility. We believe that continued progress will help in addressing issues of energy and environmental security, and ensure the maximum benefit to the U.S. taxpayers.

This completes my prepared statement. I would be happy to answer any questions you may have. Thank you.

[The prepared statement of Mr. DeHoratiis follows:]

**Statement by Guido DeHoratiis
Deputy Assistant Secretary for Oil and Gas (Acting)
Office of Fossil Energy
U.S. Department of Energy**

**House Committee on Science, Space, and Technology
Subcommittees on Energy and Environment**

April 26, 2013

I want to thank the Chairs, Ranking Members and Members of the Subcommittees for inviting me to appear before you today to discuss the critical role that the Department of Energy's Office of Fossil Energy, in collaboration with the Department of the Interior (DOI) and the Environmental Protection Agency (EPA), is playing to improve the safety and environmental performance of developing our Nation's unconventional oil and natural gas (UOG) resources.

Federal coordination and collaboration is critical to successfully addressing the challenges associated with the development of unconventional oil and gas resources. To this end, the President signed an Executive Order on April 13, 2012, creating a new Interagency Working Group to Support Safe and Responsible Development of Unconventional Domestic Natural Gas Resources.

On the same day, DOE, EPA and DOI's U.S. Geological Survey signed a related memorandum of agreement initiating multi-agency collaboration on unconventional oil and gas research. The objective of this collaborative effort is to better identify and address the highest priority issues associated with the safe and prudent development of unconventional oil and gas resources, and to make effective use of research funds across the Federal government.

This collaboration will only address a subset of unconventional resources: shale gas, tight gas, shale oil, and tight oil, and a robust Federal research and development (R&D) plan is under development. Each of the three agencies has a unique set of core capabilities relevant to this effort. Ultimately, the goal of the interagency collaboration is to ensure that each agency is focused on those tasks that are most relevant to its skill sets, and that the agencies are effectively working together on tasks that require collaboration. The President's FY 2014 budget request includes a combined total of \$44.7 million to fund this effort.

Challenges and Opportunities

Shale gas development has brought new options to American consumers, along with new environmental concerns. This is a period of great opportunity for the prudent development of our country's oil and gas resources which could make a positive contribution to our economy,

jobs, and balance of trade. But to get these benefits we must do this right. Through targeted research and development, DOE can work with our agency partners, industry, and other stakeholders to help ensure that we are meeting our shared goal of safe and responsible development of our natural resources.

Natural Gas Technologies

DOE's Natural Gas research program develops technological solutions for the prudent and sustainable development of our unconventional domestic resources. These resources, which include natural gas and oil contained in shale or other low permeability geological formations, are increasingly important components of our Nation's energy portfolio.

The successful applications of horizontal drilling and hydraulic fracturing technologies have enabled production to be extended to vast volumes of unconventional natural gas and oil that was previously uneconomical to produce. To help ensure that development of our resources is done in a safe and responsible way, DOE is implementing research in areas that include water quality and availability, air quality, induced seismicity, and mitigating the impacts of development.

Current Status of Research

The Department is carrying out research directed at quantifying and understanding the environmental and safety risks of shale gas and shale oil development, improving our understanding of emerging and developing shale plays, and increasing the efficiency of technologies for treating hydraulic fracturing flowback water.

For example, DOE partnered with Altela, Inc., to test the AltelaRain® fracturing water treatment process at a well site in western Pennsylvania. Over a 9-month period, 77 percent of the produced hydraulic wastewater was successfully treated onsite, resulting in distilled water as the effluent. Following the DOE-sponsored demonstration project, four AltelaRain modules were sold and installed at a facility in Williamsport, Pennsylvania, to treat Marcellus shale wastewater. Building on the success of this application, Altela, Inc., and its partners are opening two new wastewater treatment facilities in western Pennsylvania. Each facility is able to process up to 12,000 barrels of waste water a day—about 500,000 gallons per facility. The purified water can then be reused for any number of purposes.

Our current program focus is on improving environmental performance by:

Mitigating impacts related to wellbore integrity and zonal isolation to protect shallow groundwater resources, and

Reducing water usage, air emissions, and resource degradation through improved unconventional resource stimulation that appropriately matches technology to local geologic and hydrologic conditions.

This work is a critical component of DOE's portfolio to advance the environmentally sound development of unconventional natural gas and oil resources and will support ongoing programmatic efforts.

Summary of DOE Capabilities

DOE has research experience and capabilities in drilling and production technologies, green technologies, complex systems, imaging, materials, earth science and engineering.

DOE capabilities in drilling and production technologies include experience and expertise in quantifying, evaluating and mitigating potential risks resulting from the production and development of the shale gas and oil resources, to include multi-phase flow in wells and reservoirs, well control, casing, cementing, drilling fluids, and abandonment operations. DOE has experience in evaluating seal-integrity and wellbore-integrity characteristics in the context of protection of groundwater.

DOE has experience and expertise in the development of a wide range of new technologies and processes, including innovations which reduce the environmental impact of exploration and production such as flowback water treatment processes and water filtration technologies.

DOE specializes in the development of complex engineered systems, high speed computing and predictive modeling, and has experience in quantifying and mitigating low-frequency, high-impact risks. This includes evaluating human factors which potentially contribute to failures.

DOE has developed and evaluated novel imaging technologies for areal magnetic surveys for the detection of unmarked abandoned wells, and for detecting and measuring fugitive methane emissions from exploration, production, and transportation facilities.

Conclusion

The Office of Fossil Energy is committed to developing the science and technology that will allow the Nation to use its abundant fossil energy resources in a way that meets its energy needs, including sustaining a robust economy and ensuring environmental responsibility. We believe that continued progress will help in addressing issues of energy and environmental security, and ensure the maximum benefit to U.S. taxpayers.

This completes my prepared statement. I would be happy to answer any questions you may have at this time.

Biographical Sketch of

GUIDO DEHORATIIS

**Acting Deputy Assistant Secretary for Oil and Natural Gas
Office of Fossil Energy**

Guido DeHoratiis is the Acting Deputy Assistant Secretary for Oil and Natural Gas in the Office of Fossil Energy at the U.S. Department of Energy. In this position, he is responsible for administering oil and gas programs including research and development, planning, and analysis.

His major responsibility is developing research programs focused on the reduction of environmental, safety, and technical concerns related to oil and gas supply, in collaboration with industry, states, and the academic community.

Prior experience includes working as Program Manager for Petroleum Operations for the Naval Petroleum and Oil Shale Reserves and as the Mid-Atlantic District Supervisor for the Minerals Management Service. Mr. DeHoratiis holds a B.S. in Petroleum and Natural Gas Engineering from the Pennsylvania State University.

Chairman LUMMIS. Thank you, and your testimony provided a great segue way to Dr. Russ about the geological issues.

Now, you are from the northeast region, so you have some experience with the Marcellus area, I assume.

Dr. RUSS. That is correct.

Chairman LUMMIS. We are looking forward to your testimony, Dr. Russ. You may begin.

**TESTIMONY OF DR. DAVID RUSS,
REGIONAL EXECUTIVE,
NORTHEAST AREA, U.S.
GEOLOGICAL SURVEY**

Dr. RUSS. Thank you. Thank you for the opportunity to appear today to review Federal hydraulic fracturing research activities, the progress in coordinating research called for in Executive Order 13605, and the associated interagency memorandum of agreement, and the Department of Interior's role and responsibilities in carrying out this work.

Interior supports the responsible development of natural gas as a clean energy source, so it is important to understand this resource as well as investigate and evaluate potential environmental impacts associated with shale gas development.

The interagency collaboration builds on the core capabilities of each agency to ensure that our efforts are complementary and non-duplicative. The USGS does not regulate, nor does it manage lands or other resources. The USGS conducts scientific research and assessments of geologically based energy resources, including unconventional resources such as shale gas and shale oil. USGS programs that monitor and investigate the Nation's surface water and groundwater resources are fundamental in determining water availability and quality, including the potential impacts of resource extraction on drinking water, healthy ecosystems, and the sustainability of living species. USGS core capabilities also include the assessment of land-use change, critical to understanding the impacts of energy development activities on ecosystems and the socio-economics of communities, and the investigations of earthquakes, including earthquakes.

To meet the challenge of safely and responsibly maximizing the contribution that unconventional oil and gas resources make to the total energy supply, DOE, EPA, and Interior are developing a collaborative research framework. The three agencies are building upon current work and identifying and prioritizing new research and development activities that support sound management and policy decisions by federal, state, tribal, and local entities. The goal is to produce decision-ready information to help ensure the prudent development of energy resources, and the protection of human health and the environment. Our effort encompasses a number of research topics, including the U.S. unconventional oil and gas resource assessment, characterization, and management; water quality; water availability; air quality and greenhouse gas emissions; effects on people and their communities; ecological effects; and induced seismicity.

Interior, through the USGS, has ongoing and planned activities covering a range of research topics. Specific activities in fiscal years 2013 and 2014 are described in my written statement, but in general, USGS envisions a continuation of prior work that builds on core USGS competencies. For example, the USGS has historically had responsibility for assessing the undiscovered, technically recoverable hydrocarbon resources of the Nation and will continue this function for unconventional resources. The USGS will identify and model water-quality changes associated with the life cycle of unconventional oil and gas production, and will determine the impact of well injection and produced waters on groundwater quality. The USGS will support streamgage baseline monitoring in states where production is ongoing or planned, and will develop predictive tools and statistical models for estimating the amount of water needed for drilling and production operations. The USGS will also conduct wastewater toxicity testing and vulnerability assessments to identify and prioritize regions, aquatic communities, and wildlife habitats that have the greatest potential for impact from unconventional oil and gas activities. Decades of research have demonstrated that the deep injection of large volumes of fluids underground can induce earthquakes. The USGS will calibrate models against field and lab data to support the development of best management practices for minimizing induced seismicity. The USGS will analyze seismic data to update the national probabilistic seismic risk maps in ways that account for induced earthquakes.

In conclusion, the research activities required to address questions related to hydraulic fracturing draw on the core capabilities and competencies of USGS scientists in geology, seismology, energy resource development, biology, and hydrology. I have briefly described many of our current and proposed hydraulic fracturing-related efforts in my written statement, but a number of other USGS programs also contribute to an improved understanding of these issues.

Thank you again for the opportunity to discuss the activities of the USGS and the interagency effort to understand this important natural resource, and the potential impacts of its development. We appreciate your interest in and support for our science, and I would be happy to answer any questions that Members may have.

[The prepared statement of Dr. Russ follows:]

Statement of David P. Russ
Regional Director, Northeast Region, U.S. Geological Survey
Department of the Interior
Before the House Science, Space, and Technology Committee
Energy Subcommittee and Environment Subcommittee
To Review Federal Hydraulic Fracturing Research Activities
April 26, 2013

Thank you, Chairwoman Lummis and Chairman Stewart and members of the Subcommittees for the opportunity to appear today to review with you Federal hydraulic fracturing research activities, the progress in coordinating research called for in Executive Order 13605 and the associated interagency Memorandum of Agreement (MOA), and the Department of the Interior's (Interior) role and responsibilities in carrying out this work. I am David P. Russ, the U.S. Geological Survey (USGS) Regional Director for the Northeast Region. I manage USGS science centers and activities in the northeastern United States and coordinate USGS shale gas studies in the Northeast. I represented Interior in meetings of the Steering Committee formed through the MOA. Interior supports the responsible development of natural gas as a clean energy source, so it is important to understand this resource as well as investigate and evaluate potential environmental impacts associated with shale gas development.

In 2012, President Obama issued an Executive Order (EO), "Supporting Safe and Responsible Development of Unconventional Domestic Natural Gas Resources," as a component of his "all of the above" energy strategy. The goal of the EO is to ensure coordination among Federal agencies regarding natural gas development activities. In support of this effort, Interior, the Department of Energy (DOE), and the U.S. Environmental Protection Agency (EPA) signed an MOA to develop a research program aimed at improving our understanding of these resources as well as the potential environmental, human health, and safety impacts of hydraulic fracturing and associated operational activities. Through this effort, the three agencies are building upon current work and collaboratively identifying and prioritizing new research and development activities that support sound management and policy decisions by Federal, State, tribal, and local entities. The goal is to produce decision-ready information to help ensure the prudent development of energy resources and the protection of human health and the environment. The three agencies are working together and engaging other organizations in this effort.

The interagency collaboration builds on the core capabilities of each agency to ensure that our efforts are complementary and non-duplicative. The USGS does not regulate, nor does it manage lands or other resources. USGS core capabilities serve the Nation by providing reliable, impartial scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; study and assess water, biological, energy, and mineral resources; and enhance and protect our quality of life. The USGS conducts scientific research and assessments of geologically based energy resources, including unconventional resources such as shale gas and shale oil. USGS programs that monitor and investigate the Nation's surface water and groundwater resources are fundamental in determining water availability and quality, including the potential impacts of resource extraction on drinking water, healthy ecosystems, and the sustainability of living species. USGS core capabilities also include the assessment of land-use change, critical to understanding the impacts of energy development activities on ecosystems and the socio-economics of communities, and the investigations of earthquakes, including earthquakes induced by

the hydraulic fracturing process or the deep subsurface disposal of the wastewater that is produced during the production of oil and gas.

Federal Multiagency Coordination on Unconventional Oil and Gas Research

The Federal government has long played a role in conducting research on the formation, accumulation, and alteration of oil and gas resources and on the impact of energy resource occurrence and production on environmental and human health. These impacts can vary locally and regionally and depend on differences in the geological characteristics of the rocks, the overlying topography and drainages, and the effects of production-related activities. These characteristics along with economic factors largely govern the locations where oil and gas production will occur and of the possibilities for degradation of the environment. The emergence of technologies such as horizontal drilling, advanced drill bits and geophysical logging, and hydraulic fracturing have enabled a new class of unconventional oil and gas (UOG) resources to substantially add to our Nation's energy resources and to reduce our reliance on imported hydrocarbon resources. To meet the challenge of safely and responsibly maximizing the contribution these resources make to the total energy supply, DOE, EPA, and Interior signed a multiagency MOA to develop a collaborative research framework. That framework is currently under development.

As part of our interagency research collaboration, we will identify the most critical research needs and opportunities to be included in the framework in a manner consistent with the roles, responsibilities, and available budgets of each of the agencies. Our effort encompasses a number of research topics, including:

- U.S. UOG resources: assessment, characterization, and management
- Water Quality
- Water Availability
- Air Quality and Greenhouse Gas Emissions
- Effects on People and Their Communities
- Ecological Effects
- Induced Seismicity

Interior's Role and Responsibilities

Interior, through the USGS, has ongoing and planned activities covering a range of research topics. Specific activities in FY 13 and FY 14 are described in more detail below, but in general, USGS envisions a continuation of prior work that builds on core USGS competencies. For example, the USGS has historically had responsibility for assessing the undiscovered, technically recoverable hydrocarbon resources of the Nation and will continue this function for unconventional resources. Using geologic mapping and geochemical techniques, the USGS will also evaluate the geologic parameters of oil and gas basins under current or anticipated near-term development. Potential impacts to water quality from hydraulic fracturing related activities are one of the primary concerns of communities and public-health officials. The USGS will identify and model water-quality changes associated with the life cycle of UOG production. The USGS will determine the impact of well injection and produced waters on groundwater quality through monitoring and research. This will be accomplished, in part, through baseline surface-water and groundwater quality sampling and modeling. For water availability research, the USGS will support streamgage baseline monitoring in States where production is ongoing or planned. The USGS

will also provide water-resource information on water withdrawals, will develop water budgets to understand how much water is required to produce UOG deposits, and will develop predictive tools and statistical models for estimating the amount of water needed for drilling and production operations. To better understand the potential effects of UOG activities on people and their communities, the USGS will develop decision tools to evaluate and predict human health impacts. There is a diverse set of stressors that may ultimately degrade ecosystems where UOG operations are performed. The USGS will review data and monitoring protocols to evaluate potential impacts of UOG activities on habitats and species. The USGS will also conduct wastewater toxicity testing and vulnerability assessments to identify and prioritize regions, aquatic communities, and wildlife habitats that have the greatest potential for impact from UOG activities. Beginning in the 1960s, research has demonstrated that the deep injection of large volumes of fluids underground can induce earthquakes. The USGS will calibrate physics-based models against field and lab data to support the development of best management practices for minimizing induced seismicity. The USGS will analyze seismic data to update the national probabilistic seismic risk maps in ways that account for induced earthquakes.

FY 2013 Activities

The impacts of the final FY 2013 Operating Plan consistent with the current Continuing Resolution and sequestration reductions are still being assessed. As a result, USGS may not be able to fully implement the plans for FY 2013 described below.

Energy resource studies include resource characterization and assessments of undiscovered, technically recoverable UOG resources for high-priority shale and tight oil and gas accumulations. An assessment was completed for the Utica Shale in the Appalachians and will be completed for the Bakken Formation in North Dakota and Montana before the end of 2013. Work will continue on thermal maturity studies for selected rock formations in the Appalachians and Great Lakes basin that demonstrate the potential for some rock formations to host shale gas deposits. The USGS is also developing a methodology to estimate the amount of water needed for and produced by production of these UOG resources and expects to work with EPA on new laboratory methods for analysis of produced waters.

The USGS plans studies on the potential effects of UOG development on habitats and aquatic species in streams in the upper Chesapeake watershed and upper Delaware River in northern Pennsylvania, including sensitive freshwater mussels.

Seismicity is being analyzed in regions where deep fluid injection is prevalent to document changes in seismicity associated with hydraulic fracturing-related activities. Studies are also underway to identify space and time correlations between fluid injection and induced seismicity to better understand the dynamic linkages between fluid pressure and volume and stress changes in the earth and to identify why some sites are more prone than others to induced earthquakes.

The USGS is conducting research and assessment activities to characterize the surface water and groundwater resources of the Williston Basin (containing the Bakken Formation) and Powder River Basin. The purpose of the Williston and Powder River Basins Groundwater Availability Study is to quantify current groundwater resources in this aquifer system, evaluate how these resources have changed over time, and provide tools to better understand system response to future human demands and

environmental stress. The USGS is also participating on American Society of Testing Materials (ASTM) panels to guide development of best practices for groundwater quality and quantity studies.

Laboratory studies are being conducted to understand the release of soluble chemicals associated with UOG production in order to improve well sampling methods. Field and laboratory studies are underway to identify natural and isotopic and geochemical tracers that may help indicate the origin of waters, gases, and solutes in groundwater.

2014 USGS Hydraulic Fracturing Budget Request

The President's Budget for 2014 for UOG hydraulic fracturing research is \$18,613,000 and 58 FTE, a program increase of + \$13,035,000 and +32 FTE above the 2012 enacted level. Specific budget numbers are in the table at the end of this statement.

The 2014 request would expand the collaborative, interagency research effort with DOE and EPA to address the highest priority challenges and to answer the critical research questions posed in the multiagency research plan. The USGS would focus on research that builds upon and enhances ongoing studies funded through base appropriations, as well as conduct new and innovative investigations, assessments, technique development, modeling, and monitoring to address urgent research questions and to provide decision-ready products to other Federal agencies, States, and industry.

With the funding requested in 2014, the USGS would conduct research that assesses potential ecological impacts from UOG production. This research would include how changes in land use, water quality, and water quantity from hydraulic fracturing operations affect biological communities and specific species of management concern. The USGS would conduct studies to identify those practices that minimize risks or mitigate impacts to ecological resources, as well as identify socioeconomic impacts from UOG production on nearby communities. These studies would examine how development would affect the production of critical ecosystem services and would address the potential for estimating the value of these services. In addition, an ecosystem services analytical framework would be developed for evaluating the environmental and social consequences of developing unconventional oil and gas resources.

Energy resource assessments provide critical evaluations of where future energy development might take place, or equally important, where it is unlikely to take place. In 2014, a portion of the requested funding would allow the USGS to begin an assessment of the size and location of UOG resources in a new basin, similar to the assessments underway in the Barnett Shale, Permian Basin, and Bakken Formation. These and other assessments would form a foundation for planning where and what kind of additional studies are needed, such as those involving produced waters and potential environmental impacts. Work would also focus on the potential contamination of drinking water and consumptive loss of water resources.

With proposed funding in 2014, the USGS would analyze seismic and geologic data and subsurface stress data in areas near induced earthquakes to determine those factors that affect seismicity from the subsurface disposal of produced waters. This information could be used to guide changes to disposal operations, such as adding new wells or changing injection parameters. Cataloging the presence or absence of earthquakes induced by injection activities would yield critical information on the regions and conditions that are favorable for induced seismicity. This would be combined with probabilistic seismic

hazard analysis to assess the contribution from induced seismicity to the hazard and risk of damaging earthquakes.

In 2014, the USGS would use a portion of the requested funding to expand baseline surface water and groundwater quality monitoring and to support the continued development of analytical methods for the detection of contaminants associated with produced and flowback waters in the environment, including an enhancement of methods for sampling and measuring methane. This would include enhanced methods for monitoring and characterization of "stray gas." The USGS would support research on the development of geochemical methods and groundwater flow models used to determine if hydraulic fracturing fluids and other drilling materials are contaminating water supplies. These tools and monitoring data would enable assessments and prioritization of key human and ecological exposure pathways associated with natural or anthropogenic contaminants created and mobilized throughout the lifecycle of hydraulic fracturing activities.

Drilling for and development of resources require large quantities of water and can produce large volumes of fluids during flowback and production. In 2014, funds would be used to (1) assess the water needs associated with UOG development in selected pilot areas, (2) begin evaluation of the volumes and spatial distributions of non-potable (brackish) water resources, and (3) characterize flowback fluids and produced waters from hydraulically fractured wells.

With the proposed funds in 2014, the USGS will continue to compile water-quality data collected by other agencies from across the Nation, potentially leading to a better understanding of water quality trends in relation to UOG development.

With proposed funding in 2014, geologic mapping conducted by the USGS in cooperation with the State Geological Surveys would support research on the geological parameters of UOG basins and would provide information to address fundamental questions pertaining to the likelihood of specific rock formations containing economically viable shale gas and oil resources. In particular, three-dimensional geologic models and a better understanding of rock structures and stratigraphy would be critical to characterizing the hydro-geologic framework of regions producing UOG. Geologic maps would provide information on potential flow paths for migrating hydraulic fracturing fluids and methane, important for assessing the risk for contamination of near-surface aquifers as well as a more complete understanding for the potential for induced seismicity.

Conclusion

The research activities required to address questions related to hydraulic fracturing draw on the core capabilities of USGS scientists in geology, seismology, energy resource assessment, and biologic and hydrologic research and monitoring. I have briefly described many of our current and proposed hydraulic fracturing-related efforts in this statement, but a number of other USGS programs also contribute to an improved understanding of these issues.

Thank you again for the opportunity to discuss the activities of the USGS and the interagency effort to understand this important natural resource and the potential impacts of its development. We appreciate your interest in and support for our science.

Hydraulic Fracturing							
		2013 Full Yr. CR (PL 112-175)	2012 Enacted	Changes	Program Changes (+/-)	2014 Budget Request	Change from 2012 Enacted (+/-)
Fisheries Program		108	108	0	2,200	2,308	2,200
	FTE	1	1	0	10	11	10
Energy Resources		5,850	4,600	1,250	0	5,850	1,250
	FTE	29	23	6	0	29	6
Contaminant Biology		0	0	0	1,400	1,400	1,400
	FTE	0	0	0	5	5	5
Earthquake Hazards		800	300	500	1,200	2,000	1,700
	FTE	2	1	1	2	4	3
Groundwater Resources		520	520	0	2,100	2,620	2,100
	FTE	1	1	0	6	7	6
Hydrologic Research & Development		1,300	50	1,250	950	2,250	2,200
	FTE	1	0	1	1	2	2
Science Synthesis, Analysis and Research Program		0	0	0	185	185	185
	FTE	0	0	0	0	0	0
National Cooperative Geologic Mapping Program		0	0	0	2,000	2,000	2,000
	FTE	0	0	0	0	0	0
Total Requirements (\$000)		8,578	5,578	3,000	10,035	18,613	13,035
	Total FTE	34	26	8	24	58	32

* 2012 FTE amounts reflect actual usage, not 2012 enacted formulation estimates.

Note: References to the 2013 Full Yr. CR signify annualized amounts appropriated in P.L. 112-175, the Continuing Appropriations Act. These amounts are the 2012 enacted numbers annualized through the end of FY 2013 with a 0.612 percent across-the-board increase for discretionary programs. Exceptions to this include Wildland Fire Management, which received an anomaly in the 2013 CR to fund annual operations at \$726.5 million. The 2013 Full Yr. CR does not incorporate reductions associated with the Presidential sequestration order issued in accordance with section 251A of the Balanced Budget and Emergency Deficit Control Act, as amended (BBEDCA), 2 U.S.C. 109a. This column is provided for reference only.

The 2013 Column in this table refers to levels consistent with the FY 2013 USGS Operating Plan budget developed under the initial 2013 Continuing Resolution (P.L. 112-175); this figure does not reflect the most recent Continuing Resolution (P.L. 113-6) that became law on March 26 or the results of sequestration reductions. The hydraulic fracturing funds are a crosscut of activities, as the research, assessment, and monitoring activities serve other purposes as well. The impacts of the final Operating Plan consistent with the current Continuing Resolution and sequestration reductions are still being assessed.

DAVID P. RUSS - BIO

Dr. David P. Russ is the Regional Director for the Northeast in the U.S. Geological Survey (USGS). He is located at the USGS National Center headquarters in Reston, Virginia. A geologist by training, he leads 11 USGS science centers in the Mid-Atlantic and New England region. These Centers conduct a broad range of geologic, biologic, and hydrologic investigations and studies.

From 1970-1972, Dr. Russ served in the U.S. Army Corps of Engineers, where he was assigned to the Waterways Experiment Station in Vicksburg, Mississippi. Dr. Russ began his career with the USGS in 1975 conducting research and coordinating USGS earthquake projects in the New Madrid Seismic Zone in the Mississippi Valley. Much of his efforts centered on detecting and characterizing patterns of surface and subsurface deformation associated with the devastating 1811-12 earthquakes and determining recurrence rates and hazards of earthquakes in the Central United States. He has also conducted earthquake research in China and Europe. In 1982, Dr. Russ became the Deputy Chief of the USGS Office of Earthquakes, Volcanoes, and Engineering in Reston, Virginia, where he coordinated Earthquake Programs and managed international earthquake projects. In 1987 Dr. Russ was selected as the Assistant Chief Geologist for Program, a position in the Senior Executive Service, where he developed new programs in climate history, coastal geology, deep continental studies, and scientific drilling for the Geologic Division of the USGS. Dr. Russ subsequently served as the Associate Chief Geologist and the Associate Chief Hydrologist of the USGS.

In his current position as Regional Director for the Northeast, Dr. Russ serves as the executive leader of the USGS Chesapeake Bay program and he leads USGS participation on the Northeast Regional Ocean Council and the Mid-Atlantic Region Council for the Ocean. He has served as the DOI representative to the steering committee to develop a Federal multiagency research plan for unconventional oil and gas resources related to hydraulic fracturing and he is overseeing the development of an interagency plan to study the potential effects of Appalachian shale gas production on the environment. He is a member of the Appalachian Landscape Conservation Cooperative steering committee, chairs the Stakeholder Advisory Committee of the Northeast Climate Science Center, and coordinates USGS participation in the Urban Waters Federal partnership.

Dr. Russ received B.S. (1967) and PhD (1975) degrees from Penn State and an M.S. degree (1969) from West Virginia University, with specialties in geomorphology and structural geology. He is the recipient of the Department of the Interior Meritorious Service Award. In 2006, Dr. Russ received the Presidential Rank Award as a meritorious executive in the Senior Executive Service for sustained superior accomplishment in management of programs of the U.S. government and for noteworthy achievement of quality and efficiency in the public service.

Chairman LUMMIS. Thank you, Dr. Russ.

Now we turn to Dr. Ikeda.

Dr. IKEDA. Ikeda.

Chairman LUMMIS. I thought I had yours. I am sorry, Ikeda. Correct?

Dr. IKEDA. Correct.

Chairman LUMMIS. Thank you. You are recognized, Dr. Ikeda.

**TESTIMONY OF DR. ROBIN IKEDA,
ACTING DIRECTOR,
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY,
DEPARTMENT OF HEALTH
AND HUMAN SERVICES**

Dr. IKEDA. Good morning, Chairwoman Lummis, Chairman Stewart, and Members of the Subcommittees. Thank you for the opportunity to present this testimony.

I am pleased to represent the Department of Health and Human Services to provide you with an update of our work related to hydraulic fracturing. Although our work related to hydraulic fracturing at HHS is limited in terms of the amount of work we do, we provide technical assistance and scientific expertise to our Federal colleagues and others. President Obama has made clear his commitment to the safe and responsible development of our natural gas resources as part of the all-of-the-above energy plan. I will briefly describe the missions for the three HHS components that conduct work related to hydraulic fracturing.

CDC, ATSDR focuses on protecting people in communities from environmental exposures to harmful substances. The National Institute for Occupational Safety and Health, NIOSH, which is also part of CDC, is responsible for preventing work-related injury, illness, and death. As part of NIH, the National Institute of Environmental Health Sciences, NIEHS, conducts basic applied and clinical research on the health effects of environmental exposures. None of these three agencies have regulatory authority.

Our work related to hydraulic fracturing is in primarily four areas. First, we coordinate with federal, state, and local partners. We define research gaps and other information needs. We evaluate site-specific health conditions and potential exposures in communities, and we assess potential workplace exposures. If we identify harmful exposures in the community or the workplace, we recommend actions to protect communities and/or workers.

Our work related to hydraulic fracturing has been in collaboration with federal, state, and local partners. HHS has provided technical support to the multi-agency work group on research related to unconventional oil and gas development. Although HHS is not a member of the steering committee, we have provided technical and scientific input to this initiative at the Committee's request. In addition, HHS has provided input on design of EPA's study looking at the potential impacts of hydraulic fracturing on drinking water resources.

HHS is also working to better define public health research gaps and other information needs related to hydraulic fracturing. In 2012, we participated in three meetings to assess the public health research needs in this area. Other participants at these meetings included experts from industry, academia, and the government. Along similar lines, NIEHS provided a small grant to the University of Rochester for a one-year project to help understand the health and hydraulic fracturing related information needs among various health professionals, government officials, and communities in New York, North Carolina, and Ohio. Information from this project will be used to develop recommendations about how to respond to the public's need for information about health and hydraulic fracturing, and to guide future research.

ATSDR's site specific activities focus on whether health hazards exist from exposures to harmful substances in air, water, and soil. Typically, this work has been done at the request of EPA and/or state agencies. If public health risks are identified, ATSDR makes recommendations that individuals, organizations, or government agencies can take to protect health. ATSDR also follows up with local residents to make sure they understand the findings.

In the last two fiscal years, ATSDR has completed more than 300 of these site specific consultations, but only a small proportion of these consultations, eight sites in total, have been related to health concerns in areas with ongoing hydraulic fracturing activities. Our work at these eight sites has generally fallen into three categories: sites where there are concerns about the water quality, those where air quality is an issue, and then those where there are potentially explosive hazards, such as methane.

NIOSH works closely with industry colleagues to assess potential workplace exposures and if indicated, recommends actions like safe worker practices, use of protective equipment, or engineering controls to protect workers. To address an existing lack of information about dust and chemical exposures associated with hydraulic fracturing, NIOSH initiated an effort to better understand occupational exposures among oil and gas extraction workers. With respect to hydraulic fracturing, exposure to airborne silica during the fracturing process has been the primary focus of NIOSH work to date. Additional NIOSH activities related to hydraulic fracturing include developing a research agenda and evaluating or examining other potential worker safety hazards, such as falls, chemical exposures, or fires and explosions.

In conclusion, HHS, working with our Federal and state partners, communities, and industry, supports the President's commitment to the safe and responsible development of our natural gas resources as part of the all-of-the-above energy plan.

Thank you for the opportunity to testify today. I am happy to answer your questions.

[The prepared statement of Dr. Ikeda follows:]



**Testimony before the
Subcommittees on Energy and Environment
Committee on Science, Space and
Technology
U.S. House of Representatives**

**Review of Federal Hydraulic Fracturing
Research Activities**

Robin M. Ikeda, M.D., M.P.H.

RADM, USPHS

**Deputy Director, Office of Noncommunicable Diseases,
Injury and Environmental Health, and
Acting Director, National Center for Environmental Health,
and Agency for Toxic Substances and Disease Registry
Centers for Disease Control and Prevention
U.S. Department of Health and Human Services**

**For Release upon Delivery
Expected at 9:30 a.m.
April 26, 2013**

Good morning Chairwoman Lummis, Chairman Stewart, and Members of the Subcommittees. Thank you for the opportunity to present this testimony. I am Dr. Robin Ikeda, Deputy Director of Noncommunicable Diseases, Injury and Environmental Health at the Centers for Disease Control and Prevention (CDC). Currently, I am also serving as the Acting Director of CDC's National Center for Environmental Health (NCEH) and the Agency for Toxic Substances and Disease Registry (ATSDR).

I am pleased to represent the Department of Health and Human Services (HHS) to provide you an update on the work being done across the Department related to hydraulic fracturing. HHS serves a supporting role in providing research and technical assistance on environmental and occupational safety and health risks. While programmatic work throughout the Department related to hydraulic fracturing activities is limited, staff resources and technical expertise are provided to support scientific discourse and collaboration on a range of potential health concerns.

Background

President Obama has made clear his commitment to safe and responsible development of our natural gas resources as part of an all-of-the-above energy plan. Our scientific experts at CDC, ATSDR, and the National Institutes of Health (NIH) are engaged in activities related to hydraulic fracturing, and I would like to start by briefly describing the missions of each HHS component. CDC/NCEH and ATSDR focus on the ways the environment influences human health. This work includes laboratory research, epidemiologic studies, community public health assessments, and protecting communities from exposures related to Superfund hazardous waste sites and other environmental hazards. Our top priority is protecting people from exposures to hazardous substances using the best available science. CDC's National Institute for Occupational Safety and Health (NIOSH) is responsible for generating new knowledge in the field of occupational safety and health and transferring that knowledge into practice to prevent work-related injury, illness, and death. To accomplish this mission, NIOSH conducts scientific research, develops guidance and authoritative

recommendations, and responds to requests for workplace health hazard evaluations. NIOSH workplace studies and investigations use a tripartite approach to keep industry, labor, and government equally informed and engaged. NIH's National Institute of Environmental Health Sciences (NIEHS) conducts basic, applied, and clinical research on the health effects of environmental exposures.

My testimony will highlight HHS activities related to hydraulic fracturing. Our work in this area can be grouped into four main categories:

1. Coordinating with Federal, State, and Local Partners;
2. Assessing the State of the Science and Soliciting Expert and Stakeholder Input;
3. Evaluating Site-Specific Health Conditions and Potential Exposures in Communities; and
4. Assessing Potential Workplace Exposures and Recommending Practical Solutions to Protect Workers.

Coordinating with Federal, State, and Local Partners

The majority of our work related to hydraulic fracturing has been in collaboration with federal and state partners. For example, last year, following the President's Executive Order on safe and responsible development of unconventional domestic natural gas resources, an interagency workgroup led by a steering committee comprised of the U.S. Environmental Protection Agency (EPA), the Department of Energy (DOE), and the Department of the Interior (DOI) is working to coordinate research across those agencies related to unconventional oil and gas development. Although HHS is not a member of the steering committee, at the request of the committee, several components of HHS – NCEH/ATSDR, NIOSH, and NIEHS – have provided technical support for this initiative.

HHS also provides support to EPA's Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources. For example, ATSDR reviewed the design of

EPA's study. In addition, over the last few months at EPA's request, ATSDR provided health information to several families whose wells were sampled as part of the study.

Assessing the State of the Science and Soliciting Expert and Stakeholder Input

CDC, ATSDR, and NIH/NIEHS are identifying ways to better understand health concerns potentially related to natural gas extraction activities. In April 2012, CDC/ATSDR and NIH/NIEHS participated in a meeting convened by the National Academy of Sciences' Institute of Medicine to better define environmental and public health research needs and responses in the area of hydraulic fracturing. In May 2012, CDC and ATSDR co-hosted a meeting with George Washington University to bring together experts from industry, academia, and government to discuss scientific gaps in understanding of health concerns potentially associated with natural gas extraction.

In October 2012, NIH/NIEHS partnered with the North Carolina Environmental Health Collaborative in a summit to bring together diverse stakeholders interested in exploring the public health implications and prevention of potential adverse public health impacts associated with hydraulic fracturing.

While NIEHS has no programs or activities specifically focusing on unconventional oil and gas research, NIEHS provided \$129,000 of funding in FY 2013 to the University of Rochester, in partnership with the University of North Carolina and the University of Cincinnati, for a one-year project to help understand the information needs among various health professionals, government officials, and communities related to health and hydraulic fracturing in New York, North Carolina, and Ohio.

Evaluating Site-Specific Health Conditions and Potential Exposures in Communities

Broadly, ATSDR's site-specific activities focus on identifying whether health hazards exist from exposures to hazardous substances in air, water, soil, and biota. Typically,

this work has been done at the request of EPA and/or state agencies and often relates to designated Superfund sites. If public health risks are identified, then ATSDR makes recommendations that individuals, organizations, or government agencies can take to protect public health. ATSDR also follows up with local residents to make sure they understand the findings and steps they can take to protect their health. In the last two fiscal years, ATSDR completed more than 300 health consultations, of which approximately one percent examined health concerns potentially related to natural gas development activities.

I will briefly summarize the site-specific assessments in areas with ongoing natural gas development. It is important to note that none of these sites are currently part of EPA's Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources.

The first five assessments were based on environmental sampling collected by EPA or state agencies:

- Dimock, Pennsylvania - At the request of EPA, in 2011, ATSDR reviewed data and supported an EPA "Do Not Use Until Further Notice" action for private wells because of levels of bacteria, methane, and other harmful substances. ATSDR also recommended additional water sampling. Currently, ATSDR is reviewing EPA's 2012 private well sampling from the area to assess the potability of the drinking water.
- LeRoy, Pennsylvania – At EPA's request, in 2011, ATSDR evaluated data collected from seven private drinking water wells following a well-head blow out at a nearby gas well. Based on these data, ATSDR found that levels of salts and other substances in one well and levels of arsenic in another well could pose a health hazard. ATSDR did not attempt to conclusively attribute the presence of chemicals detected in the private wells at this site to a definitive source. While ATSDR can recommend additional sampling to better characterize exposures or protective health actions, ATSDR recognizes the expertise and authority of EPA

and state environmental agencies to determine both the preferred sampling protocols and the sources of contamination. Water treatment systems have since been installed in the homes served by these wells.

- Pavillion, Wyoming – At the request of EPA, in 2011, ATSDR reviewed drinking well water data and confirmed a potential public health hazard due to high concentrations of organic and inorganic chemicals. ATSDR will review additional EPA sampling data and will continue to support EPA's community education and engagement activities.
- Medina, Ohio - At the request of EPA, in 2011, ATSDR reviewed EPA sampling data and identified a public health hazard due to levels of methane capable of causing an explosion in private drinking water wells. While the source of the methane was unknown, ATSDR recommended that a leaking abandoned natural gas well nearby be sealed because it represented an explosive hazard. ATSDR also recommended that residents vent their water well heads and enclosed spaces where water is used in the home and that additional air and water sampling be conducted.
- Garfield County, Colorado - In 2008 and 2010, at the request of the Garfield County Public Health Department, ATSDR and the State of Colorado examined volatile organic compounds (VOCs) and other contaminants in ambient air. Insufficient information was available to determine if these exposures posed a health risk because toxicity reference values do not exist for more than 60 of the ambient air contaminants measured.

While ATSDR has relied on existing data to conduct the site activities mentioned above, ATSDR has measured contaminants at two sites with limited available data:

- Posey County, Indiana – At the request of Indiana's Department of Environmental Quality, ATSDR has been working with the Indiana Department of

Environmental Management (IDEM) and USGS to determine whether exposures from potentially contaminated drinking water wells pose a health concern.

- Washington County, Pennsylvania - ATSDR, EPA, and the State of Pennsylvania are collaborating on an air exposure investigation to determine if air exposures around a natural gas compressor station pose a health concern.

As requested by EPA, state agencies, and individual petitioners, ATSDR will continue to address site-specific requests to ensure that community members and partners have objective information that contributes to safe water and air.

Assessing Potential Workplace Exposures and Recommending Practical Solutions to Protect Workers

NIOSH currently supports a six-year effort (2010-2016) to examine the oil and gas industry, establish a comprehensive research agenda, and evaluate worker exposures to chemicals during hydraulic fracturing. In FY 2013, NIOSH will provide \$440,000 in support of these activities.

Occupational safety hazards in the oil and gas extraction industry are well known; however, there are very few data regarding occupational health hazards during hydraulic fracturing operations. In 2008, NIOSH initiated the "Field Effort to Assess Chemical Exposures in Oil and Gas Extraction Workers" program to investigate potential workplace health hazards in this rapidly expanding industry and address the lack of information on occupational exposures associated with hydraulic fracturing.

Initial hazard assessments identified exposure to crystalline silica during hydraulic fracturing as the most significant known health hazard to workers. Silica, in combination with water and chemicals, is used as a means to hold open the fissures created by hydraulic fracturing. Millions of pounds of silica are used at each well. Through formal partnerships with several hydraulic fracturing companies, worker exposure assessments

for silica have been conducted at 11 different sites in five different states (Colorado, Texas, North Dakota, Arkansas, and Pennsylvania). At each of these sites, worker exposures to respirable crystalline silica consistently exceeded the NIOSH Recommended Exposure Limit (0.05 mg/m³) and the calculated OSHA Permissible Exposure Limit (0.98 mg/m³ for samples that are 100 percent silica), in some cases by more than a factor of ten. Inhalation of fine dusts of respirable crystalline silica can cause silicosis, an incurable but preventable lung disease, as well as lung cancer. Silicosis typically develops after long periods of exposure and progresses gradually; however, rapidly fatal cases of acute silicosis resulting from very intense exposures over a short time period are well documented among sandblasters, miners, and other occupational groups.

When the silica hazard was identified, NIOSH widely communicated its findings and recommendations to industry groups, trade associations, and other federal agencies to emphasize the need to take action to control this hazard. In June 2012, NIOSH and the Occupational Safety and Health Administration (OSHA) released a joint Hazard Alert, which discussed the health hazards associated with occupational exposure to airborne silica from hydraulic fracturing. The Alert included recommendations for reducing workers' exposure levels to silica.

In an effort to limit the exposure of workers to silica, NIOSH developed and successfully tested a control technology that reduces the amount of silica dust released from sand moving machines during hydraulic fracturing operations. This technology is currently patent pending and NIOSH has received applications to license and commercialize this new technology.

NIOSH researchers will continue to partner with industry to conduct field-based exposure assessment studies to identify, characterize, and, if needed, recommend control measures. These assessments will involve evaluating exposure to potential contaminants that include benzene, other volatile organic compounds, lead, naturally occurring radioactive material, and diesel particulate matter. Other areas of research by

NIOSH concerning the Oil and Gas Extraction Industry include injuries and fatalities from falls and fires and explosions during drilling and well servicing operations and motor vehicle safety. A common thread through all of this research is collaboration with industry partners and a focus on producing practical outputs to help protect workers, including training materials and informational products.

Conclusion

HHS maintains an unwavering commitment to ensuring the health and safety of the American people. We believe that by working with our federal and state partners, communities, and industry, we can continue to support a healthy population and a healthy environment.

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

Robin M. Ikeda, MD, MPH
Deputy Director, Office of Noncommunicable Diseases, Injury and Environmental Health
Centers for Disease Control and Prevention

Robin M. Ikeda, MD, MPH, is the Deputy Director Noncommunicable Diseases, Injury and Environmental Health at the Centers for Disease Control and Prevention (CDC). In this position, she provides strategic guidance and oversight to CDC's four noncommunicable disease centers – the National Center for Birth Defects and Developmental Disability, the National Center for Chronic Disease Prevention and Health Promotion, the National Center for Environmental Health/Agency for Toxic Substances and Disease Registry, and the National Center for Injury Prevention and Control. These four Centers have a combined budget of more than \$1.5 billion and more than 3,000 employees.

Dr. Ikeda previously served as Acting Director for the National Center for Injury Prevention and Control (NCIPC), and has held a variety of other positions at CDC, including Associate Director for Science at NCIPC, as well as Associate Director for Science within the Epidemiology Program Office and the Office of Workforce and Career Development. She began her CDC career as an Epidemic Intelligence Service Officer assigned to the Bureau of Communicable Disease Control at the New York State Department of Health.

Dr. Ikeda holds a B.A. from Stanford University, a M.D. from Cornell University Medical College, and a M.P.H. (Epidemiology) from the Emory University Rollins School of Public Health. She is board-certified in Internal Medicine holds the rank of Rear Admiral in the United States Public Health Service. Dr. Ikeda resides in Atlanta with her husband and their two daughters.

Chairman LUMMIS. I thank the witnesses for their testimony, and the Chair now recognizes herself for the first questions.

I want to start with each of you. Having been an ex-pat member of the Interior and Environment Appropriations Subcommittee, a lot of them are going to be related towards spending.

In Fiscal Year 2013, the EPA, DOE, and USGS were given a combined \$45 million for fracking related research at your agencies. Can each of you from those agencies tell us how much your agency plans to spend this year related to this proposal?

Dr. TEICHMAN. We will take it in the order that we testified earlier, Chairman Lummis, and I believe I got that correct.

Chairman LUMMIS. Thank you, Dr. Teichman. Yes, Lummis, rhymes with hummus. Thank you.

Dr. TEICHMAN. And let me also thank you, and in a moment of bipartisan support, Representative Bonamici as well for rocking the red as Washington Capitals fans. I appreciate your red blazers here this morning.

One other very brief personal note. I thank all the Committee Members for their work in the prior half an hour to this hearing, as one who was on the Tokyo metro system the morning that the Sarin attack occurred, just happened to be at a different station, and whose son worked for Senator Frist when the letter with ricin was opened in that office. So I appreciate the seriousness of your work.

In Fiscal Year 2013, the EPA will spend \$6.1 million and 14.9 FTE to continue the drinking water study that we began at the request of Congress in the Fiscal Year 2010 appropriations report.

Chairman LUMMIS. Thank you, Dr. Teichman.

Mr. DEHORATIIS. Good morning. In Fiscal Year 2013, the Department of Energy plans to spend \$10 million to support the effort, the research areas that support the topics that are in the framework.

Chairman LUMMIS. And Dr. Russ?

Dr. RUSS. Thank you. Yes, our Continuing Resolution sequestration information is still being sent over, I believe, from OMB to the Congress, but our intention is for Fiscal Year 2013 to spend approximately \$8.6 million.

Chairman LUMMIS. Okay. A follow-up for you, Dr. Russ. Last year I was part of a discussion with Dr. McNutt in Interior Approps on whether we should grant USGS the extra money for these studies. And I was a little concerned about duplication, but I really was most supportive of the USGS portion, because Dr. McNutt told me on the record that the money would be used to develop best practices for wastewater injection and seismic activity. And you alluded to those continued uses in your testimony. So that, as I understand it, is still the plan going forward?

Dr. RUSS. Yes, it is, Congresswoman.

Chairman LUMMIS. No changes there?

Dr. RUSS. No.

Chairman LUMMIS. No expansion there?

Dr. RUSS. There will be a modest expansion, I think, in our induced seismicity component where we have a little bit more money this year than last to look at the impacts of induced seismicity and by looking at things like injection rates of fluids underground to

better understand the impacts potentially producing earthquakes, and working with EPA, as well as industry to understand best management practices potentially reduce the occurrence of these types of events.

Chairman LUMMIS. Okay. I am a landowner and I am in a split estate situation where the oil and gas is being developed and so for somebody like me who owns the subsurface but not the surface, obviously we are very concerned about wastewater injection issues and appreciate USGS expertise in that area.

Dr. Teichman, I also had last year a discussion on fracking with former Administrator Jackson at the Interior Appropriations Subcommittee. It was not quite as satisfying to me as my exchange with Dr. McNutt. It was in that testimony that Ms. Jackson admitted the EPA had found no conclusive evidence that fracking had caused contamination in Pavillion, Wyoming. This after the huge exposé in the New York Times indicating after they had released their draft report that Wyoming was not in as positive a position as people thought it should be.

Exactly how does the EPA intend to use this research money in a way that doesn't duplicate its other studies related to fracking, especially does not duplicate the lack of peer-reviewed science and the lack of transparency that is the hallmark of the Pavillion draft report, especially its release as a draft report that was extremely critical and quite frankly, wrong, and created this big flurry of concern about fracking, and now has been completely impeached by subsequent work. How can you assure me that doesn't happen again?

Dr. TEICHMAN. Perhaps the best thing I can do I tell you the interactions we have had with our Science Advisory Board on the EPA drinking water study that I am a part of.

I would note for you that in Dr. Ikeda's written testimony, it refers to the fact that the Pavillion, Wyoming situation is not part of the EPA drinking water study, and so I wish to draw that distinction to your attention.

Chairman LUMMIS. And I would wish to draw the point that Lisa Jackson, when I asked her is the drinking water contaminated by fracking in Pavilion, and she testified no. So what—the problem I am having is that EPA is not distinguishing in people's minds drinking water versus groundwater, non-drinking groundwater. And furthermore, the fact that EPA was probably responsible for contaminating some of those wells during the testing process adds to the further frustration, and you know, Pavillion is frequently held up as the poster child for bad practices and bad consequences, when it was hugely prematurely released. It has not been peer reviewed. It was exaggerated, and in fact, it appears that EPA itself was contaminating those wells in their own efforts.

I am hugely frustrated with the EPA and its treatment of my state and of fracking in general. It is as if it tried to create an example at Pavillion to exacerbate or raise the profile of fracking as a national issue without the science to back it up. So I—so the distinction between groundwater and drinking water is important.

My time is—oh yeah, my time is way up, excuse me.

I yield to the Ranking Member, Mr. Swalwell, with my apologies.

Mr. SWALWELL. Thank you, Chair Lummis, and no apology needed. I am interested in this discussion as well, and as I mentioned in my opening remarks, perhaps with fracking we may find that the drinking water and groundwater contamination concerns would apply to any state that has or participates in fracking, but then once you look at individual states, you might find that there are issues that are unique to those states. And I am talking, of course, about California.

And so Dr. Russ, as I noted in my opening statement, my constituents in California are particularly concerned about the possibility of manmade earthquakes. I represent the Hayward Fault. That is in my district, and it is an internationally known fault line. Nature and physics give us enough problems as it is, so how significant is the potential for induced seismicity, and what are some of the ways that we can sufficiently address that risk, as well as what do we know now and what do you want to know in the future? And I was encouraged to hear that there may be some funding that can be put towards further studies.

Dr. RUSS. Thank you, Mr. Swalwell. Yes, induced seismicity we regard as a very important topic for research. We want to know more about how many earthquakes are occurring in areas where fluid is being injected underground, wastewater fluid is being injected. We want to know the rate in which those events are occurring, and the size of those events. We want to know if one earthquake that has been induced can trigger another earthquake, and can it be a larger, more damaging earthquake? We want to know the relationship between the pressure and the rate of injection and the volumes of water and waste materials that are injected underground so we can calibrate those rates against the potential occurrence of earthquakes.

Mr. SWALWELL. And what do we know now?

Dr. RUSS. We know now that there is relationships between the occurrence of these induced earthquakes and the locations of subsurface injection wells. We know that it is important to understand if there is an active fault nearby injection sites, which could be—that fault might be ruptured and trigger an event. We know that there has been a significant uptick in the numbers of small to medium earthquakes in the central United States, which we believe are associated largely with induced earthquakes.

Mr. SWALWELL. Great. And also, Dr. Russ, in my state, as in many, water is a precious resource and fracking is an extremely water-intensive process. If these activities were to expand into Northern California, do you have a sense of where the required water resources would be obtained from, and what the impact on local water availability would be?

Dr. RUSS. Very good question. Water availability is one of the key research topics that are in our draft research report. Each area, as you mentioned, is unique in terms of its occurrence, the nature of where the aquifers are and where the various units of contained water, whether it is streams or subsurface sources. So we would have to take a look at that individual area to determine what are the actual occurrences and the problems. Also, seasonality of the weather in a given area affects water availability, so the weather is an important component as well.

Mr. SWALWELL. Will the research plan also examine alternative fracking fluid technologies that would be less harmful to the environment?

Dr. RUSS. Yes, that is the intent.

Mr. SWALWELL. Okay. Also will the research plan examine recycling of wastewater that would be produced in the fracking process?

Dr. RUSS. I am not sure if that is—if I have the knowledge on that one.

Mr. SWALWELL. Okay, any other witness? Dr. Teichman?

Dr. TEICHMAN. Yes, I believe the research plan will include the ability of recycling wastewaters as a way of preserving water acquisition and not introducing additional chemicals into the hydraulic fracturing process.

Mr. SWALWELL. Great. And going back to where I started, for all witnesses, would you agree that at least right now, as I mentioned, we must proceed with extreme caution but that we may find that some states are better suited, if you can address the groundwater and drinking water concerns that some states may be better suited for exploration through fracking rather than other states?

Dr. TEICHMAN. I will take the first stab and then turn, perhaps, to Dr. Russ, and to state that certainly the geological formations are different in different states, and the approaches to be taken, therefore, should be dependent upon what the different states geology is. For those who are traditionally drilling much deeper than the aquifers, then I think we would expect that practice to certainly be more positively environmentally friendly than those who might be drilling into them.

Mr. SWALWELL. Great. Actually, I will yield back the balance of my time. Thank you, Chair.

Chairman LUMMIS. Thank you. I thank the Ranking Member.

Next we go to the Chairman of the Environment Subcommittee, Mr. Stewart.

Mr. STEWART. Thank you, Madam Chairman. I want to go through a couple of questions, but I want to divert just if I can and do some very quickly.

Dr. Russ, I would like to comment on some of the things you have said. You know, I am afraid that you would leave the impression with the American people being familiar with this hearing today that there is a great risk of massive earthquakes because of water reinjection and hydraulic fracking. Is that your intention here with your testimony?

Dr. RUSS. No, it is not.

Mr. STEWART. Because we agree that this is very, very immature science, and we really can't draw any conclusions yet at this point, is that true?

Dr. RUSS. I would say that is true in terms of potential damaging earthquakes.

Mr. STEWART. Okay. So there is some speculation, but very, very little evidence to draw any conclusions to this?

Dr. RUSS. We are very early in our research.

Mr. STEWART. Okay, thank you for that.

A couple others, and again, I will make these very easy if I could. I am supposing that none of you would disagree with the Presi-

dent's belief that greenhouse gas emissions pose a global threat. Would that be true? None of you would disagree with that? Okay.

And then let me, if I could just cite a point, from 2005 to 2011, which I know that you all are familiar with, of course, the greenhouse gas emissions have decreased by 12 percent. And over this same period, global greenhouse emissions have actually increased significantly, and a lot of the reason for this is because of our abundance of natural gas. Then could we agree that it is a good thing—it would be a good policy that it was something we want to facilitate everything that we can do to increase our natural gas production. Would we agree that that is a good event?

Dr. TEICHMAN. Let me just state in my testimony that I believe we should indeed develop our energy sources in a way that maximizes the positive benefits and certainly minimizes the negative. I would, however, mention if you ask me which is the cleanest form of energy, it is energy conservation.

Mr. STEWART. Okay, but the policy being is it is good for us to facilitate natural gas production, any of you disagree with that? Okay, thank you then.

Then in your testimony, either written or in some cases, your testimony today, you praise the benefits of natural gas but you caution that, as you said, we want to reap these benefits but we want to “do it right.” And given that these practices, they have been going for decades. This isn't something that is new. There are some new variations of the technology, but this isn't dramatically new or different than what we have been doing for quite a lot of time. And to my knowledge, there are no proven instances of groundwater contamination, and as we have just said, greenhouse gasses have been declining thanks to natural gas, and so I would ask you, I mean, what have we done wrong? We say we want to do it right, but what are our concerns? What have we done wrong up to this point? And I would invite any of the panelists to try and answer that.

Dr. TEICHMAN. Let me try and start by stating that I believe that the technology of drilling very deeply and horizontally with new drill bits and using hydraulic fracturing is something which the combination of has allowed us to see a much greater resource than I would say we knew of decades ago, to refer to your question.

Mr. STEWART. Which is a great thing.

Dr. TEICHMAN. I certainly am glad to see domestic energy supplies that may reduce our reliance on foreign supplies, absolutely I agree with you in that regard.

To that extent, I think these newer combination of technologies we just need to make sure we are maximizing the positive benefits of the exploration of natural gas and oil, by the way, and minimizing the potential for environmental harm at the same time.

Mr. STEWART. Okay, so there isn't anything particular that you think we have done wrong up to this point, would that be true?

Dr. TEICHMAN. I think that is true, although I would think that work that I have heard industry talking about, and I hope is being implemented, to have stronger casings or additional casings when they go through aquifers, to recycle the wastewater to go ahead and use greener fracking fluids, I would very much encourage work in that direction.

Mr. STEWART. And I think all of us would, by the way, Doctor. I think—I mean, there would be very little argument. I can't imagine a reasonable argument against those suggestions at all.

Dr. TEICHMAN. I think that is right, other than sometimes they may cost a little bit more, but I believe in the long run it is to the benefit of all.

Mr. STEWART. Okay, and again, my fear is that there is perception that this panel or that some others may create, kind of coming back to the, you know, the earthquakes. Holy cow, you know, we are going to have this enormous event when we don't know that, and my fear is that the perception is that we would leave the American people that we have done something wrong, that we have been remiss in our environmental concerns up to this point, and I just don't think that is the case. I don't think the evidence supports that, and I appreciate that you would agree with that.

With that being said, my time is up and I yield back to you, Madam Chairwoman.

Chairman LUMMIS. Thank you, Chairman Stewart.

The Chair now recognizes Ms. Bonamici.

Ms. BONAMICI. Thank you very much, Madam Chair. I have several questions and very little time, so I am going to ask a few at a time and then allow you an opportunity to respond, so the first question is to Dr. Russ.

I want to follow up on your testimony about water availability research where you said that the USGS will develop water budgets to understand how much water is required to produce UOG deposits. So when you are analyzing the suitability of different communities, do you take into account the local economy's water need, both present and future, to support potential future economic growth? So hold that, and then my next question is to Dr. Teichman.

Dr. Teichman, yesterday in the Environment Subcommittee, we held a hearing on policy relevant issues related to climate change. We discussed the impacts of greenhouse gas emissions on the planet and all of the witnesses who testified agreed that anthropologic climate change is happening, and we need to take action to address it. Now one concern I have heard about hydraulic fracturing is the possibility of fugitive emissions of methane gas, so I wanted you to please describe what the EPA is doing with your ongoing studies into the potential of fugitive emissions of methane from hydraulic fracturing.

And then finally for all of the panel, we have had, in the Environment Subcommittee, several discussions about stakeholder input, which is an important issue when discussing scientific and environmental and public health issues. Now obviously, there has been some miscommunication and misinformation regarding hydraulic fracturing, so will you please detail what efforts you have made to get input from stakeholders related to your research plan, and also what you are planning to do to communicate and reach out to the public to ensure that the general public and stakeholders are informed about what you are doing.

So starting with Dr. Russ on the water.

Dr. RUSS. Thank you. A water availability and the development of water budgets, we feel, is a critical component to understand the

amount of water it takes—is used, actually, in the overall operations of hydraulic fracturing and related activities. And yes, the water availability takes a look at all of the uses of water, surface water, groundwater, including the water that is needed to supply normal communities with the waters that they need, whether it is drinking water, irrigation, or whatever, so it does include all of these sources.

Ms. BONAMICI. And also, do you consider the potential future to support economic growth in a particular community?

Dr. RUSS. Yes, socioeconomics is a part of this study.

Ms. BONAMICI. Thank you very much.

Dr. Teichman on the—

Dr. TEICHMAN. Fugitive emissions.

Ms. BONAMICI. That is it.

Dr. TEICHMAN. Right. Indeed, that is a concern that we have that we actually believe the industry shares with us, that we should not have such methane stray emissions occurring as part of the drilling process, and therefore, I believe—although this is somewhat out of my bailiwick and more into the policy side as opposed to the research, that we have a new source performance standard on well completion, that therefore would minimize the methane emissions associated with the completion of wells, and such that the material that would be collected by the industry and so saving those methane emissions could actually reap greater benefits than the cost to do so.

Ms. BONAMICI. Thank you.

And for the panel—did you want to add something?

Dr. TEICHMAN. No, I was just going to go to your second question—

Ms. BONAMICI. Okay, perfect.

Dr. TEICHMAN. —for the panel, but I will be very brief because I can spend too much time on this. But part of the EPA drinking water study, just to give you an example, in our development of the study plan for it, there were four public stakeholder meetings, an e-mail box set up, public comment was offered on the draft study plan, the SAB consulted and had an opportunity for public comment then from the stakeholders. The SAB had a peer review of the study plan. There were technical workshops, webinars, a docket was set up, a list serve, and that is just on the study plan. We have had the same type of external outreach on our study conduct.

Ms. BONAMICI. Thank you. Others on the panel, would you please comment on stakeholder input and communication to public?

Dr. RUSS. Yes, as we have gone through the plans an preparation of our draft research plan, we have webinars with industry, with states, with academia, and other nongovernmental organizations. We have, in addition, participated in many professional meetings and other community meetings that have asked about what we are looking at, including in our research plan. Particularly, we have worked with states through things like river basin commissions and participated in their meetings to understand the potential effects and water use of hydraulic fracturing. So we take their comments into consideration when we build our ideas for the report.

Ms. BONAMICI. Thank you, and the others, I have a bit of time left. Mr. DeHoratiis?

Mr. DEHORATIIS. Yes, the Department of Energy participated in both the EPA activities and USGS activities, especially in terms of the webinars and presentations that were made. We have had also additional interactions with industry and participated in several, you know, public professional organizations. You know, there are societies that we have given presentations at the Society of Petroleum Engineers and other professional activities.

Ms. BONAMICI. Thank you.

Dr. IKEDA. And I will just mention a few activities along these lines, and not necessarily related to the research plan, but so for example, the project that I mentioned during my testimony that NIEHS is supporting that does—they are looking at information needs from the community, so that is one activity. Another is that part and parcel of our standard operating procedures when we work at the sites that I mentioned is to communicate findings back to the community and address any concerns or questions that they might have at that time. And then I would also add that NIOSH works very closely with industry and the Silica example that I mentioned in my testimony have also worked very closely to communicate findings with workers, along with industry partners.

Ms. BONAMICI. Thank you, and I see my time has expired. Thank you, Madam Chair.

Chairman LUMMIS. Thank you, and we—the Chair now recognizes the gentleman from Texas, Mr. Hall.

Mr. HALL. I thank you, Madam Chairman, and I would like to use a lot of my time to tell you how very proud I am of you, and I am going to, again, thank our Chairman, Chairman Smith, for selection of you to head this Committee, because you are doing a wonderful job. You ask the proper questions. You didn't get proper answers.

I just want to say when it comes to hydraulic fracturing, EPA has gained notoriety for using just driven science and levying allegations that later have to be retracted and have been retracted. I think certainly several examples such as—Dimock, Pennsylvania; Parker County, Texas; and Pavillion, Wyoming that the Chairperson alluded to where it appears that the agency is more interested in rushing judgment and placing information in the hands of the media than they are looking for sound scientific approach.

I just think that it is pitiful, and then when they mention the first lady of—we invited her to come before us, Lisa Jackson. We had to do everything but threaten to subpoena her to get her and finally got an agreement from her to appear at 10 o'clock one morning. That 10 o'clock happened to be the day that the Supreme Court guessed wrong on Obamacare, and she was a member of the—that had to be with the President that day, so she escaped that. Lisa Jackson came before this Committee and made the statement that they were not in the business of creating jobs. I think that is one of the meanest things I have ever heard anybody testify to here at a time when men are having to go home and face their families. They can't send their daughter to school or they can't keep their son in school or they can't continue to feed their own family. I just think we are in a critical time. And when the EPA answered to Congressman Rohrabacher, ask him, he asked the question do you know of anywhere, any time when fracturing has

caused mistreatment of drinking water, every one of them said no. Nowhere in the United States.

Mr. Teichman, in May of 2012, Fred Hauchman, who was the director of the EPA's Office of Science Policy, said that the agency is "doing a pretty comprehensive look at all of the statutes to determine where there are some holes to justify further regulation of hydraulic fracturing."

I guess my question to you, Mr. Teichman, can you assure this Committee that EPA will not use a steering committee or the broader interagency working group to search for holes or engage in a search for ways to regulate hydraulic fracturing, rather than trying to help Congress find some way to support jobs and seek for jobs? You have come to my state and you came to my state and without yielding to scientific—and I would like to remind you, sir, that you are under oath when you come here, and that there is a statute of limitations when you mislead a Congressional Committee. That statute has not run. It won't run until we have a new President, and I am really proud of the Chair for taking you on. I guess I just ask that one question to you as to whether or not you can assure the Committee that the EPA is not going to use false and unrelated testimony that you later have to go back on or if the courts have to turn you around on, and both of those things have happened, have they not?

Dr. TEICHMAN. I can't speak to the testimony about the rest of the EPA. I can tell you that I signed for this Committee the truth and whatever the official term is, or the document, I apologize, and I am very glad to have done so and there is nothing I have said here to the best of my knowledge is not totally truthful, nor will it be for the rest of the answer to this question.

The answer to your question, I believe, is in my testimony where the research that we are doing at EPA, if you were to ask me who the intended audience is, it is indeed Federal agencies. It is also state, local and tribal governments. It is also the oil and gas industry, and it is also the general public, and I believe those are the policymakers, not me as the researcher, who will make the decisions on policymaking, and I am hoping to provide research results that inform all of their thinking in the soundest possible way.

Mr. HALL. I don't know whose direction you are following, but when you come here and give us bad science backup for your testimony, that gives me some question about what your attitude is, and one of the young ladies up there said that your job is to protect the citizens, and that is what you are trying to do. Our job is to also protect jobs and to be sure that we have proper science when decisions are made that affect this entire country.

I think my time is up. I would just leave with this. One of the horses next Saturday in the Kentucky Derby, there's a horse named Frac Daddy, F-r-a-c D-a-d-d-y, and he has the same odds that you have with me. He's a 45-1 long shot.

I yield back my time.

Chairman LUMMIS. I thank the gentleman from Texas, and recognize Mr. Veasey.

Mr. VEASEY. Thank you, Madam Chair.

I wanted to talk with you specifically about this issue, and I don't know if you have heard me speak before the Committee be-

fore, but I really sort of represent a very unique perspective when it comes to drilling, because most of the drilling that I am—that happens—that I know about—that I am more familiar with, I will say, happens in an urban setting. I live in Ft. Worth, Texas, which is basically the hub of the Barnett shale, and so, I mean, I live in a city with 700,000-plus people, but I have frack ponds, pipelines, compressor stations, you name it, in neighborhoods. And so it is certainly a difference, because I can tell you that while this issue has been controversial in other areas, including Ft. Worth, it is not controversial in Midland, Texas, where it is a part of the everyday life and basically makes up their entire economy.

And so what I wanted to ask you specifically, because I have about 438 active wells in my district right now, and wanted to ask you, has any of your research been centered on the effects of natural gas in an urban setting? Because—and another reason why that is so important is that back in 2005, it really took off in Ft. Worth, but now, you are going to start seeing more of that take place in Dallas County as well, possibly.

Mr. DEHORATHIS. Well, one of the things that we are doing at the Department of Energy is promoting research in dealing with air emissions, especially in areas where there may be associated gas that is being flared, and so we are definitely looking at technology to control and mitigate those emissions. Whether it is dealing with improved flaring operations or alternatives to flaring, beneficial use of the natural gas that may be associated gas associated with oil production from shale oil formations, and also emission capture technology.

So I think that is the technology work at the Department of Energy we are doing that is going to focus more on urban areas.

Mr. VEASEY. Okay. Dr. Teichman, do you have anything on urban drilling specifically?

Dr. TEICHMAN. Specifically I am not aware that any of the case studies, either retrospective or prospective, are intentionally in an urban area, but I could be wrong and I would like to double check that and offer the answer for the record.

Mr. VEASEY. Okay. I wanted to talk with you about drought. As you know, specifically in Texas right now we are experiencing droughts. We have had situations where, you know, people have—they are not taking as many cattle as they were before to feed lots and things like that, so I mean we are experiencing that problem. And I know that first water reserves in Texas has really been an issue lately, and I know the fracking uses, only about one percent of the fresh water reserves in our state right now, but it was estimated to use about nine percent of the fresh water annually in one of the cities in the Barnett shale area. The water needs for natural gas will obviously continue to grow, but as you probably are also familiar, our area in the state, the Dallas/Ft. Worth area, is one of the fastest growing areas in the entire region, so we obviously are going to continue to need to look for water for an increasing population in the metroplex.

Will any of the research that you plan include information for water recycling?

Dr. TEICHMAN. I believe that question also was raised in a slightly different form, and the answer is yes, to the extent that we can

recycle wastewater so that we don't need to continuously use new water sources for the hydraulic fracturing, we will look into that practice and hopefully it will prove to be very fruitful for all parties. It will save water use, and it will probably save expense, in fact, for the industries that are developing the resource.

Mr. VEASEY. And let me just say this also, the earthquake issue has been something that has been covered quite extensively in our local newspaper. Obviously when, you know, there were never any earthquakes and as someone that is a lifelong resident of the metroplex, I can tell you that we have never had any earthquakes, and then all of a sudden, we have a lot of earthquakes. They have been very small, you know, earthquakes. I think the last one that we had recently was about 2—it was measured at 2.6 or so, but you know—but we have the earthquakes.

One scientist from the city of Cleburne, which I know that Ralph Hall knows about the city of Cleburne, that they hired him. He came in and said to one of the newspapers that yes, you know, there is earthquakes—there may be earthquakes associated with drilling, and then told the other newspaper there may be earthquakes associated with drilling but it wouldn't hesitate me to sell my minerals and let them drill on my land. So in regards to the earthquakes, how serious of an issue do you think it is or not, and particularly in specificity to the size of the earthquakes that we have been, you know, seeing, these 2.6 or lower, maybe a little bit higher. Can you give me some—your thoughts on that particular issue?

Chairman LUMMIS. And quickly, because the time is expired.

Mr. VEASEY. Thank you, Madam Chair.

Chairman LUMMIS. You bet.

Dr. RUSS. Yes, very quickly. A very good question. One of our goals is to understand through research just how large of an earthquake might be induced by underground injection of fluids, and so this understanding of the injection rates and volumes and how that might affect the types of earthquakes, the distribution of earthquakes is part of what we are working on. There has been some earthquakes in the Dallas/Ft. Worth area. You asked about urban areas a moment ago, and there is an earthquake that occurred in Youngstown, Ohio, that we are studying as well, so that is an urban area.

So we don't have the answers to these questions yet. It is a complex topic, but it is one of the issues we are looking at.

Chairman LUMMIS. I thank the witness, and I recognize the gentleman from Texas, Mr. Weber.

Mr. WEBER. Well thank you, Madam Chairman. I am a little late in getting here, so I really don't have a lot of questions. I think my colleague over here, also from Texas, was able to get some questions and extract a pound of flesh, so I think I will leave it at that. I yield back.

Chairman LUMMIS. Thank you, Mr. Weber. We have about ten minutes until votes, and we have completed one round of testimony. If others are interested, I would suggest that we give each of us the opportunity to ask one more question. Just one question. Is that agreeable?

Mr. SWALWELL. Sure.

Chairman LUMMIS. I thank the Ranking Member, and the Chairman yields to herself to ask a question.

I note in what you have told me that you are spending money to implement this plan on looking at fracking, and yet, we haven't seen the plan. And I look back at what my opening remarks, the agencies committed to release a draft of the research plan in October, final plan in January. We haven't even received a draft version. You are spending money to implement the plan. I want the plan. Will you please commit to give us the plan?

Dr. TEICHMAN. Chairman Lummis, with all due respect, the plan is under development. As soon as I am able to have it released, I will get it to you.

Chairman LUMMIS. Well, you know, the logical follow-up question is why are you spending money to implement a plan that you haven't released to the public or given for public comment? That is my question, and now I yield to—

Dr. TEICHMAN. May I respond? I apologize, but in Fiscal Year 2013, which is when we are indeed spending dollars for our drinking water study, that is consistent with the money we have. It is—the plan will be for Fiscal Year 2014, where no dollars have been spent yet.

Chairman LUMMIS. I thank the gentleman, and yield to Mr. Swalwell.

Mr. SWALWELL. Thank you, Madam Chair.

I wanted to ask Mr. DeHoratiis, my understanding is that investments that your office has made in hydraulic fracturing as far as research and development decades ago can be directly linked to the oil and gas boom that we are seeing today. And if that is the case, would you say that this provides a clear example of how federally funded applied energy research can have a major impact on establishing or accelerating the development of new energy technologies that are critically important to our Nation?

Mr. DEHORATIIS. Thank you very much. Yes, you know, DOE was working in shale gas research back as early as 1978, before it was even a thought in most people's minds that we could produce oil from shale formations, oil and gas. So DOE is very proud of that. Our efforts today are taking what we think is the next step forward, looking at mitigation technologies, how can we do it and improve? Just as technology has advanced on the production side, we want to make sure that technology is advancing on the performance side. And so we are looking at better ways to reduce the amount of water that we need, how can we reuse water, how can we find alternatives to water? What about the air emissions? Can we do things in that area? Can we better understand the impacts of wastewater injection that may induce seismicity? So we are doing research in all these areas, and we feel that this is a very important research topic for us.

Mr. SWALWELL. Great, thank you, and I yield back the balance of my time.

Chairman LUMMIS. Thank you. We have been joined by a Member of the Committee who hasn't had a chance to ask questions, so I will yield five minutes to the gentleman from Florida, Mr. Grayson.

Mr. GRAYSON. Thank you very much. I have some questions for Dr. Ikeda, and this has to do with the ATSDR's activities with regard to the island of Vieques in Puerto Rico. Are you familiar with the ATSDR's activities regarding Vieques?

Dr. IKEDA. Yes.

Mr. GRAYSON. All right. Is it fair to say that it is within scientific knowledge that the military has released toxins in various places, including Vieques and elsewhere, where the military has done bombing? Is it fair to say that we know to a scientific certainty that the military has released toxins into the environment in areas that it has done bombing?

Dr. IKEDA. We are focused on the human health aspects, environmental exposures, and our work in Vieques has not documented human health exposures or human health impacts related to military activities in Vieques.

Mr. GRAYSON. Okay, Doctor, my question was is it fair to say with a scientific certainty that bombing has led to environmental damage through the release of toxins? That is my question.

Dr. IKEDA. I can't speak to the environmental damage. Our focus is on the human health aspects of exposures in the environment.

Mr. GRAYSON. All right. Is it fair to say, Doctor, to a scientific certainty that the release of mercury into the environment can cause human health damage?

Dr. IKEDA. Mercury has been associated with negative health impacts, yes.

Mr. GRAYSON. Now the same thing is true of Agent Orange, right?

Dr. IKEDA. Yes, correct.

Mr. GRAYSON. And the same thing is true of depleted uranium, right?

Dr. IKEDA. Yes.

Mr. GRAYSON. And the same thing is true of napalm, right?

Dr. IKEDA. Yes.

Mr. GRAYSON. All right. Now can you tell me how much napalm was released in Vieques during the half century of bombing by the Navy?

Dr. IKEDA. I am sorry, I don't have that information.

Mr. GRAYSON. Do you have any idea?

Dr. IKEDA. I don't know. No, we would have to get back to you.

Mr. GRAYSON. Do you—can you tell me how much depleted uranium was released on Vieques during a half century of bombing by the Navy?

Dr. IKEDA. Again, I am sorry. I don't have that information.

Mr. GRAYSON. Does anybody within your agency have that information?

Dr. IKEDA. I certainly will check and get back.

Mr. GRAYSON. Can you tell me how much Agent Orange was used and released into the environment at Vieques over the course of half a century?

Dr. IKEDA. Again, I am sorry.

Mr. GRAYSON. Can you identify for me with specificity any of the environmental toxins that do cause damage to human health that you know or don't know was released into the environment at Vieques at any time in the past 60 years?

Dr. IKEDA. I couldn't do that with any specificity, so we would have to get that information back to you.

Mr. GRAYSON. All right. It is fair to say that you really can't make a firm judgment or even a wild guess as to whether there has been damage to health—human health in Vieques without knowing what toxins released, when, and how much?

Dr. IKEDA. I am sorry, I don't know the specifics about the report, but the final results from the report have shown that there were not human health impacts related to the military activities in Vieques.

Mr. GRAYSON. Doctor, if you don't know whether or how much Agent Orange was released, how could you possibly reach that conclusion?

Dr. IKEDA. No, I am saying that—I am sorry, that I personally don't have the information, but the information in the report is final.

Mr. GRAYSON. Well Doctor, I will represent to you that nobody in that report—involved in that report, which to some degree, preceded your time at the agency, nobody working on that report at ATSDR, as far as I know, knew the answer to that question. Nobody knows at ATSDR how much Agent Orange was released. Nobody knows how much napalm was released. It wasn't in the report.

Now given that fact, given the fact that you were not told exactly what toxins were released by the military during the bombing, is it fair to say that we don't really know with a firm answer whether the bombing caused any health damages on the island or not?

Dr. IKEDA. Again, I would say that based on the information that we do have, we did not find evidence of human health impacts—negative human health impacts related to the military bombing.

Mr. GRAYSON. Doctor, if you know nothing, then really, you can't say anything, right?

Dr. IKEDA. I will stand by my answer. Again, I am sorry, I don't have the personal information, but according to our report and the work that we have done and the data that we do have—

Mr. GRAYSON. I will ask you to assume hypothetically, since you don't have that information here with you today, if the Navy has not released the information to you or the people of Vieques or even to us in Congress, the information about how much of these toxins were released during their bombing, is it fair to say then that you cannot reach any firm, final scientific conclusions without the information that you need in order to be able to reach that conclusion?

Dr. IKEDA. Again, I would say that based on the information that we have, we believe that our conclusions are valid.

Mr. GRAYSON. Based on that information that you have which you know is—

Chairman LUMMIS. The gentleman's time is expired.

Mr. GRAYSON. Thank you very much, Madam Chair.

Chairman LUMMIS. I will now yield to the gentleman from Utah, Mr. Stewart.

Mr. STEWART. Thank you, Madam Chairman.

Mr. Grayson, your comment that if you know nothing, you can't say anything, very clearly, sir, you have never raised teenagers, because I have several of them who—

Mr. GRAYSON. Point well taken.

Mr. STEWART. I only have a few minutes. I would like to follow up just in a big picture kind of general sort of way, and again, it is something that I think we would agree with, but I would like to caution us, if we could, and that is that in regarding to fracking and the research and the science and the development and the technology around that, and the EPA has repeatedly insisted, and we appreciate this, that you are trying to be transparent and research-driven as you approach this, and thank you for doing that. It is important that you do do that, but there are examples where that appears to not have taken place. And I won't elaborate them here. We have discussed some of them already in the Committee, but there are times when it appeared that the agency is more interested in rushed judgments and placing—and this is particularly troubling—placing information in the hands of the media rather than undertaking a sound scientific approach, and just the few seconds that I have, I would ask us—ask you to agree that that is detrimental to what we are all trying to do here, and that it invites suspicion as to the agency's motivation. And if I could have your commitment that the agency would do everything in its power to work within the normal protocols and to not put information out there—frankly, I am afraid that this Committee has done—that this hearing has done today in regard to—as I said, in regards to earthquakes—to not put a perception or partial information out there that the media then, of course, runs with and does what the media does. And I would appreciate your commitment that you will do everything within your power to try to avoid that.

Dr. TEICHMAN. I believe that is probably most directed to me—

Mr. STEWART. Yes, sir.

Dr. TEICHMAN. —and I would say that EPA has been and will continue to be committed to performing all of its research in strict conformance with the highest standards of scientific quality as promoted by our own EPA scientific integrity policy and related policies, and you are hearing that from the person who helped write the scientific integrity policy for EPA.

Mr. STEWART. Okay, and again, we appreciate that. And if we could have this science-based once again and go through the normal protocols rather than, in some cases where it has been partial information, or in some cases absolutely inaccurate information has been provided to the press and allowed them to, you know, create great concerns among the local populations. It just didn't bear out, so thank you for your commitment to doing that.

Madam Chair, I yield back.

Chairman LUMMIS. I thank the gentleman from Utah, and the Chair now recognizes Ms. Bonamici.

Ms. BONAMICI. Thank you, Madam Chair.

I wanted to ask about the cooperation that you are getting from the industry, and get back to the topic of earthquakes, because that is something that we have heard from a couple of Members here, and I know that there is a Williams Ellsworth who is with the USGS and is or was a geophysicist. I don't know if he is still with

the USGS, but has written more than 100 papers on earthquakes and reviewed a study, Mr. Ellsworth study of geophysics at Stanford, earned his doctorate from MIT, former president of the Seismological Society of America. When he was asked if there was any doubt among his colleagues about what produced quakes in Arkansas, Colorado, Ohio, Oklahoma, and Texas, he said injection of wastewater into class 2 wells has induced earthquakes, including those you site. In my opinion, it is pretty clear in all of these cases, Youngstown, Arkansas, DFW, Trinidad, and Oklahoma, that injection wells were the cause. So obviously, there are people who are experts who are making this connection.

Have you been able to get information from the industry that would help you form opinions about that, for example, the amount of water, what they are using, and how they are injecting the water? Thank you.

Dr. RUSS. Yes, I will take a stab at answering that. This is Dr. Russ. And yes, Dr. Ellsworth is a geophysicist with our offices in Menlo Park, California. He is still very much an active member of that unit, and I think he has done a good job at summarizing and looking at the evidence to support the relationship between the activities subsurface injection and earthquakes that you mentioned.

Ms. BONAMICI. Thank you. And are you working on this report and this plan, this research, are you able to get the information you need from the industry about what they are injecting, how much they are injecting, and what their process is?

Dr. RUSS. We have been successful at getting some of the information we think is necessary. We would like to have more information, rates of pumpage, volumes of water injected. In some cases, companies haven't recorded that information so we are trying to work with the companies and with the Environmental Protection Agency to see how we can improve our ability to get some of that important information.

Ms. BONAMICI. Dr. Teichman, do you want to weigh in on this, please?

Dr. TEICHMAN. I would only add today's remarks, and that is part of our drinking water study. We have two prospective studies that we are hoping to have, in which case we will be there measuring baseline data of water quality before fracking occurs at a site, while it is occurring, and even after wells are completed and, in fact, the production is stopped. And we hope by that time to be there and getting the very type of data that you are talking about and measuring the potential environmental impact, if any, as we do that.

Ms. BONAMICI. Thank you, and I hope that the industry is cooperative because the more facts that you have, the more data you have, the more you will be able to have accurate reports that you can get back to us.

Thank you very much. I yield back. Thank you, Madam Chair.

Chairman LUMMIS. I thank the gentlelady from Oregon, and the gentleman from California as well. Our Ranking Members, their attendance and the attendance of the Minority as well as the Majority Members is deeply appreciated. I also want to thank the witnesses for their valuable testimony, and the Members for their questions.

The Members of the Committee may have additional questions for you, and we will ask you to respond to those in writing. The record will remain open for two weeks for additional comments and written questions from Members. Again, with my deepest thanks to the witnesses today, you are now excused, and this hearing is adjourned.

[Whereupon, at 11:30 a.m., the Subcommittee was adjourned.]

Appendix I

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

Responses by Dr. Kevin Teichman

Enclosure

**EPA Responses to Questions for the Record from
May 13, 2013 Hearing entitled,
“Review of Federal Hydraulic Fracturing Research Activities”**

Congresswoman Cynthia Lummis

Question 1: The April 13th 2012 Memorandum establishing the interagency initiative stated that “within six months of formation the steering Committee will have a draft of the research plan for public comment” and the formal multi-year research plan would be formalized within nine months. To date, no research plan has been made public.

a. What is the current status of the research plan?

Response: The tri-agency research plan is still under development. The work to date to develop the plan has been very helpful in both coordinating the research efforts of the three agencies and developing the President’s FY 2014 Budget Request.

b. When will the draft be available for public comment?

Response: Work on the plan remains a high priority, and it will be released for public comment upon completion of federal interagency review.

c. What will public comment look like, in terms of length, notification, and method of comment?

Response: The three Memorandum of Agreement (MOA) agencies are fully committed to an extensive public comment process, and will release the details of the public comment period when the draft plan is released.

d. What is the source of or reason for the delay?

Response: The development of a multi-agency research plan is a technically complex task, which is evolving quickly and directly impacts U.S. energy sources and our environment. The three MOA agencies are working diligently to complete a detailed research plan as quickly as possible. Preparation of the research plan has required:

- **Articulation of the core science capabilities of each of the three agencies, so as to maximize the coordination of research and funding efficiencies and to minimize the possible overlap of research activities**
- **Identification of the primary research topics and key scientific questions associated with each topic**
- **Coordination of input from scientists and other staff from multiple agencies, including HHS**

- **Gathering of recommendations and suggestions from multiple stakeholder groups, including states, tribes, industry, academia, and non-governmental organizations**
- **Agency review and concurrence.**

Question 2: A USGS staff briefing regarding the tri-agency effort says that the research plan will include steps to promote transparency and maximize stakeholder participation. What is EPA specifically doing to ensure its research activities are transparent and stakeholder inclusive?

Response: During FY 2012 and 2013, all of EPA's unconventional oil and gas research has been devoted to the Congressionally requested Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources. Transparency and stakeholder input has played, and will continue to play, a critical role in this study. The EPA has engaged stakeholders through technical roundtables; technical workshops; public webinars; requests for information via federal register notices; federal, state, and tribal partner consultations; sector-specific meetings; and informational public meetings. In addition, the EPA's Science Advisory Board includes opportunities for the public to provide comments for consideration by panel members during their consultation and peer review processes related to the SAB's review of EPA's Study.

- a. Do you commit to a similar level of transparency for all of EPA's regulatory activities related to unconventional oil and gas production?

Response: Yes. The EPA works hard to ensure transparency in all of its regulatory processes, including for any potential rulemakings related to unconventional oil and gas production.

- b. What stakeholders have been identified for participation, how were they selected, and how will they be able to participate or be included?

Response: Please see response to Question 2 above. The EPA has invited state, tribal, and local government officials; industry; non-governmental organizations; academia; and the public.

- c. Will this include industry stakeholders?

Response: Yes. Please see response to the first part of questions 2 and 2(b) above.

Question 3: Given that the technology used in the hydraulic fracturing process is and has been rapidly evolving, how does the steering committee plan to keep up with current operating conditions?

- a. What efforts are being made to include, consult with, or otherwise involve industry to ensure that the interagency initiative has the most current information and understands the state of the technology and methods being used in the field?

Response: The Tri-agency Steering Committee remains committed to soliciting input from all stakeholders as unconventional oil and gas activities evolve. As an example, last July, the

Steering Committee held webinars for three different groups of external stakeholders: industry; state, tribal, and local governments; and non-governmental organizations. At that time, we described the research areas we thought should be studied and asked these groups:

- **In each of the potential research areas, what are the most important research questions that can be addressed in the short-term? In the long-term?**
- **What would the most useful research products be in the short-term? In the long-term?**
- **Are there other potential research areas that should be considered?**
- **What research is your organization pursuing, and how do you intend to share your research results?**

In addition, the members of the Steering Committee and its Technical Subcommittee continue to participate in many of the numerous technical conferences, meetings, and workshops devoted to this topic and which involve external stakeholders. Lastly, when the draft research plan is completed, we will make the plan available for public comment.

b. How will the steering committee consider ongoing state efforts related to unconventional oil and gas production?

Response: As noted in the response to question 3a, the Steering Committee held webinars for state stakeholders.

**EPA Responses to Questions for the Record from
May 13, 2013 Hearing entitled,
“Review of Federal Hydraulic Fracturing Research Activities”**

Congressman Chris Stewart

Question 1: During a May 8th hearing before a House Appropriations Committee panel, EPA Acting Administrator Bob Perciasepe said EPA is developing guidance on permitting fracking operations in parallel with the pending study on the relationship between hydraulic fracturing and drinking water. What is the relationship between the ongoing study, the guidance on permitting fracking, and this interagency initiative?

Response: Consistent with the Energy Policy Act of 2005, the EPA is developing permitting guidance for oil and gas hydraulic fracturing operations using diesel fuels. Separately, the results of the tri-agency research effort, including the EPA drinking water study that is part of EPA’s contribution to this effort, will inform future potential policy decisions made by federal agencies; state, tribal, and local governments; the oil and gas industry; and others.

- a. Will the EPA wait for the results of the interagency initiative, or wait until that work begins, prior to formulating guidance, or will guidance go forward before and despite this initiative?

Response: The EPA believes that developing guidance on the permitting of hydraulic fracturing operations using diesel fuels is important to provide regulatory certainty, improve compliance with Safe Drinking Water Act requirements and strengthen environmental protections consistent with existing law. The Agency commits to taking into account public comments and relevant scientific information as it works to develop final guidance. However, the EPA does not believe that finalizing this guidance depends upon completion of these interagency research efforts.

Question 2: Has the research plan been considered a Highly Influential Scientific Assessment? Are any of the research projects under this framework being considered a HISA?

Response: The research plan being developed as part of the tri-agency effort is not being considered a Highly Influential Scientific Assessment. Even so, the three agencies are committed to making the draft plan available for public comment.

The EPA considers the final report from its Congressionally requested Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources to be a Highly Influential Scientific Assessment. Whether additional research products from the tri-agency effort will be identified as such, remains to be determined.

Question 3: Will the yet to be released research plan be reviewed by the Scientific Advisory Board? Will the recently convened ad-hoc panel on hydraulic fracturing review or otherwise be allowed to comment on the research plan?

Response: The draft research plan will be available for public comment after the plan has received approval from the three signatories to the Memorandum of Agreement and other agencies interested in unconventional oil and gas production. During the public comment period, individual members of the recently convened EPA Science Advisory Board ad-hoc panel may comment on the draft research plan as individuals but not as SAB representatives. There are no specific restrictions on individual panel members expressing their opinions as members of the public provided they do not make statements that compromise their ability to be objective or impartial in their capacity as members of the ad-hoc panel.

**EPA Responses to Questions for the Record from
May 13, 2013 Hearing entitled,
“Review of Federal Hydraulic Fracturing Research Activities”**

Congresswoman Suzanne Bonamici

Question 1: Please describe in detail what steps are being taken to gather relevant data and information from industry stakeholders to address induced seismicity at hydraulic fracturing sites.

- a. Please include detailed discussion of industry stakeholder cooperation in sharing relevant data and information and any challenges encountered by government agencies.

Response: The EPA defers to the U.S. Geological Survey and/or the Department of Energy to describe the steps being taken to gather relevant data and information from industry stakeholders to address induced seismicity at hydraulic fracturing sites.

- b. Please include a detailed discussion of any relevant information and data and the reasons that industry stakeholders have not provided this information to government agencies.

Response: The EPA defers to the U.S. Geological Survey and/or the Department of Energy to describe the steps being taken to gather relevant data and information from industry stakeholders to address induced seismicity at hydraulic fracturing sites.

Responses by Mr. Guido DeHoratiis

QUESTION FROM REPRESENTATIVE LUMMIS

Q1. The April 13, 2012 Memorandum establishing the interagency initiative stated that “within six months of formation the Steering Committee will have a draft of the research plan for public comment” and the formal multi-year research plan would be formalized within nine months. To date, no research plan has been made public.

a. What is the current status of the research plan?

A1a. A draft of the tri-agency research plan is still under development. The development of a multi-agency research plan in a technically complex, rapidly evolving field is a complicated task.

QUESTION FROM REPRESENTATIVE LUMMIS

Q1. The April 13, 2012 Memorandum establishing the interagency initiative stated that “within six months of formation the Steering Committee will have a draft of the research plan for public comment” and the formal multi-year research plan would be formalized within nine months. To date, no research plan has been made public.

b. When will the draft be available for public comment?

A1b. The plan remains a work in progress. The plan’s development has involved gathering recommendations and suggestions from multiple stakeholder groups including States, industry, academia, and non-governmental organizations. It will be released for public comment upon completion of federal interagency review.

QUESTION FROM REPRESENTATIVE LUMMIS

Q1. The April 13, 2012 Memorandum establishing the interagency initiative stated that “within six months of formation the Steering Committee will have a draft of the research plan for public comment” and the formal multi-year research plan would be formalized within nine months. To date, no research plan has been made public.

c. What will public comment look like in terms of length, notification, and method of comment?

A1c. The tri-agency steering committee has actively engaged stakeholders as the research plan is being developed. Last July, the tri-agency steering committee held a series of webinars for external stakeholders including industry; State and Tribal governments; and environmental and other non-profit organizations. At that time, steering committee representatives described the research areas they thought should be studied, and asked these groups to identify the most important research questions, as well as the research areas their organizations were pursuing. In addition, the members of the steering committee and its technical subcommittee have continued to engage stakeholders at technical conferences, meetings, and workshops devoted to this topic. The three agencies are fully committed to a vigorous public comment period that will be of sufficient duration to receive feedback. The agencies will provide details on the public comment period when the draft plan is released.

QUESTION FROM REPRESENTATIVE LUMMIS

Q1. The April 13, 2012 Memorandum establishing the interagency initiative stated that “within six months of formation the Steering Committee will have a draft of the research plan for public comment” and the formal multi-year research plan would be formalized within nine months. To date, no research plan has been made public.

d. What is the source of or reason for the delay?

A1d. It is complicated to develop a multi-agency research plan in a rapidly-evolving technically complex field that directly impacts U.S. energy sources and the environment. The three agencies are working diligently to complete a detailed research plan as quickly as possible. Preparation of the research plan has required:

- Articulation of the core science capabilities of each of the three agencies to help coordinate research, identify priority research gaps, reduce duplication of research, and identify funding efficiencies,
- Identification of the primary research topics and key scientific questions associated with each topic,
- Coordination of input from scientists and other staff from multiple agencies,
- Gathering of recommendations and suggestions from multiple stakeholder groups including States, industry, academia, and non-governmental organizations, and
- Agency review and concurrence

QUESTION FROM REPRESENTATIVE LUMMIS

- Q2. To date, what funds have been spent on the tri-agency initiative or any of the research areas or objectives within its purview? Please detail how much was spent and on what activities.
- A2. As of yet, no FY 2013 DOE funds have been spent on this initiative. However, DOE is currently soliciting proposals seeking expertise and technical approaches for mitigating issues related to wellbore integrity and zonal isolation (protecting shallow groundwater resources) and by reducing water usage, air emissions, and resource degradation through better unconventional resource stimulation that appropriately matches technology to local geologic and hydrologic conditions. This funding opportunity is a critical component of the DOE research and development portfolio to advance the environmentally-sound development of unconventional natural gas and oil resources.

QUESTION FROM REPRESENTATIVE LUMMIS

- Q3. Given that the technology used in the hydraulic fracturing process is and has been rapidly evolving, how does the steering committee plan to keep up with current operating conditions?
- a. What efforts are being made to include, consult with, or otherwise involve industry to ensure that the interagency initiative has the most current information and understands the state of the technology and methods being used in the field?
- A3a. The tri-agency steering committee remains committed to soliciting input from all stakeholders as unconventional oil and gas activities evolve. As an example, last July, the steering committee held webinars for the three different groups of external stakeholders: industry; State, Tribal, and local governments; and non-governmental organizations. At that time, we described the research areas we thought should be studied and asked these groups:
- In each of the potential research areas, what are the most important research questions that can be addressed in the short-term? In the long-term?
 - What would the most useful research products be in the short-term? In the long-term?
 - Are there other potential research areas that should be considered?
 - What research is your organization pursuing, and how do you intend to share your research results?

In addition, the members of the steering committee and its technical subcommittee continue to participate in many of the numerous technical conferences, meetings, and workshops devoted to this topic that involves external stakeholders. Thus, when the draft research plan is completed and made available for public comment,

it will already reflect the insights and priorities of interested and impacted stakeholders.

QUESTION FROM REPRESENTATIVE LUMMIS

Q3. Given that the technology used in the hydraulic fracturing process is and has been rapidly evolving, how does the steering committee plan to keep up with current operating conditions?

b. How will the steering committee consider ongoing state efforts related to unconventional oil and gas production?

A3b. All three agencies are actively engaged with their state government counterparts in a variety of programmatic areas and activities that seek to advance safe and sustainable oil and gas production in all of its forms (conventional as well as unconventional). For example, DOE interacts with state officials through organizations such as the Interstate Oil and Gas Compact Commission (IOGCC) and the Groundwater Protection Council (GWPC). DOE also works closely with State Review of Oil and Natural Gas Environmental Regulations (STRONGER), a multi-stakeholder organization that is committed to supporting reviews of state oil and natural gas environmental regulatory programs to ensure these programs are sufficiently robust and keep up with the pace and regional character of unconventional resource development across the United States.

Responses by Dr. David Russ

U.S. Geological Survey
Reply to the U.S House of Representatives
Subcommittee on Science, Space and Technology
Review of Hydraulic Fracturing Research Activities
Dr. David Russ

The Honorable Cynthia Lummis

Questions for the Record:

1. The April 13, 2012 Memorandum establishing the interagency initiative stated that “within” six months of formation the Steering Committee will have a draft of the research plan for public comment” and the formal multi-year research plan would be formalized within nine months. To date, no research plan has been made public.

a. What is the current status of the research plan?

Response:

The tri-agency research plan has been developed and is currently being revised. Development of the research plan has been very helpful in both coordinating the research efforts of the three agencies and developing the President’s FY 2014 Budget Request.

b. When will the draft be available for public comment?

Response:

Work on the plan remains a high priority, and it will be released for public comment upon completion of internal, interagency review.

c. What will public comment look like in terms of length, notification, and method of comment?

Response:

The three MOA agencies are fully committed to a vigorous public comment period, and will release the details of the public comment period when the draft plan is released.

d. What is the source of or reason for the delay?

Response:

The development of a multi-agency research plan in a technically complex field, which is both evolving quickly and directly impacts U.S. energy sources and our environment, is a challenging task. Doing so in a period of budgetary uncertainty increases the difficulty of the task. The three MOA agencies are working diligently to complete a detailed research plan as quickly as possible. Preparation of the research plan has required:

1. Articulation of the core science capabilities of each of the three agencies so as to maximize the coordination of research and funding efficiencies and to minimize possible overlap of research activities.
2. Identification of the primary research topics and key scientific questions associated with each topic.
3. Coordination of input from scientists and other staff from multiple agencies, including HHS.
4. Gathering of recommendations and suggestions from multiple stakeholder groups including States, industry, academia, non-governmental organizations.
5. Agency review and concurrence.

The Honorable Suzanne Bonamici

Questions for the record:

1. Please describe in detail what steps are being taken to gather relevant data and information from industry stakeholders to address induced seismicity at hydraulic fracturing sites.
 - a. Please include a detailed discussion of industry stakeholder cooperation in sharing relevant data and information and any challenges encountered by government agencies;
 - b. Please include a detailed description of any relevant information and data and the reasons that industry stakeholders have not provided this information to government agencies.

Response:

Numerous investigations of earthquakes associated with oil and gas production from unconventional reservoirs have revealed that hydraulic fracturing treatments rarely cause earthquakes that are large enough to be felt at the surface. However, injection of wastewater

into deep aquifers occasionally induces earthquakes that are large enough to cause damage to surface structures.

One of the weakest links in our research efforts to understand how fluid injection sometimes induces earthquakes is access to comprehensive injection data. Our attempts to obtain data from industry stakeholders related to earthquakes induced by industrial activities involving fluid injection into geologic formations have been largely unsuccessful. Our sense is that industries involved in oil and gas production, or other operations that entail deep injection of fluids, may be reluctant to share data with a government science agency over concerns about how these data might be used in the future. Furthermore, most states do not require the operators of waste fluid disposal wells to provide injection data that is adequate for research purposes.

Responses by Dr. Robin Ikeda

**Hearing Questions for the Record
The Honorable Chris Stewart**

Review of Federal Hydraulic Fracturing Research Activities

Dr. Robin Ikeda

1. In a press release on November 7, 2011, ATSDR released a draft report on water quality in LeRoy Township in Pennsylvania and stated that “available data suggest to ATSDR that one well was impacted by natural gas activities.” Your written testimony on ATSDR’s activity in LeRoy states ATSDR “did not attempt to conclusively attribute the presence of chemicals detected in the private wells at this site to a definitive source.”

a. Please reconcile the statement from ATSDR’s 2011 press release with your testimony.

The ATSDR press release and the written testimony provided by ATSDR are consistent with each other. As mentioned in the press release, *“The reason for the change in chemical levels in the one well... is unclear. Further evaluation at the site is needed to understand the source of the impacts to the well.”*

b. What are the implications for ATSDR to issue press statements “suggesting” that contamination has resulted in a community from natural gas activities without subjecting such a statement to the scientific rigor required by ATSDR and HHS’ guidelines for government science and expected by the public?

ATSDR has a responsibility to communicate our public health findings to communities in which we work. Prior to any release, information is reviewed internally and by other involved entities, such as EPA or the state health department. For this and all consultations, ATSDR follows a standard public release process to the community, media, and other stakeholders.

2. Your written testimony on ATSDR’s activity in LeRoy Township in Pennsylvania states that “ATSDR recognizes the expertise and authority of EPA and state environmental agencies to determine both the preferred sampling protocols and the sources of contamination.”

a. Did ATSDR work with EPA or state officials to get the benefit of this “expertise” before suggesting in its 2011 press release that data from a residential well suggested it had been “impacted by natural gas activities”?

Yes, ATSDR worked with EPA on the 2011 Chesapeake ATGAS 2H Well Site health consultation. ATSDR’s work at this site was initiated at the request of EPA.

b. Why did ATSDR issue a statement relating to the potential source of contamination if, as you acknowledge, the EPA and state authorities are the experts on issues of contamination sources?

As part of our health assessment process, ATSDR may suggest that EPA or other regulatory agencies collect information to determine potential source(s) so that appropriate actions can be taken to protect health.

c. Will you assure this Committee that no further public statements or suggestions as to alleged contamination from oil and gas activities will be released by ATSDR without a rigorous scientific review process that includes consultation with agencies that have expertise in determining appropriate sampling protocols and sources of contamination?

ATSDR is committed to ensuring scientific integrity and objectivity in all of our work. As appropriate, ATSDR will consult with other agencies with expertise in determining appropriate sampling protocols and sources of contamination.

3. Will you commit that all consultation, assessment, or study relating to health impacts associated with oil and gas activities will be undertaken with a rigorous scientific approach that is consistent with ATSDR's Public Health Assessment Manual and HHS guidelines for government science?

ATSDR is committed to ensuring the scientific integrity and objectivity of all of our work, including the assessment of health hazards near hydraulic fracturing activities. Our site assessment work is conducted in a manner consistent with the guidance found in ATSDR's Public Health Assessment Guidance Manual.

4. Would you agree that consultations relating to health risks from oil and gas activities – activities that are vitally important to this Nation's economy – should be considered "highly influential scientific assessments" and thereby subject to appropriate levels of transparency, rigor, and peer review?

ATSDR's site-related work follows a standard process of scientific review that relies on peer-reviewed comparison values. Prior to any release, information is reviewed internally and by other involved entities, such as EPA or the state health department. ATSDR's site-specific consultations are not considered "scientific studies" or "results of research" and do not fall under the "highly influential" scientific category, as defined by OMB.

5. Will you commit to this Committee that relevant HHS, CDC, and ATSDR officials will schedule a briefing to discuss your Agency's activities relating to communities impacted by shale gas development?

Our relevant agencies and officials will work with the Committee to schedule a briefing.

6. Is ATSDR conducting any public health studies, consultations, or assessments related to the oil and gas industry that have not been at the request and direction of EPA?

a. If yes, provide a list and identify the requestor for these activities.

ATSDR typically receives requests to conduct studies or consultations at the request of EPA and/or state agencies. The following table provides a list of ongoing site-based consultations and the requestor.

Location—Topic	Requestor	Status
Posey County, Indiana— Private well water quality	Indiana Department of Environmental	Conducted in partnership with USGS. Have shared

	Management	results of methane findings with residents. Report in development.
Washington County, PA— Ambient air quality	Private Citizen (request to both ATSDR and EPA)	Conducted in partnership with U.S. EPA. Sampling data collected, report in development.

7. Has EPA or a State Agency ever made a clear source determination related to any oil and gas exploration activities where ATSDR was called into perform a health consultation, assessment, study or evaluation?

ATSDR was advised in two cases that a source determination was made by a regulatory agency related to oil and gas exploration activities in Pennsylvania. At those two sites, where ATSDR conducted a health consultation, the Pennsylvania Department of Environmental Protection determined that natural gas activities were the source of surface water contamination (Leroy, PA) and private well water contamination (Dimock, PA).

8. Does ATSDR recognize that hydrology is a dynamic study of groundwater systems that operate in constant flux in relation to many variables most notably environmental conditions such as rainfall amount, duration, or recharge rates, use, and natural variability in geologic structure?

ATSDR employs a variety of experts including those trained in geology, hydrogeology, and fluid dynamics. ATSDR acknowledges the complexities of hydrology.

a. How have these variables been considered in ATSDR's previous work concerning the development of oil and natural gas resources?

ATSDR recognizes that groundwater and private well sampling provide information on hydrogeological conditions at a single point in time. This same consideration is taken in the development of all our assessments of groundwater concerns regardless of source, including evaluations of drinking water wells near unconventional gas development activities.

9. Is ATSDR's work in regard to the oil and gas extraction industry more informative of the ever changing nature of groundwater as a drinking source particularly for private drinking wells, rather than an attempt to ignore the great lengths that oil and gas companies and State regulatory agencies take to protect this vital resource?

ATSDR supports the president's commitment to the safe development of natural gas as part of an 'all of the above' energy plan. As a public health agency, ATSDR provides public health technical assistance to local, state and federal agencies upon their request to evaluate whether exposures may impact health.