

**FRACTURED SCIENCE:
EXAMINING EPA'S APPROACH
TO GROUNDWATER RESEARCH:
THE PAVILLION ANALYSIS**

HEARING
BEFORE THE
SUBCOMMITTEE ON ENERGY AND
ENVIRONMENT
COMMITTEE ON SCIENCE, SPACE, AND
TECHNOLOGY
HOUSE OF REPRESENTATIVES
ONE HUNDRED TWELFTH CONGRESS

SECOND SESSION

WEDNESDAY, FEBRUARY 1, 2012

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CONTENTS

February 1, 2012

Witness List	Page 2
Hearing Charter	3

Opening Statements

Statement by Representative Andy Harris, Chairman, Subcommittee on Energy and Environment, Committee on Science, Space, and Technology, U.S. House of Representatives	18
Written Statement	20
Statement by Representative Brad Miller, Ranking Member, Subcommittee on Energy and Environment, Committee on Science, Space, and Technology, U.S. House of Representatives	21
Written Statement	22

Witnesses:

Mr. Jim Martin, Region 8 Administrator, Environmental Protection Agency	
Oral Statement	23
Written Statement	25
Mr. Tom Doll, State Oil & Gas Supervisor, Wyoming Oil & Gas Conservation Commission	
Oral Statement	31
Written Statement	33
Ms. Kathleen Sgamma, Vice President, Government & Public Affairs, Western Energy Alliance	
Oral Statement	45
Written Statement	47
Dr. Bernard Goldstein, Professor and Dean Emeritus, Graduate School of Public Health, University of Pittsburgh	
Oral Statement	53
Written Statement	55

Appendix I: Answers to Post-Hearing Questions

Mr. Jim Martin, Region 8 Administrator, Environmental Protection Agency ...	82
Mr. Tom Doll, State Oil & Gas Supervisor, Wyoming Oil & Gas Conservation Commission	98
Ms. Kathleen Sgamma, Vice President, Government & Public Affairs, Western Energy Alliance	120
Dr. Bernard Goldstein, Professor and Dean Emeritus, Graduate School of Public Health, University of Pittsburgh	123

Appendix II: Additional Material for the Record

Submitted Report for the Record by Representative Brad Miller, Ranking Member, Subcommittee on Energy and Environment, Committee on Science, Space, and Technology, U.S. House of Representatives	127
Submitted Letter for the Record by Pavillion Area Concerned Citizens, The Powder River Basin Resource Council, and The Western Organization of Resource Councils	135

IV

	Page
Submitted Statement for the Record by Chairman Ralph Hall, Committee on Science, Space, and Technology, U.S. House of Representatives	145
Submitted Statement for the Record by Representative Paul D. Tonko, Com- mittee on Science, Space, and Technology, U.S. House of Representatives	168

**FRACTURED SCIENCE:
EXAMINING EPA'S APPROACH TO
GROUNDWATER RESEARCH:
THE PAVILLION ANALYSIS**

WEDNESDAY, FEBRUARY 1, 2012

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:10 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Andy Harris [Chairman of the Subcommittee] presiding.

RALPH M. HALL, TEXAS
CHAIRMAN

EDDIE BERNICE JOHNSON, TEXAS
RANKING MEMBER

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

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Subcommittee on Energy & Environment Hearing

*Fractured Science – Examining EPA’s Approach to Ground Water Research:
The Pavillion Analysis*

Wednesday, February 1, 2012
10:00 a.m. to 12:00 p.m.
2318 Rayburn House Office Building

Witnesses

Mr. Jim Martin, Region 8 Administrator, Environmental Protection Agency

Mr. Tom Doll, State Oil & Gas Supervisor, Wyoming Oil & Gas Conservation Commission

Ms. Kathleen Sgamma, Vice President, Government & Public Affairs, Western Energy Alliance

Dr. Bernard Goldstein, Professor and Dean Emeritus, Graduate School of Public Health,
University of Pittsburgh

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

***Fractured Science – Examining EPA’s Approach to Ground Water
Research: The Pavillion Analysis***

**Wednesday, February 1, 2012
10:00 a.m. to 12:00 p.m.
2318 Rayburn House Office Building**

PURPOSE

On Wednesday, February 1, at 10:00 a.m. the Subcommittee on Energy and Environment of the House Committee on Science, Space, and Technology Committee will hold a hearing to review the EPA’s approach to ground water research in Pavillion, Wyoming.

WITNESSES

- **Mr. Jim Martin**, Region 8 Administrator, Environmental Protection Agency
- **Mr. Tom Doll**, State Oil & Gas Supervisor, Wyoming Oil & Gas Conservation Commission
- **Ms. Kathleen Sgamma**, Vice President, Government & Public Affairs, Western Energy Alliance
- **Dr. Bernard Goldstein**, Professor and Dean Emeritus, Graduate School of Public Health, University of Pittsburgh

BACKGROUND

On December 8, 2011, the Environmental Protection Agency (EPA) released a draft report summarizing the Agency’s findings of its groundwater investigation in Pavillion, Wyoming. EPA initiated this inquiry in September 2008 in response to complaints made by some private well-owners in the area regarding taste and odor problems in their well water. Utilizing its authority under the Comprehensive Environmental Response, Compensation, and Liability Act, commonly known as Superfund, the purpose of EPA’s investigation was to determine “the presence, not extent, of groundwater contamination in the area”.¹

¹ EPA Draft Research Report, *Investigation of Ground Water Contamination near Pavillion, Wyoming*, Office of Research and Development, December 2011. Available at http://www.epa.gov/region8/superfund/wy/pavillion/EPA_ReportOnPavillion_Dec-8-2011.pdf (p. xi).

Pavillion, Wyoming

The town of Pavillion is a small agricultural community established in the early 1900s in Fremont County, Wyoming (Figure 1). As of 2010, the town had a reported population of 231 residents. The town of Pavillion and the surrounding areas have a history of poor drinking water quality, which includes issues of objectionable taste and odor. In a report issued by the Wyoming Water Development Commission², it is noted that, for the period immediately following World War II, “most wells produced marginal quality water at best.”³ Additionally, the report characterizes the pursuit of a domestic well with quality water during this time period as “always an uncertain venture”. The problem of variable water quality is due to the complexity of the geology of the Wind River Formation.

*It was determined, through this and other studies, that the water quality of this aquifer varies widely over very short distances between wells. Likewise, water quality varies widely among wells that are of the same depth. In summary, there is no identifiable trend in groundwater quality that shows an area or a drilling depth that offers assurance of installing a well with good quality water.*⁴

To address this problem, the town installed a central water system in the 1940s, which tended to produce higher quality drinking water than the surrounding wells, a trend the Commission concludes is largely the same today.⁵

Pavillion has a history of oil and gas exploration and production dating back to the 1960s. The Pavillion natural gas field—one of several fields within the Wind River Basin—is the focus of the study, as the private drinking water wells of interest in the investigation overlie this formation. According to the EPA report, there are 169 vertical production wells in the Pavillion field.

Investigation

The stated objective of the investigation was to determine if there was a contamination of groundwater above the Pavillion gas field. The specific area of investigation as defined by the EPA study is “a sparsely populated rural area in west-central Wyoming directly east of the town of Pavillion.”⁶ According to the Wyoming Water Development Commission report, the areas north and east of the town historically have been characterized by uncertainty with regard to whether or not one might be able to produce good water quality from a domestic well.

Although EPA has no jurisdiction to regulate the water quality of privately-owned wells, the Agency initiated an investigation under its authority over Superfund due to citizen complaints

² Pavillion Area Water Supply Level 1 Study, for the Wyoming Water Development Commission, October 2011.

³ *ibid.* p. I-1

⁴ *ibid.* p. I-3

⁵ *ibid.*

⁶ EPA Draft Research Report, p. 1

regarding the taste and odor of their water. This collaborative effort between EPA Region 8 and the Office of Research and Development (ORD) included sampling of private residential wells, stock wells used for agriculture, municipal wells, a local creek, produced water, soil, and existing shallow monitoring wells already installed. The deepest stock water well is approximately 800 ft below the surface; however, a majority of the residential wells used for drinking water are drilled to 500 ft or shallower.⁷

In addition, there are 3 shallow pits within the investigation area. These pits are considered legacy sites due to their development and use well before State regulations governing the disposal of wastewater from natural gas and oil production were updated. Although these pits are no longer in use and are undergoing voluntary remediation, they are considered a potential pathway for shallow water contamination as they are part of the same groundwater formation used by most domestic wells. Consistent with this, EPA's report notes that Agency sampling of the shallow monitoring wells near the pits detected high concentrations of "benzene, xylenes, gasoline range organics, diesel range organics, and total purgeable hydrocarbons."⁸ EPA is a member of a stakeholder group working to determine the distance and depth of the shallow groundwater and the contamination caused by these pits.

Based on its preliminary assessment of the study area, EPA decided that the detection of methane and other organic chemicals in domestic wells from its two sampling events in March 2009 and January 2010 warranted drilling two additional monitoring wells in June of 2010. EPA drilled these monitoring wells to a depth of 785 ft and 980 ft below the surface.⁹ (For perspective, the majority of drinking water wells in the area are at a depth of 500 feet or less, and the shallowest natural gas well developed using hydraulic fracturing is 1220 feet.) EPA sampled the monitoring wells in September 2010 and April 2011.

Draft Report

The report, entitled "*Draft Research Report: Investigation of Ground Water Contamination near Pavillion, Wyoming*", was released on December 8, 2011 and published in the Federal Register on December 14, 2011. Notice was given for a 45 day public comment period, until January 27, 2012. EPA subsequently extended this comment period until March 12, 2012.

The draft report postulates numerous "lines of reasoning" associated with various chemical compounds detected through the course of the study, and presents as its key conclusion "that ground water in the aquifer contains compounds likely associated with gas production practices, including hydraulic fracturing".¹⁰ Additional detail regarding EPA methods and findings is summarized in the report's extended abstract (Appendix I), as well as in a recent

⁷ Taucher and Bartos, et al. *Available Groundwater Determination, Technical Memorandum*. WWDC Wing/Bighorn River Basin Plan Update – Groundwater Study. Prepared for the Wyoming Water Development Commission 2010-2011. Chapter 8. Accessed at http://waterplan.state.wy.us/plan/bighorn/2010/finalrept/gw_toc.html

⁸ EPA Draft Report. p. 33.

⁹ Figure 2 shows a bar graph representing the depths of different types of wells in the investigation area. Note the pink line between the two monitoring wells indicating there had been a gas release during the drilling of a drinking water well deeper than the permit allowed, suggesting another potential pathway for contamination of the groundwater.

¹⁰ EPA 2011 News Releases, *EPA Releases Draft Findings of Pavillion, Wyoming Ground Water Investigation for Public Comment and Independent Scientific Review*, 12/08/2011.

Congressional Research Service report.¹¹ Additional background regarding hydraulic fracturing and the EPA's broader comprehensive study of the relationship between hydraulic fracturing and drinking water can be found in the charter of the Committee's May 2011 hearing on "Review of Hydraulic Fracturing Technology and Practices".¹²

In light of immediate and ongoing criticism of the scientific methods used in the study, concerns have been raised with regard to sampling size and integrity, quality assurance and quality control, the construction and drilling of monitoring wells, and the Agency's refusal to publicly release all its data, leaving many unanswered questions.

Issues for Consideration

Data Availability/Transparency

Prior to release of the report, EPA met with representatives of the State of Wyoming and Encana Oil and Gas to discuss its findings. At that time, many items of concern were raised, most of which were outlined in four pages of questions presented at a November 22, 2011 meeting of the Pavillion Technical Working Group, a group consisting of state regulators, industry experts and EPA personnel.¹³

- In a letter dated December 20, 2011¹⁴, Governor Matt Mead wrote to Administrator Lisa Jackson requesting EPA release all the data and records it collected as part of its investigation and to conduct additional testing and analysis.
- On December 21, 2011¹⁵, Encana Oil & Gas (which purchased the Pavillion natural gas field in 2004 and operates production wells located in the study area) sent a similar letter to Jim Martin, EPA Region 8 Administrator, requesting information including records related to analytical methods used to conduct sample testing, methods and materials used in drilling the EPA deep wells, and the raw data results of water samples analyzed by EPA labs and contractor labs.
- Encana Oil & Gas sent a second letter¹⁶ on January 6, 2012 to Assistant Administrator Paul Anastas, reiterating its request for information.
- Governor Mead sent a second letter¹⁷ to Administrator Jackson on January 16, 2012 stating he had not received a response on his request for additional information, more testing, and an extension of the comment period.

On January 19, Administrator Lisa Jackson responded¹⁸ to Governor Mead assuring the Pavillion study was undertaken using the highest level of scientific integrity. Despite this

¹¹ The EPA Draft Report of Groundwater Contamination Near Pavillion, Wyoming: Main Findings and Stakeholder Responses

¹² <http://science.house.gov/hearing/full-committee-hearing-hydraulic-fracturing-technology-0>

¹³ Fugleberg, Jeremy. "Wyoming Officials: No EPA Answer to Our Pavillion Data Questions." Casper Star Tribune [Casper, Wyoming]. 9 December 2011. Online.

¹⁴ Mead, Matt. Letter to EPA Administrator Lisa Jackson. 20 December 2011.

¹⁵ Schopp, John. Letter to EPA Region 8 Administrator James B. Martin. 21 December 2011.

¹⁶ Schopp, John. Letter to Assistant Administrator Paul Anastas. 6 January 2012.

¹⁷ Mead, Matt. Letter to EPA Administrator Lisa Jackson. 16 January 2012.

¹⁸ Jackson, Lisa P. Letter to Wyoming Governor Matt Mead. 19 January 2012.

assertion, EPA has not yet released key information requested by the State and Encana, raising questions as to why such information is being withheld.

Monitoring Wells and Sampling Plan

EPA has a number of guidelines¹⁹ outlining planning requirements for developing a monitoring and sampling plan for Superfund investigation and sites. These guidelines provide steps EPA should take to ensure a scientifically robust study plan. The information available on EPA's website²⁰ dedicated to this study indicates that guidelines related to developing monitoring and sampling plans were not followed. Additionally, a number of Federal and State agencies have been involved in testing and analyzing groundwater quality and availability in the Wind River Formation dating back to the 1950s. In 2005, the United States Geological Survey (USGS) issued a report that specifically lays out a sampling plan for groundwater quality in the Wind River Indian Reservation, Wyoming.²¹ EPA has stated that it did not consult with USGS during the development and execution of this study. Stakeholders have pressed EPA for an explanation regarding the factors that led to selection and location of sampled wells for the initial phases of the study, noting that EPA did not fully eliminate the legacy pits as a source of contamination, and ignored the potential for septic tanks in the area to be a potential pathway of contamination. Concerns have also been raised that the number of sampling events (EPA conducted two sample events on the deep monitoring wells) is insufficient to make statistical inferences and conclusions.

Questions have been raised about EPA's choice for the location of the deep monitoring wells. The utility of installing monitoring wells at a Superfund site is to determine the background water quality and how the area under investigation may have changed it. Typically, this results in a monitoring well upgradient of the suspected contamination, and several wells downgradient of the suspected contamination. The Draft report does not explain why the monitoring wells were drilled where they were. Additionally, the report does not identify which well is intended to be the background quality monitor, nor does it identify in which direction the groundwater flows.

Despite repeated requests from stakeholders, EPA continues to withhold detailed records regarding the drilling, installation and monitoring of the two wells. These wells were drilled and installed without the State of Wyoming's knowledge or assistance. Without these records, it is difficult to eliminate the possibility that EPA's actions in drilling and installing the monitoring wells may have contributed to the contamination detected in the samples.

Quality Assurance/Quality Control

One of the basic ways to test for quality and accuracy of samples taken in the field is the testing of blank samples. These samples are typically distilled water and included among the

¹⁹ EPA Guidance for Monitoring at Hazardous Waste Site: Framework for Monitoring Plan Development and Implementation OSWER Directive No. 9355.4-28; EPA Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan EPA QA/G-SS; EPA Guidance on Data Quality Indicators EPA QA/G-5i

²⁰ <http://www.epa.gov/region8/superfund/xy/pavillion/>

²¹ USGS 2005. "Monitoring-Well Network and Sampling Design for Groundwater Quality, Wind River Indian Reservation, Wyoming." Scientific Investigations Report 2005-5027.

vials of real samples collected in the field for labs to test. Detecting chemical compounds in a blank sample is not unusual, but it does point to a greater potential for cross-contamination of samples at the lab or in the field when the samples are actually bottled. The samples EPA tested were analyzed for contaminants in parts per billion. The level of sensitivity of the equipment needed to accurately detect these low concentrations means an even greater attention to detail is required. It could be as simple as a lab technician not changing their gloves when analyzing successive samples that leads to contamination. A significant number of EPA's blanks were contaminated with the very same compounds it found in the samples from the monitoring wells (albeit at significantly lower concentrations). This raises a number of questions regarding the quality control of the sampling methods used.

Figure 1. Location of physiographic features in and near the Wind River Indian Reservation.²²

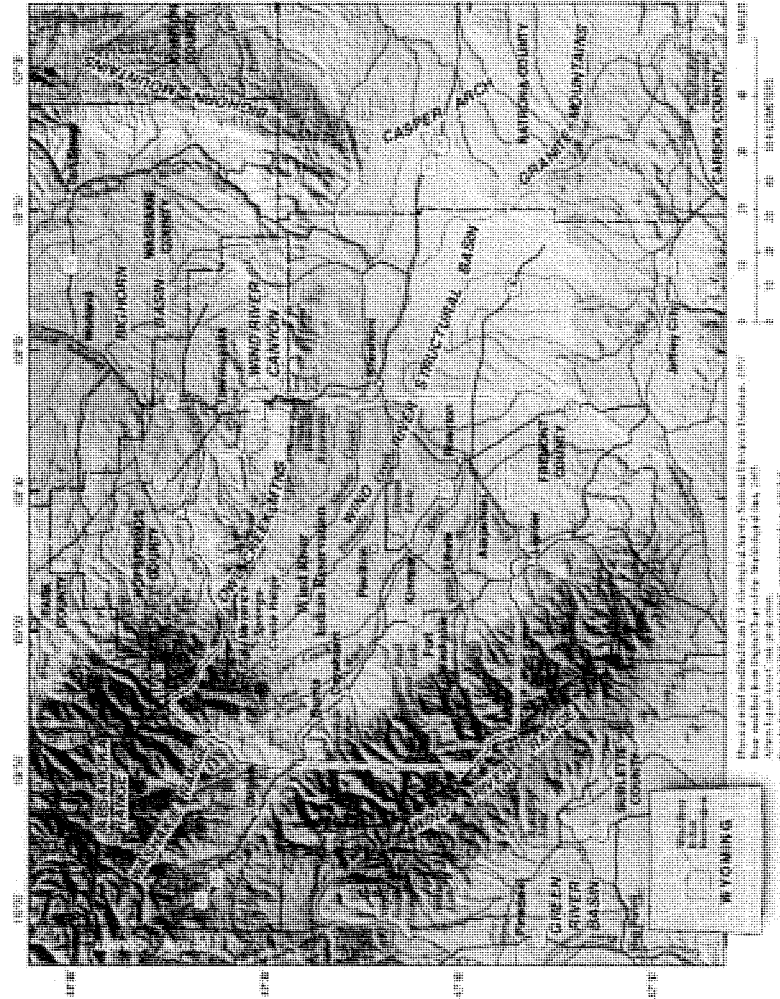
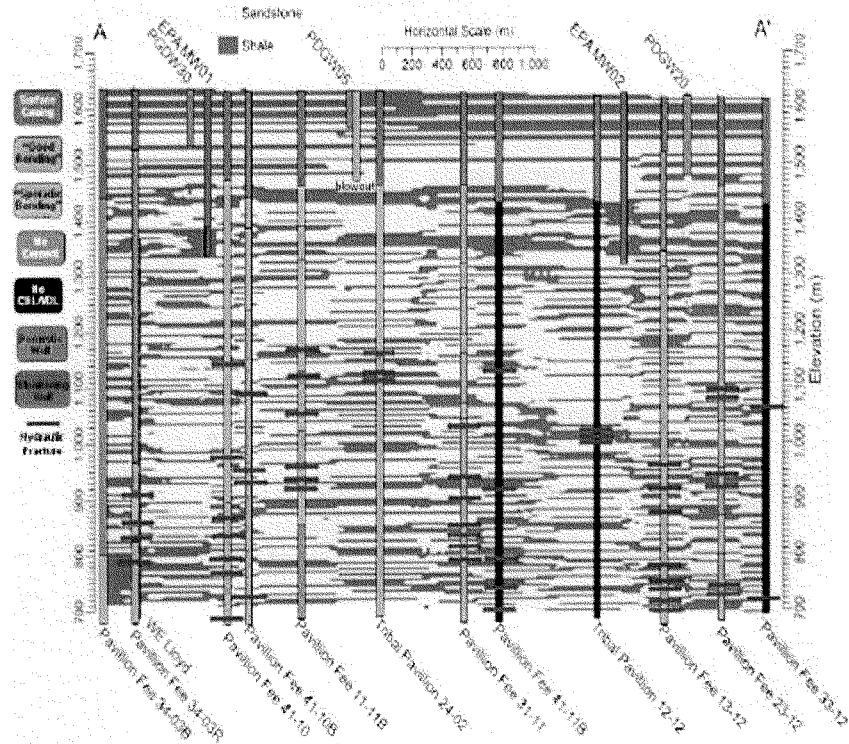


Figure 1. Location of physiographic features in and near the Wind River Indian Reservation, Wyoming.

²² United States Geological Survey. "Monitoring-Well Network and Sampling Design for Ground-Water Quality, Wind River Indian Reservation, Wyoming". Scientific Investigations Report 2005-5027. 2005

Figure 2. Cross-section of well depths near site. Orange lines are EPA monitoring wells drilled. Light blue lines are drinking water wells. Red lines indicate hydraulic fracture in production wells.²³



²³ EPA Draft Report. p. 31.

Appendix I. Extended Abstract from Draft Research Report: Investigation of Ground Water Contamination near Pavillion, Wyoming.

In response to complaints by domestic well owners regarding objectionable taste and odor problems in well water, the U.S. Environmental Protection Agency initiated a ground water investigation near the town of Pavillion, Wyoming under authority of the Comprehensive Environmental Response, Compensation, and Liability Act. The Wind River Formation is the principal source of domestic, municipal, and stock (ranch, agricultural) water in the area of Pavillion and meets the Agency's definition of an Underground Source of Drinking Water. Domestic wells in the area of investigation overlie the Pavillion gas field which consists of 169 production wells which extract gas from the lower Wind River Formation and underlying Fort Union Formation. Hydraulic fracturing in gas production wells occurred as shallow as 372 meters below ground surface with associated surface casing as shallow as 110 meters below ground surface. Domestic and stock wells in the area are screened as deep as 244 meters below ground surface. With the exception of two production wells, surface casing of gas production wells do not extend below the maximum depth of domestic wells in the area of investigation. At least 33 surface pits previously used for the storage/disposal of drilling wastes and produced and flowback waters are present in the area. The objective of the Agency's investigation was to determine the presence, not extent, of ground water contamination in the formation and if possible to differentiate shallow source terms (pits, septic systems, agricultural and domestic practices) from deeper source terms (gas production wells).

The Agency conducted four sampling events (Phase I - IV) beginning in March 2009 and ending in April, 2011. Ground water samples were collected from domestic wells and two municipal wells in the town of Pavillion in Phase I. Detection of methane and dissolved hydrocarbons in several domestic wells prompted collection of a second round of samples in January, 2010 (Phase II). During this phase, EPA collected additional ground water samples from domestic and stock wells and ground water samples from 3 shallow monitoring wells and soil samples near the perimeter of three known pit locations. Detection of elevated levels of methane and diesel range organics (DRO) in deep domestic wells prompted the Agency to install 2 deep monitoring wells screened at 233 - 239 meters (MW01) and 293 - 299 meters (MW02) below ground surface, respectively, in June 2010 to better evaluate to deeper sources of contamination. The expense of drilling deep wells while utilizing blowout prevention was the primary limiting factor in the number of monitoring wells installed. In September 2010 (Phase III), EPA collected gas samples from well casing from MW01 and MW02. In October 2010, EPA collected ground water samples from MW01 and MW02 in addition to a number of domestic wells. In April 2011 (Phase IV), EPA resampled the 2 deep monitoring wells to compare previous findings and to expand the analyte list to include glycols, alcohols, and low molecular weight acids.

Detection of high concentrations of benzene, xylenes, gasoline range organics, diesel range organics, and total purgeable hydrocarbons in ground water samples from shallow monitoring wells near pits indicates that pits are a source of shallow ground water

contamination in the area of investigation. When considered separately, pits represent potential source terms for localized ground water plumes of unknown extent. When considered as whole they represent potential broader contamination of shallow ground water. A number of stock and domestic wells in the area of investigation are fairly shallow (e.g., < 30 meters below ground surface) representing potential receptor pathways.

Determination of the sources of inorganic and organic geochemical anomalies in deeper ground water was considerably more complex than determination of sources in shallow media necessitating the use of multiple lines of reasoning approach common to complex scientific investigations. pH values in MW01 and MW01 are highly alkaline (11.2-12.0) with up to 94% of the total alkalinity contributed by hydroxide suggesting addition of a strong base as the causative factor. Reaction path modeling indicates that sodium-sulfate composition of ground water typical of deeper portions of the Wind River Formation provides little resistance to elevation of pH with small addition of potassium hydroxide. Potassium hydroxide was used in a crosslinker and in a solvent at this site.

The inorganic geochemistry of ground water from the deep monitoring wells is distinctive from that in the domestic wells and expected composition in the Wind River formation. Potassium concentration in MW02 (43.6 milligrams per liter) and MW01 (54.9 milligrams per liter) is between 14.5 and 18.3 times values in domestic wells and expected values in the formation. Chloride concentration in monitoring well MW02 (466 milligrams per liter) is 18 times the mean chloride concentration (25.6 milligrams per liter) observed in ground water from domestic wells and expected in the formation. Chloride enrichment in this well is significant because regional anion trends show decreasing chloride concentration with depth. In addition, the monitoring wells show low calcium, sodium, and sulfate concentrations compared to the general trend observed in domestic well waters. The formulation of fracture fluid provided for carbon dioxide foam hydraulic fracturing jobs typically consisted of 6% potassium chloride. Potassium metaborate was used in crosslinkers. Potassium hydroxide was used in a crosslinker and in a solvent. Ammonium chloride was used in crosslinker.

A number of synthetic organic compounds were detected in MW01 and MW02. Isopropanol was detected in MW01 and MW02 at 212 and 581 micrograms per liter, respectively. Diethylene glycol was detected in MW01 and MW02 at 226 and 1570 micrograms per liter, respectively. Triethylene glycol was detected in MW01 and MW02 at 46 and 310 micrograms per liter, respectively. Another synthetic compound, tert-butyl alcohol, was detected in MW02 at a concentration of 4470 micrograms per liter. Isopropanol was used in a biocide, in a surfactant, in breakers, and in foaming agents. Diethylene glycol was used in a foaming agent and in a solvent. Triethylene glycol was used in a solvent. Tert-butyl alcohol is a known breakdown product of methyl tert-butyl ether (a fuel additive) and tert-butyl hydro peroxide (a gel breaker used in hydraulic fracturing). Material Safety Data Sheets do not indicate that fuel or tert-butyl hydroperoxide were used in the Pavillion gas field. However, Material Safety Data Sheets do not contain proprietary information and the chemical ingredients of many additives.

The source of tert-butyl alcohol remains unresolved. However, tert-butyl alcohol is not expected to occur naturally in ground water.

Benzene, toluene, ethylbenzene, and xylenes (BT-X) were detected in MW02 at concentrations of 246, 617, 67, and 750 micrograms per liter, respectively. Trimethylbenzenes were detected in MW02 at 105 micrograms per liter. Gasoline range organics were detected in MW01 and MW02 at 592 and 3710 micrograms per liter. Diesel range organics were detected in MW01 and MW02 at 924 and 4050 micrograms per liter, respectively. Aromatic solvent (typically BTEX mixture) was used in a breaker. Diesel oil (mixture of saturated and aromatic hydrocarbons including naphthalenes and alkylbenzenes) was used in a guar polymer slurry/liquid gel concentrate and in a solvent. Petroleum raffinates (mixture of paraffinic, cycloparaffinic, olefinic, and aromatic hydrocarbons) were used in a breaker. Heavy aromatic petroleum naphtha (mixture of paraffinic, cycloparaffinic and aromatic hydrocarbons) was used in surfactants and in a solvent. Toluene and xylene were used in flow enhancers and a breaker.

Detections of organic chemicals were more numerous and exhibited higher concentrations in the deeper of the two monitoring wells. Natural breakdown products of organic contaminants like BTEX and glycols include acetate and benzoic acid. These breakdown products are more enriched in the shallower of the two monitoring wells, suggesting upward/lateral migration with natural degradation and accumulation of daughter products. Hydraulic gradients are currently undefined in the area of investigation. However, there are flowing conditions in a number of deep stock wells suggesting that upward gradients exist in the area of investigation.

Alternative explanations were carefully considered to explain individual sets of data. However, when considered together with other lines of evidence, the data indicates likely impact to ground water that can be explained by hydraulic fracturing. A review of well completion reports and cement bond/variable density logs in the area around MW01 and MW02 indicates instances of sporadic bonding outside production casing directly above intervals of hydraulic fracturing. Also, there is little lateral and vertical continuity of hydraulically fractured tight sandstones and no lithologic barrier (laterally continuous shale units) to stop upward vertical migration of aqueous constituents of hydraulic fracturing in the event of excursion from fractures. In the event of excursion from sandstone units, vertical migration of fluids could also occur via nearby well bores. For instance, at one production well, the cement bond/variable density log indicates no cement until 671 m below ground surface. Hydraulic fracturing occurred above this depth at nearby production wells.

A similar lines of reasoning approach was utilized to evaluate the presence of gas in monitoring and domestic wells. A comparison of gas composition and stable carbon isotope values indicate that gas in production and monitoring wells is of similar thermogenic origin and has undergone little or no degradation. A similar evaluation in domestic wells suggests the presence of gas of thermogenic origin undergoing biodegradation. This observation is consistent with a pattern of dispersion and degradation with upward migration observed for organic compounds.

Elevated levels of dissolved methane in domestic wells generally increase in those wells in proximity to gas production wells. Near surface concentrations of methane appear highest in the area encompassing MW01. Ground water is saturated with methane at MW01 which is screened at a depth (239 meters below ground surface) typical of deeper domestic wells in the area. A blowout occurred during drilling of a domestic well at a depth of only 159 meters below ground surface close to MW01. A mud-gas log conducted in 1980 (prior to intensive gas production well installation) located only 300 m from the location of the blowout does not indicate a gas show (distinctive peaks on a gas chromatograph) within 300 meters of the surface. Again, with the exception of two production wells, surface casing of gas production wells do not extend below the maximum depth of domestic wells in the area of investigation. A number of production wells in the vicinity of MW01 have sporadic bonding or no cement over large vertical instances. Again, alternate explanations of data have been considered. Although some natural migration of gas would be expected above a gas field such as Pavillion, data suggest that enhanced migration of gas has occurred within ground water at depths used for domestic water supply and to domestic wells. Further investigation would be needed to determine the extent of gas migration and the fate and transport processes influencing migration to domestic wells.

Chairman HARRIS. The hearing is called.

I am going to read, before we start the hearing, I just want to remind all the Members of the audience what the Committee rules are, and as a functioning body, a legislative body, we of course have rules. That is the way society works. You have to live by the rules and agree to the rules, and the Ranking Member had indicated before the hearing was gavelled in that we should discuss it, but I will bring the Ranking Member's attention to the rule, rule number 9, the following shall apply to coverage of Committee meetings or hearings by audio or visual means, subsection J is very clear: personnel providing coverage by the television or radio media shall be currently accredited to the radio and television correspondents galleries and that personnel providing coverage by still photography shall be currently accredited to the press photographers galleries.

Obviously, someone who records this hearing is to be credentialed. I will remind the Members of the audience and the Ranking Member that on the House Floor, you can't even bring a cell phone into the gallery. We allow cell phones but we do draw the line at what recording devices, when you use a recording device, that you have to be credentialed.

I would also note that this hearing is being webcast at science.house.gov in its entirety, every word, every phrase, no editing, and it will be available in its entirety on the same site following the hearing. Therefore, every piece of information from this hearing is fully available to every member of the public. That is why we have rules that control who is recording because every bit of information is available to the public, just so we clear the air on that.

With that, I would like to begin my opening statement.

Mr. MILLER. Mr. Chairman, I move—in addition to the fellow who was just escorted out, who I understand was not credentialed, although he is, I understand, filming an HBO documentary, an ABC crew showed up earlier and they were turned away on the stated reason that they had not requested the film in advance. I think all those rules are to control access where there is limited access. It is very clear that we have space in this room for either of them to testify—to film this hearing.

If you claim that that rule does not provide—does not allow them to film or more accurately allows you the discretion, the majority the power to turn them away, I move that the rules be suspended to the end, that the HBO—the fellow who wanted to film for HBO be allowed to film this hearing and that ABC News be allowed to film this hearing, and all God's children be allowed to film this hearing until the room is too full to conduct our business.

Chairman HARRIS. Does the Ranking Member intend to persist with that motion?

Mr. MILLER. I do.

Chairman HARRIS. Well, then, we are calling a recess because we don't have a quorum on the Committee.

[Recess.]

Chairman HARRIS. All opposed? In the opinion of the Chair, the ayes have it.

Mr. MILLER. Mr. Chairman, I ask for a recorded vote.

Chairman HARRIS. A recorded vote is ordered. The clerk will call the roll.

The CLERK. Chairman Harris?

Chairman HARRIS. Aye.

The CLERK. Chairman Harris votes aye.

Mr. Rohrabacher?

[No response.]

The CLERK. Mr. Bartlett?

[No response.]

The CLERK. Mr. Lucas?

Mr. LUCAS. Aye.

The CLERK. Mr. Lucas votes aye.

Mrs. Biggert?

[No response.]

The CLERK. Mr. Akin?

Mr. AKIN. Aye.

The CLERK. Mr. Akin votes aye.

Mr. Neugebauer?

Mr. NEUGEBAUER. Aye.

The CLERK. Mr. Neugebauer votes aye.

Mr. Broun?

Dr. BROUN. Aye.

The CLERK. Mr. Broun votes aye.

Mr. Fleischmann?

Mr. FLEISCHMANN. Aye.

The CLERK. Mr. Fleischmann votes aye.

Mr. Hall?

Chairman HALL. Aye.

The CLERK. Mr. Hall votes aye.

Mr. Miller?

Mr. MILLER. No.

The CLERK. Mr. Miller votes no.

Ms. Woolsey?

Ms. WOOLSEY. No.

The CLERK. Ms. Woolsey votes no.

Mr. Lujan?

[No response.]

The CLERK. Mr. Tonko?

Mr. TONKO. No.

The CLERK. Mr. Tonko votes no.

Ms. Lofgren?

Ms. LOFGREN. No.

The CLERK. Ms. Lofgren votes no.

Mr. McNerney?

Mr. MCNERNEY. No.

The CLERK. Mr. McNerney votes no.

Ms. Johnson?

Ms. JOHNSON. No.

The CLERK. Ms. Johnson votes no.

Chairman HARRIS. Have all Members voted? Anyone wish to change their vote?

Will the clerk report the vote?

The CLERK. Mr. Chairman, seven Members vote aye and six Members vote no.

Chairman HARRIS. The motion to table having been passed, the motion is laid on the table. I will——

Mr. MILLER. Mr. Chairman, I move that the Committee be in recess for a period of not less than one week to allow the gentleman from HBO to apply for press credentials and to allow ABC News and any other credentialed press organization to provide the overnight notice that they intend to film this hearing.

Dr. BROUN. Mr. Chairman?

Chairman HARRIS. The gentleman from Georgia.

Dr. BROUN. I move to table the motion.

Chairman HARRIS. There is a motion to table the motion. All in favor, say aye. All opposed? In the opinion of the chair, the ayes have it.

Mr. MILLER. Mr. Chairman, I ask for a recorded vote.

Chairman HARRIS. A recorded vote is requested. The clerk will call the roll.

The CLERK. Mr. Harris?

Chairman HARRIS. Aye.

The CLERK. Mr. Harris votes aye.

Mr. Rohrabacher?

[No response.]

The CLERK. Mr. Bartlett?

[No response.]

The CLERK. Mr. Lucas?

Mr. LUCAS. Aye.

The CLERK. Mr. Lucas votes aye.

Mrs. Biggert?

[No response.]

The CLERK. Mr. Akin?

Mr. AKIN. Aye.

The CLERK. Mr. Akin votes aye.

Mr. Neugebauer?

Mr. NEUGEBAUER. Aye.

The CLERK. Mr. Neugebauer votes aye.

Mr. Broun?

Dr. BROUN. Aye.

The CLERK. Mr. Broun votes aye.

Mr. Fleischmann?

Mr. FLEISCHMANN. Aye.

The CLERK. Mr. Fleischmann votes aye.

Mr. Hall?

Chairman HALL. Aye.

The CLERK. Mr. Hall votes aye.

Mr. Miller?

Mr. MILLER. No.

The CLERK. Mr. Miller votes no.

Ms. Woolsey?

Ms. WOOLSEY. No.

The CLERK. Ms. Woolsey votes no.

Mr. Lujan?

[No response.]

The CLERK. Mr. Tonko?

Mr. TONKO. No.

The CLERK. Mr. Tonko votes no.

Ms. Lofgren?

Ms. LOFGREN. No.

The CLERK. Ms. Lofgren votes no.

Mr. McNerney?

Mr. MCNERNEY. No.

The CLERK. Mr. McNerney votes no.

Ms. Johnson?

Ms. JOHNSON. No.

The CLERK. Ms. Johnson votes no.

Chairman HARRIS. Any Members wish to change their vote? If no, the clerk will report the roll.

The CLERK. Mr. Chairman, seven Members vote aye and six Members vote no.

Chairman HARRIS. The majority voting to table the motion, the motion is tabled.

Thank you very much, and sorry for the delay, but as the chairman of the full Committee has said, you know, if the minority wants a vote on something, they will get a vote on it each and every time.

I want to welcome everyone to this morning's hearing to examine EPA's approach to groundwater research near Pavillion, Wyoming.

The increased production and use of clean natural gas is the source of one of the few bright spots in our current economic climate. In 2010, the shale gas industry supported 600,000 jobs, and a Federal Reserve economist estimates that lower natural gas prices enabled by increased production saved American consumers more than \$16 billion in home energy costs last year, and of course, the price of natural gas has come down since last year. So it would be more than \$16 billion in home energy costs saved each year from natural gas.

Wyoming is a perfect case study. Tens of thousands of people are employed in oil and gas production, and royalties and taxes on that production delivered almost \$2 billion going to state and local taxpayer coffers, more than \$3,400 for every citizen in the state.

However, in a remarkable display of arrogance and disregard for the plain facts, the President last week proclaimed his support for expanded shale gas production, while at the same time allowing every part of his Administration, from the EPA to the Department of the Interior to the CDC, to attack these practices through scientific innuendo and regulatory strait-jacketing.

In the past year, the Subcommittee has held numerous hearings on EPA's use and abuse of science. Time and again we have demonstrated that this agency is substituting outcome-driven science for rigorous objective science. EPA's investigation of groundwater contamination in Pavillion appears to be yet another example of politics trumping policy and advocacy trumping science.

The scientific method is a process characterized by the development of a hypothesis, creation of a rigorous experiment to test it, documentation of observations and objective analysis of results. Scientists in fact frequently believe that sharing the data is an important part of the scientific process. As far as I can see, EPA never managed to get even farther than the first step of most normal scientific investigation.

EPA will no doubt emphasize today that this is a draft report that will soon undergo peer review. This fails to acknowledge, however, the impact this report has already had. The day after the draft report was released, the Governor of Delaware announced that it was the validation for his decision to vote against development of natural gas in the Delaware River Basin. This illustrates the power of EPA's press release science to drive public opinion and even critical decisions by policymakers.

The key question before us today is, was the investigation conducted in a scientifically robust manner that justifies all this potential economic upheaval?

I look forward to hearing from witnesses, but I am concerned about indications that EPA's approach in Wyoming has been poorly conducted, unnecessarily alarming, and fits within a pattern of an outcome-driven, regulate-for-any-excuse philosophy at the agency.

Transparency is central to getting to the bottom of these scientific questions. Regardless that the President boasts that he leads the "most transparent Administration in history" and despite receiving multiple requests from state, media, and interested stakeholders, interestingly enough, it was not until late last night, the eve of this hearing, that EPA finally disclosed data essential to meaningfully evaluate their findings. Now, note that the original deadline for comment passed two weeks ago. Well, I am not sure how the EPA thought that people were going to make decisions on the adequacy of this study without the information that now the EPA I guess feels essential to make those kind of determinations.

Now, while I am pleased that EPA posted 622 documents to its website last night, and I would offer that maybe they should follow the same rules the House has that you need 3 days of putting something out before you should actually consider it, clearly, that is not enough time for this Committee to take that into consideration in the hearing today. It is unfortunate that this transparency appears to only have been compelled by the calling of a Congressional oversight hearing, but then again, maybe that is the purpose of the 112th Congress.

Compounding this problem is the complete failure to collaborate with experts and institutions with knowledge in the unique hydrogeology of this region. For example, the State of Wyoming, despite possessing decades of experience in groundwater assessments, was not consulted with about the most important aspects of this investigation, and we will hear from one of our witnesses today about that. The agency did not even consult with the U.S. Geological Survey before releasing the report, a sister government agency that has extensive understanding of aquifer complexity and geological characteristics in the region. Also concerning is EPA's apparent failures to follow its own laboratory protocols, Superfund site requirements, peer review handbook, information quality guidelines, as well as USGS recommendations for drilling and sampling monitoring wells.

Hypocritically, these are behaviors and practices that the agency would not accept from any state or private sector entity conducting a comprehensive groundwater investigation.

Finally, I'm afraid EPA's actions in Pavillion demonstrate a disturbing loss of perspective. The principal concern of this investiga-

tion should always have been the health and welfare of the people living near Pavillion, Wyoming. Unfortunately, in its single-minded pursuit of the hydraulic fracturing smoking gun, EPA appears to have lost focus on identifying the real causes of, and real solutions to, drinking water quality problems locally in Pavillion, Wyoming.

I want to thank the witnesses for appearing before the Subcommittee and I look forward to a constructive discussion.

[The prepared statement of Mr. Harris follows:]

PREPARED STATEMENT OF CHAIRMAN ANDY HARRIS

I want to welcome everyone to this morning's hearing to examine EPA's approach to ground water research near Pavillion, Wyoming.

The increased production and use of clean natural gas is the source of one of the few bright spots in our current economic climate. In 2010, the shale gas industry supported 600,000 jobs, and a Federal Reserve economist estimates that lower natural gas prices enabled by increased production saved American consumers more than \$16 billion in home energy costs in 2010. Wyoming is a perfect case study—tens of thousands of people are employed in oil and gas production, and royalties and taxes on that production delivered almost \$2 billion go to State and local taxpayer coffers—more than \$3,400 for every citizen in the State.

However, in a remarkable display of arrogance and disregard for the plain facts, the President last week proclaimed his support for expanded shale gas production, while at the same time allowing every part of his Administration—from the EPA to Interior to the CDC—to attack these practices through scientific innuendo and regulatory straight-jacketing.

In the past year, this Subcommittee has held numerous hearings on EPA's use and abuse of science. Time and again we have demonstrated that this Agency is substituting outcome-driven science for rigorous objective science. EPA's investigation of groundwater contamination in Pavillion appears to be yet another example of politics trumping policy and advocacy trumping science.

The scientific method is a process characterized by the development of a hypothesis, creation of a rigorous experiment to test it, documentation of observations and objective analysis of results. As far as I can see, EPA never managed to get farther than the first step.

EPA will no doubt emphasize today that this is a draft report that will soon undergo peer review. This fails to acknowledge, however, the impact this report has already had. The day after the draft report was released, the Governor of Delaware announced that it was the validation for his decision to vote against development of natural gas in Delaware River Basin. This illustrates the power of EPA's "press release science" to drive public opinion and even critical decisions by policymakers.

The key question before us today is, was the investigation conducted in a scientifically robust manner that justifies all this upheaval? I look forward to hearing from witnesses, but am concerned about indications that EPA's approach in Wyoming has been poorly conducted, unnecessarily alarming, and fits within a pattern of an outcome-driven, "regulate-for-any-excuse" philosophy at the Agency.

Transparency is central to getting to the bottom of these scientific questions. Regardless that the President boasts that he leads the "most transparent Administration in history" and despite receiving multiple requests from state, media, and interested stakeholders, it was not until late last night, that EPA finally disclosed data essential to meaningfully evaluate their findings. While I am pleased that EPA posted 622 documents to its website last night, it is unfortunate that this transparency appears to only have been compelled by the calling of a Congressional oversight hearing.

Compounding this problem is the complete failure to collaborate with experts and institutions with knowledge in the unique hydrogeology of this region. For example, the state of Wyoming, despite possessing decades of experience in ground water assessments, was not consulted with about the most important aspects of this investigation. The Agency did not even consult with the U.S. Geological Survey before releasing the report, a sister agency that has extensive understanding of aquifer complexity and geological characteristics.

Also concerning is EPA's apparent failures to follow its own laboratory protocols, Superfund site requirements, peer review handbook, information quality guidelines, as well as USGS recommendations for drilling and sampling monitoring wells. Hypocritically, these are behaviors and practices that the Agency would not accept from

any state or private sector entity conducting a comprehensive ground water investigation.

Finally, I'm afraid EPA's actions in Pavillion demonstrate a disturbing loss of perspective. The principle concern of this investigation should be the health and welfare of the people living near Pavillion, WY. Unfortunately, in its single-minded pursuit of the hydraulic fracturing smoking gun, EPA appears to have lost focus on identifying the real causes of, and real solutions to, drinking water quality problems in Pavillion.

I want to thank the witnesses for appearing before the Subcommittee and I look forward to a constructive discussion.

Chairman HARRIS. The Chair now recognizes Mr. Miller for five minutes of an opening statement.

Mr. MILLER. Thank you, Chairman Harris.

The stated purpose of this hearing is to examine the methodology, the quality assurance, the peer review process and the like of an EPA study that links hydraulic fracturing, or fracking, and groundwater contamination near Pavillion, Wyoming.

The principal criticism of the EPA is that the EPA's procedures have lacked transparency. EPA conducted the study in response to requests by citizens in the area. After fracking operations began there, they began to suffer headaches, sore throat, nausea, sinus problems and other symptoms that are known to be associated with the contaminants found in Pavillion's drinking water supply by the EPA study. EPA—it is a draft report that is the product of three years of research. The report is subject to a public comment period, followed by peer review. EPA has extended the public comment period for 45 days beyond—from 45 days to 90 days at the request of industry. Public comments are due by March 12, 2012. EPA is now soliciting also nominations for disinterested experts to serve as peer reviewers, real scientists, not members of the Science Committee, real scientists. Once selected, the peer review panel will have 30 days to complete their work. In other words, the Pavillion study is a work in progress and all the criticisms we will hear today are a part of the public comment and part of the peer review process.

The Pavillion study does not call for any regulation of fracking. Their study is part of risk assessment, not risk management. Risk assessment informs risk management. Once we know the risks, EPA will then weigh of the economic benefits and the potential public health consequences of fracking to determine what safeguards, if any, are appropriate to develop needed natural gas resources while protecting the environment and public health.

Although the industry and their political allies dismiss the concerns about fracking as uninformed hysteria, their refusal to provide basic information about the operations, their operations and their efforts to hinder independent scientific research like the Pavillion study cannot be reassuring to citizens living near fracking operations. The industry has refused to disclose the chemicals they inject into the earth, claiming that the information is proprietary, their "secret sauce." But the draft Pavillion study is not the only study to find groundwater contamination, and at least one instance of surface water contamination, near fracking operations by chemicals not ordinarily found in nature and known to be part of the secret sauce. Some of the chemicals are known carcinogens.

In short, the public concern about fracking seems very reasonable. The question is not whether we are pro-drilling or anti-drill-

ing. The question is whether we will drill with our eyes open. The public wants to know if fracking is safe, and they are entitled to know. But the industry and their political allies just say, in effect, move along, there is nothing to see here.

The integrity of scientific research at EPA is properly the subject of this Subcommittee's interest, although none of the Republican witnesses today appear to satisfy the requirements of disinterested expertise to serve as peer reviewers. With no disinterested scientists as witnesses, a reasonable question is whether this hearing is really about the science, the integrity of the science, or if it is just a big wink and nod to the industry that the majority is on their side no matter what.

I yield back the balance of my time.

[The prepared statement of Mr. Miller follows:]

PREPARED STATEMENT OF RANKING MEMBER BRAD MILLER

Thank you Chairman Harris

The stated purpose of this hearing is to examine the methodology, quality assurance, the peer review process and the like of an EPA study that links hydraulic fracturing, or "fracking," and groundwater contamination near Pavillion, Wyoming. EPA conducted the study in response to requests by citizens in the area. The draft report is the product of three years of research. The report is subject to a public comment period, followed by a peer review. EPA has extended the public comment period from 45 days to 90 days at the request of industry. Public comments are due by March 12, 2012. EPA is also now soliciting nominations for disinterested experts to serve as peer reviewers. Once selected, the peer review panel will have thirty days to complete their work.

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Chairman HARRIS. Thank you very much, Mr. Miller.

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

I would like to introduce our witness panel at this time, and again, I am going to apologize to the witnesses for the delay we had at the beginning of the hearing, but again, you know, one of our principles is, we make certain that, you know, minority or majority, if someone makes a motion, they are going to get a vote.

Our first witness today is Mr. James B. Martin. Mr. Martin is the Regional Administrator for Region 8 at the Environmental Protection Agency. He has worked in the environmental field for nearly 30 years. Prior to his career in public service, Mr. Martin managed Western Resource Advocates, a nonprofit focused on energy, public lands and water issues.

Our next witness will be Mr. Tom Doll. Mr. Doll is the State Oil and Gas Supervisor at the Wyoming Oil and Gas Conservation Commission. Prior to becoming supervisor, he had 38 years' experience in petroleum engineering and management, primarily in Wyoming and the northern Rockies. He is Wyoming's official representative to the Interstate Oil and Gas Compact Commission.

Our third witness is Ms. Kathleen Sgamma. Ms. Sgamma is the Vice President of Government and Public Affairs at the Western Energy Alliance. She handles federal legislative, public lands, environmental and regulatory issues for companies involved in all aspects of exploration and production of oil and natural gas in the West.

Our final witness is Dr. Bernard Goldstein. Dr. Goldstein is a Professor and Dean Emeritus at the Graduate School of Public Health at the University of Pittsburgh. He is a physician, board certified in internal medicine, hematology and toxicology. He also served as Assistant Administrator for EPA's Office of Research and Development from 1983 to 1985.

I want to thank you all for appearing before the Subcommittee today, and again, thank you very much for your patience in waiting to testify.

As our witnesses should know, spoken testimony is limited to five minutes each after which the Members of the Committee will have five minutes each to ask question.

I now recognize our first witness, Mr. James Martin from the Environmental Protection Agency.

STATEMENT OF MR. JIM MARTIN, REGION 8 ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY

Mr. MARTIN. Good morning, Chairman Harris Ranking Member Miller and other Members of the Committee. My name is Jim Martin, and I am the Regional Administrator for the Environmental Protection Agency's Region 8. That is the region that encompasses the Dakotas, Montana, Utah, Wyoming and Colorado. I am here today to talk with you about the agency's groundwater investigation at Pavillion, Wyoming.

In the spring of 2008, EPA staff at our regional office were contacted by a group of people from the rural community of Pavillion in central Wyoming. They had noticed a change in their drinking water, in its odor, its taste and its color, and wanted to know not only what had happened but whether their water was safe to drink.

While the state had directed the operating company to test the water, the results were inconclusive and left the residents without those critical answers. After conferring with our state colleagues and with the Northern Arapahoe and Eastern Shoshone Tribes of the Wind River Indian Reservation, EPA agreed in 2008 to conduct additional sampling.

To ensure as thorough an approach as possible, we developed a plan that included a broad list of compounds at the lowest levels of detection. We conducted our initial round of sampling in March 2009. We looked at both domestic drinking water wells and at two of the wells that serve the town Pavillion just west of the Pavillion oil and gas field. We found that roughly a third of the domestic wells had detections of organic compounds including methane, total petroleum hydrocarbons and some other organics the lab was able to tentatively identify but not quantify.

Our phase 2 sampling was again planned in collaboration with the tribes, the state and the operating company, in this case, Encana. Our goal was to better quantify the chemicals present in order to assess potential health risks and to identify potential sources. Again, we considered a wide range of potential sources in developing the sampling plan. The sampling plan—the sampling, rather, occurred in January of 2010 but in a more refined area based on the results from our phase 1 sampling. Again, we confirmed that organic chemicals of concern were present in 16 of the 17 domestic well samples including methane and petroleum hydrocarbons. We also sampled shallow pit monitoring wells and found very high concentrations of several contaminants.

We shared our data with the Agency for Toxic Substances and Disease Registry. Based both on those data and on a set of uncertainties, that agency recommended that residents use an alternative source of water for drinking and cooking and that they ventilate their bathrooms while running their showers. However, we concluded that without future data, further data, rather, we still could not identify potential sources of the contamination.

Another round of consultation with stakeholders occurred and we then decided to construct two deep monitoring wells. Those wells were constructed in the summer of 2007–2010, rather—and we collected samples from both wells on two separate occasions. Throughout, we applied the most stringent quality assurance protocols used by the agency. Those results showed very high alkalinity at deeper levels of the aquifer, petroleum-related organic compounds including benzene at 50 times the maximum contamination level set by the Safe Drinking Water Act, and a number of synthetic organic compounds that do not occur naturally in groundwater. EPA's technical team evaluated these data with great care and weighed a range of possible explanations that might fit the entire data set as well as the regional geology and the fuel production practices. Based upon multiple lines of reasoning, we have tentatively concluded that the drinking water aquifer contains compounds likely associated with gas production activities including hydraulic fracturing.

We make clear in the draft report that our analysis is limited to the particular geologic conditions in the Pavillion gas field and should not be assumed to apply to fracturing in other geologic set-

tings. It should be noted that fracturing in Pavillion is taking place in and below the drinking water aquifer and in close proximity to drinking water wells.

As we were moving toward completion of the report, we asked three external scientists to review the sampling and analysis as a sort of final check-in. We also broadly shared the data and then conducted a series of meetings with the state, the tribes, BLM and BIA and the company to gather their concerns and assessments. In late 2011, we released the draft report. We provided notice of our intention to subject this report to a formal external peer review by scientists and engineers unaffiliated with EPA. Contemporaneously, we sought public comment on the draft report and have since extended the deadline for comment to March 12.

To support this review, we have released an unprecedented amount of raw data, qualify assurance documentation and other supporting information. In addition, we are working with the state, the tribes and others to develop a plan for additional investigation at the site.

In conclusion, I believe EPA acted carefully, thoughtfully and transparently in responding to the concerns raised by local residents in 2008. We have applied the highest standards of scientific rigor and have operated in the spirit of transparency and collaboration. There is more work to be done, and collaboration and transparency will continue to be the hallmarks of our investigation.

With that, I yield the floor, Mr. Chairman.

[The prepared statement of Mr. Martin follows:]

PREPARED STATEMENT OF MR. JIM MARTIN, REGION 8 ADMINISTRATOR,
ENVIRONMENTAL PROTECTION AGENCY

TESTIMONY OF
JIM MARTIN
REGION 8 ADMINISTRATOR
U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

HEARING BEFORE THE
U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY AND THE ENVIRONMENT
HEARING ON GROUND WATER RESEARCH AT PAVILLION, WYOMING
February 1, 2012

Good morning Chairman Harris, Ranking Member Miller, and other members of the Committee. My name is Jim Martin. I am the Regional Administrator for the U.S. Environmental Protection Agency Region 8. I am here to talk to you about the ground water investigation that EPA is conducting near the town of Pavillion, Wyoming.

Before providing specific information about this investigation, I would like to emphasize two important points. First, EPA's highest priority in this specific case is to ensure that the residents of Pavillion have access to safe drinking water. We will continue to work cooperatively with the State of Wyoming, Tribes, the gas production company, Encana, and the community to secure a long-term drinking water solution. Second, as a science-driven agency, we take seriously our obligation to meet high standards of scientific integrity. We have used appropriate Agency procedures throughout each phase of the investigation. All data that have been collected have been subjected to rigorous quality assurance (QA) review and validation. We have gone to great lengths to assure transparency, taking steps in addition to the normal practice of EPA in releasing scientific work to the public. All of the information we have released to any party is being posted on a website dedicated solely to the Pavillion investigation.

Approximately 80 domestic water wells in the area of EPA's investigation overlie the Pavillion gas field, which is one of several gas fields within the Wind River Basin - a large, complex, structural, asymmetric, deep sedimentary basin covering much of central Wyoming. The first oil and gas exploration wells were drilled in the 1950s. Commercial natural gas extraction in the field commenced in the 1960s, with gas

production well installation activity intensifying in the late 1990s through 2006. The field currently consists of approximately 169 vertical production wells. Ninety-seven production wells are designated as "Tribal Pavillion" and are regulated by the U.S. Bureau of Land Management. The remaining wells are designated as "Pavillion Fee" and are regulated by Wyoming Oil and Gas Conservation Commission.

In response to concerns raised by residents regarding objectionable taste and odor problems in well water, EPA initiated a ground water investigation near the town of Pavillion three years ago under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), better known as Superfund. Our actions reflect our longstanding responsibility under federal laws to address threats to public health. Since the signing of CERCLA in 1980, EPA has conducted hundreds of site investigations to assess potential risks to drinking water. Since that time, in conjunction with the State of Wyoming, the Eastern Shoshone and Northern Arapaho Tribes, the local community, and Encana, EPA has been working to assess ground water quality and identify potential sources of contamination. The overall goal of this investigation was and remains to provide information to help inform decisions to ensure the safety of the drinking water in the Pavillion area.

Our investigation of drinking water at Pavillion has been supported by an extensive commitment of scientific resources. We conducted four phases of sampling between March of 2009 and April of 2011, including drinking water and livestock watering wells, public water supply wells, shallow monitoring wells and deep monitoring wells. Successive phases involved retesting of some wells sampled in earlier phases. The State of Wyoming and Tribes were consulted prior to implementation of every phase.

At the request of citizens, EPA began its investigation by sampling domestic wells in the area to assess ground water conditions and evaluate potential threats to human health and the environment. Based on these results, EPA refined the area of potential concern and determined a second round of investigation was needed. During the second phase of the investigation, EPA collected nearly 50 samples from drinking water wells, shallow groundwater, and other locations, each of which were analyzed for over 300 different constituents, including petroleum hydrocarbons, pesticides, industrial compounds, bacteria, inorganic metals, and general water quality parameters. This resulted in thousands of individual pieces of data, each of which has been carefully reviewed to ensure its validity. The results of this sampling determined that ground water in Pavillion contained a number of organic and inorganic constituents, including several organic hydrocarbons that were found widely in domestic wells, as well as in shallow

monitoring wells. Detections in shallow monitoring wells located in the drinking water aquifer included high levels of petroleum compounds such as benzene, xylene, methylcyclohexane, naphthalene, and phenols. In the spring of 2010 when EPA was validating and evaluating the Phase 2 sampling results, EPA did not reach any conclusions about source(s) of constituents of concern in domestic wells, but determined that additional investigation was necessary to evaluate whether deeper sources might be contributing to the contamination observed in some deeper domestic wells. Detections of organics in domestic wells were generally within available health and safety thresholds. However, concern about naturally occurring inorganic substances, the absence of established health values for some organic compounds detected, and the presence of much higher levels of contamination in the aquifer in close proximity all contributed to the recommendation by the Agency for Toxic Substances and Disease Registry that residents use alternate water and ventilate while showering.

In the summer of 2010, EPA constructed two deep monitoring wells to sample water in the aquifer at and below the depths of drinking water wells. Phases three and four of the investigation involved taking samples from these monitoring wells, as well as from selected domestic and livestock wells. The results, discussed in the draft report issued on December 8, 2011, indicate that ground water in the aquifer contains compounds likely associated with gas production practices, including hydraulic fracturing as conducted in this area. Analysis of samples taken from the deep monitoring wells in the aquifer indicates detection of benzene, methane, and synthetic chemicals, like glycols and alcohols consistent with gas production and hydraulic fracturing fluids.

EPA has worked diligently and methodically in pursuing our stated research objectives from start to finish. We have made every effort to work cooperatively and openly with the State of Wyoming, Tribes, and other parties. A rigorous, transparent and objective approach to our involvement at Pavillion has been employed from the outset. We have gone to great lengths to consult and share information with the State of Wyoming, the Tribes, Encana, and the public. To ensure a transparent and rigorous analysis, EPA released these findings for public comment and will submit them to an independent scientific review panel. We have extended the public comment period for an additional 45 days to allow the public and other interested parties sufficient time to review the extensive amount of study information being added to the public record.

We have employed rigorous scientific methods. Upon the completion of sampling from the deep monitoring wells, EPA career scientists engaged in a careful evaluation of the data to both assure their quality and

determine what conclusions could be drawn. These experts determined that the contaminants found in the deep monitoring wells were most likely the result of hydraulic fracturing in the Pavillion gas field and are not related to agriculture, septic systems or the installation of the monitoring wells themselves. Their findings were subjected to intensive review by career management and staff of our research organization. In addition, a technical review of the results was conducted by independent experts before the full draft report was made available to the public.

Representatives from the State of Wyoming and Encana have criticized EPA's draft report, stating, for example, that we did not follow standard Agency sampling and analysis protocols, and that the quality of our data was compromised due to extended sample holding times. EPA did, in fact, follow accepted protocols. The investigation was subjected to the Agency's highest level QA procedures. Audits of data quality and technical systems in the laboratory and field were conducted by an independent contractor and EPA QA manager. Where sample holding times were exceeded, EPA protocols were followed and professional judgment was used to determine the appropriate use of the data.

The evidence supporting the likely role of hydraulic fracturing activities in the observed contamination is presented in detail in the draft report, as is the reasoning process by which our experts evaluated that evidence. I draw your attention to the careful language with which our conclusions are couched. We make clear that the causal link to hydraulic fracturing has not been demonstrated conclusively, and that our analysis is limited to the particular geologic conditions in the Pavillion gas field and should not be assumed to apply to fracturing in other geologic settings. It should be noted that fracturing in Pavillion is taking place in and below the drinking water aquifer and in close proximity to drinking water wells – production conditions different from those in many other areas of the country.

EPA delayed the release of the draft report by several weeks to assure that a full technical review of the data and supporting information could be conducted by the State, Tribes, Encana, federal agencies and other parties. EPA staff shared extensive data and met on several occasions to discuss the data with these stakeholders. In addition, Administrator Jackson met personally with Encana leadership, and EPA staff met at length with Encana technical representatives.

As mentioned above, EPA will conduct a rigorous and transparent external peer review of the draft report. The review will entail the convening of a panel of five to seven individuals with expertise in the relevant scientific and engineering disciplines. On January 17, a Federal Register Notice was posted requesting

public nominations for the peer review panel.¹ These individuals will be unaffiliated with EPA and will be screened carefully for conflicts of interest. The public is being provided the opportunity to nominate peer reviewers and to comment on the draft charge to the peer review panel.

The peer review panel will review public comments submitted to the docket and will meet publicly to consider and weigh their expert opinions on the charge questions. The public will have the opportunity to provide oral and written comments at that meeting. The panel will then submit their separate reports to the Agency, and of course those reports will be publicly available. In addition, at the request of Governor Mead, we plan to schedule the public peer review meeting in Wyoming.

We have also indicated to the Governor that we welcome the State's willingness to support additional scientific investigation at Pavillion, which we believe is important considering the results of our initial investigation. This should include additional sampling of the drinking water and monitoring wells, and studying the fate and transport of contaminants in the subsurface. In addition to working with the State and Tribes, we are in discussions with the U.S. Geological Survey about partnering on the sampling of the monitoring wells.

In conclusion, EPA has acted carefully, thoughtfully, deliberately, and transparently in our ground water investigation and in sharing the data and findings contained in our draft report. We have applied the highest standards of scientific rigor. We hope and expect to continue in a spirit of collaboration and cooperation with Wyoming, the Tribes, and others as we conduct a peer review and consider additional study that may be warranted at this site.

Thank you for the opportunity to testify today. I am prepared to answer questions from the Committee.

¹ <http://www.gpo.gov/fdsys/pkg/FR-2012-01-17/pdf/2012-716.pdf>

Chairman HARRIS. Thank you very much.
 I now recognize our second witness, Mr. Tom Doll from the Wyoming Oil and Gas Conservation Commission.

**STATEMENT OF MR. THOMAS DOLL,
 STATE OIL AND GAS SUPERVISOR,
 WYOMING OIL AND GAS CONSERVATION COMMISSION**

Mr. DOLL. Thank you. I am here this morning as a representative of the Honorable Governor of the State of Wyoming, Matthew H. Mead, and provide the following testimony regarding the EPA's groundwater science at Pavillion, Wyoming.

The Pavillion Wind River formation natural gas field was discovered in 1960. By 2006, full field development was completed. This greater Pavillion gas field has 168 wells. Currently, there are 78 wells on tribal and 58 wells on private minerals. The last wells in this greater Pavillion gas field area that were hydraulically fractured occurred in 2007.

In 2008, EPA reacted to complaints from a few domestic well owners claiming taste and odor problems following hydraulic fracturing at nearby gas production wells. EPA conducted sampling and testing of 42 shallow domestic and stock water wells, and in August 2010, results of that testing was made public.

EPA drilled two monitoring wells in the Pavillion natural gas field in the summer of 2010. Both monitoring wells were completed at depths considerably below that of the shallow water supply wells. EPA via email notified the Wyoming Department of Environmental Quality of the plan to drill the monitoring wells literally as the rig was moving in, so I would question whether that is consultation with the state or not.

Sampling of the two monitoring wells occurred in October 2010 and again in April of 2011. Data was made public in November followed by the Pavillion draft report on groundwater in December 2011.

The complex geology of the Wind River formation in central Wyoming makes identification of potential contamination pathways difficult. The sands are discontinuous and are individual lenses within a shale matrix. Visual individual potato chips layered in a bowl. Some are in contact and most are not. The Wind River formation is a shallow aquifer and is also a deep natural gas reservoir.

EPA's draft report is based on two monitoring well sampling events. EPA found a single detect of 2-butoxyethanol out of nine lab samples analyzed using an analytical method still under development. Actual sample values for organics are so low, they are measured in parts per billion. This chemical compound at the 12.7 parts per billion detected is acceptable for drinking water supplied from a public water system.

The EPA review of material safety data sheets found 2-butoxyethanol as a compound in foam additives used in hydraulic fracturing but ignored its use in other applications such as metal coatings and solvents. The EPA concluded that hydraulic fracturing caused groundwater contamination.

Now I would like to focus on the natural gas wells in the immediate area of these two EPA monitoring wells. None of these natural gas wells have been hydraulically fractured since 2005. EPA's

data is only applicable to the natural gas fields in central Wyoming. This fact is lost in the public reaction to the EPA announcement and a worldwide damnation of hydraulic fracturing has occurred. The report provides no data to show how these two EPA monitoring wells represent water supply wells used by anyone in the Pavillion natural gas field. Wyoming state agencies' technical questions have yet to be addressed, and I have been informed now that the new data has been released and posted on the EPA web page.

The EPA report also ignores the ongoing public outreach investigation of natural gas well integrity and landowner-identified sites. EPA has not addressed other possible surface pathways of groundwater contamination. Wyoming state agency scientists contend that the chemical compounds detected were introduced during the drilling, completion, testing and sampling of the EPA monitoring wells. Further well testing is required.

Wyoming has historically regulated hydraulic fracturing. Since 2010, Wyoming is the only state to require chemical disclosure prior to the initiation of the treatment. Disclosure of the actual chemical compounds used is also required post treatment. This well information is public and is posted on the Oil and Gas Conservation Commission web page.

In conclusion, the EPA Pavillion draft report contains poor-quality data and science. The State of Wyoming experts do not support the EPA's data or analysis, and recommends further testing before any conclusion of groundwater contamination by any source be made. The goal is for residents of Pavillion to have clean water and conclusive answers about the source of the area's groundwater problems. Additional short-term sampling and long-term science-based efforts are being planned by the State of Wyoming and the USGS for the Pavillion area.

Thank you for providing this opportunity to address the Subcommittee regarding Pavillion, Wyoming.

[The prepared statement of Mr. Doll follows:]

PREPARED STATEMENT OF MR. TOM DOLL, STATE OIL & GAS SUPERVISOR, WYOMING
OIL & GAS CONSERVATION COMMISSION

Thomas E. Doll
State Oil and Gas Supervisor
Wyoming Oil and Gas Conservation Commission

Testimony on "Fractured Science: Examining EPA's Approach to
Ground Water Research in Pavillion, WY,"
House Subcommittee on Energy and the Environment of the Committee on Science, Space and
Technology during the 112th Congress.
February 1, 2012

Written Comments submitted by Thomas E. Doll, PE, Wyoming State Oil and Gas Supervisor. I am here this morning as a representative of the honorable Governor of the State of Wyoming, Matthew H. Mead, and appear as a witness before the House Subcommittee on Energy and the Environment of the Committee on Science, Space and Technology during the 112th Congress.

LOCATION: The Pavillion natural gas field is located in north central Fremont County Wyoming, 5 miles east of the Town of Pavillion, which is located near the center of the 3,500 square mile Wind River Indian Reservation. Ground water on the Wind River Indian Reservation is valuable resource for the Eastern Shoshone and Northern Arapaho tribal members and others who live on the Reservation. The Wind River Reservation is surrounded by the Wind River Range to southwest, the Absaroka and Washakie Ranges to the northwest and the Owl Creek Mountains on the north and includes areas of foothills, high plateaus, rugged badlands, plains, and terraced stream valleys. The Pavillion natural gas field lies in an area of high to medium high aquifer sensitivity to surface contamination. The Five Mile Creek drainage runs through the center of the gas field. It is a major source of groundwater recharge for this area.

See Attachment 1.

NATURAL GAS WELL DRILLING: The first oil well in Wyoming was drilled in south central Fremont County in 1899. The first drilling in the general Pavillion area occurred in 1959. The Pavillion field discovery well was drilled in 1960. A series of separate drilling programs occurred in the general area during the 1960's, again during the late 1970's through early 1980's, and again during the mid-1990's, with approximately 80 total wells drilled. The overall Pavillion Gas Field is approximately 20 square miles in surface area. From the late 1990's through 2006, an ongoing drilling program provided infield development. The overall structural closure of the gas bearing formation is 5,800 acres. The wells are drilled on Oil and Gas Conservation Commission (OGCC) approved spacing, approximately 900 feet apart. The operator used a closed-loop mud system eliminating reserve pits and stimulated the Wind River formation using low volume foamed hydraulic fracture treatment. The foam improves the clean-up of the injected water. Total well count for the Pavillion natural gas field is 168 wells. No wells in the greater Pavillion Gas Field have been hydraulically fractured since 2007. No wells near the EPA monitoring wells have been hydraulically fracture stimulated since 2005. Currently 136 producing and shut-in wells remain in the Pavillion natural gas field, 78 wells on tribal and 58 wells on private minerals. The Wind River formation natural gas is a dry gas with little condensate or produced water.

Wyoming, since June, 2010 requires disclosure of all chemical compounds used in the well stimulation process. Disclosure of all chemical compounds planned to be injected is required prior to the performance of the job. Wyoming is the only state to require all chemical compound disclosure as part of the stimulation approval. Disclosure of all chemical compounds actually injected is required post treatment. This chemical compound information is posted on the Oil and Gas Conservation Commission (OGCC) web page, <http://wogcc.state.wy.us> and is available for public review by clicking on "Completions".

Wyoming surface casing set depths and cementing requirements were clarified in June, 2010. See Attachment 2.

GROUNDWATER ISSUES: Wyoming has approved water well permits from 1932 forward. They show well depths from a few feet below surface to 750'. No data reviewed for the Pavillion Draft Report shows the producing depth, well construction or producing aquifer isolation. The ground water quality varies but generally decreases with depth and distance from recharge sources. Natural gas volume usually increases with depth. Water volume usually decreases with depth.

In 1959 the United States Geological Survey (USGS) documented Pavillion water as unsatisfactory for domestic use due to high concentrations of naturally occurring sulfate, total dissolved solids and pH levels. Sites of known groundwater contamination in or adjacent to the Pavillion natural gas field were reported in 1998 according to the Wyoming Department of Environmental Quality (WDEQ). This was before the infield development drilling of the Pavillion natural gas field. In 2005 the first landowner complaints to state agencies of contaminated ground water from natural gas well development were made. From 2005 through 2007 well testing for WDEQ by independent laboratories showed no impacts from oil and gas development. In 2008, the Environmental Protection Agency (EPA) received complaints from a few domestic well owners regarding sustained objectionable taste and odor problems following hydraulic fracturing at nearby gas production wells. The EPA reacted in spite of the fact that no natural gas wells in the Pavillion Gas Field have been hydraulically fracture stimulated since 2007. The EPA conducted shallow domestic and stock water well sampling and testing during two phases during 2009 and 2010, and in August, 2010 at a public meeting in Pavillion reported the results. EPA drilled two monitoring wells in the Pavillion natural gas field in the summer of 2010. Sampling and testing occurred in October, 2010 and April, 2011. The result of this testing effort is the "[Draft Investigation of Ground Water Contamination near Pavillion, Wyoming](#)" (referred hereafter as "Pavillion Draft Report"). No wells near the EPA monitoring wells have been hydraulically fracture stimulated since 2005.

PUBLIC OUTREACH – NATURAL GAS WELL INTEGRITY AND LANDOWNER IDENTIFIED SITES: Public outreach efforts were established by the EPA, WDEQ and OGCC, in late 2010 with Pavillion Working Group meetings held four times during 2011. Two Pavillion Working Groups were formed, one to address natural gas well integrity and one to address landowner identified sites. The purpose of both Working Groups was to identify potential sources of paths of groundwater contamination from either the natural gas wells or the surface. The groups are comprised of representatives from EPA, Bureau of Land Management (BLM), the tribes, area landowners, and the natural gas well operator, Encana, and

Wyoming agencies: Oil and Gas Conservation Commission, Department of Environmental Quality, Water Development Office, Office of the State Engineer, and Rural Water. The meetings were open to the public and facilitated by the Director of DEQ and the OGCC Supervisor.

After thorough review of well records for the 168 wells drilled in the Pavillion field, 36 natural gas wells were identified with surface casing set depth or cementing issues. Thirty-four of these wells were tested by the operator Encana, reported to OGCC, and 4 natural gas wells were identified for further study. Approximately 62 potential pit locations were reviewed by the Working Group. More than thirty historic drilling reserve and production pit sites in the general Pavillion area had been previously investigated by the Department of Environmental Quality for hydrocarbon content, five of which were placed in the Department's Voluntary Remediation Program. The Working Group addressed 33 of the 62 sites as landowner identified potential groundwater contamination sites. Eleven sites were selected and sampled for hydrocarbon contamination with one site of the eleven placed into the Department of Environmental Quality's Voluntary Remediation Program.

MONITORING WELL DATA/DRAFT REPORT: Several times during 2011, the Working Groups asked the EPA for the release of the monitoring well data. The EPA said the data was going through Quality Assurance-Quality Control review and was not available. The data was first provided to the public and to the state agencies in November, 2011. The EPA made public the Pavillion Draft Report on Ground Water in December, 2011. The EPA concludes based on limited data set that contamination of groundwater was caused by a chemical used hydraulic fracturing. No data was provided by the EPA for the Pavillion Draft Report showing the producing depth, well construction or producing aquifer isolation. The EPA report does not address the need to solve the landowner's water supply issues; rather the report only addresses hydraulic fracturing.

The Pavillion Draft Report was issued with incomplete data and technically inadequate conclusions. There was no opportunity to review and verify the data by Wyoming state agencies. The data was not verified by further testing or vetted through a peer review process. Based on a limited sampling and an inconclusive data set from Pavillion Wyoming ground water, EPA's conclusion is now national and international fodder for the hydraulic fracturing debate. Now the quality of the hydraulic fracturing debate suffers and the EPA's science itself is questioned.

The EPA conceptual scientific model and line of reasoning used in Pavillion is based on two groundwater monitoring wells and two sampling events. Three different laboratories used a battery of analyses to detect contaminants. The testing of 9 samples by these 3 labs resulted in a single detect of a contaminant of concern, a synthetic organic compound, 2-butoxyethanol. The laboratory reported 12.7 parts per billion detect of this compound utilized a methodology the EPA admits was still under development (R3, page 5) and is an untested unverified protocol. This level of 2-butoxyethanol is acceptable for drinking water from a public water system. The EPA reviewed Material Safety Data Sheets which lead to identification of 2-butoxyethanol as a chemical used in hydraulic fracturing. The EPA concluded that ground water contamination was caused by hydraulic fracturing. The chemical compound 2-butoxyethanol is commonly used in metal coatings, paints and solvents.

Typically a single detect would prompt to scientists involved to ask for retesting or additional testing for confirmation. Actual organic compound sample values detected are so low that they are measured in parts per billion. Unfortunately EPA did not conclude that additional testing was needed before suggesting that hydraulic fracturing had caused contamination at Pavillion. The scientific method requires collection of data in a reproducible manner, providing thorough and open analysis, and prior to making any conclusions on that data. The conclusions drawn from limited data from the two monitoring wells at Pavillion are not based on any weight of evidence or on the best available science. Therefore the EPA science is questionable and erroneously draws the conclusion that hydraulic fracturing is the cause of groundwater contamination.

State agencies are concerned that the organic and synthetic organic chemicals were likely introduced during the drilling, completion, testing and sampling of the monitoring wells. The EPA did not follow United State Geological Survey recommendations for monitoring well drilling and sampling. None of the fluids, materials, or equipment that was actually used by EPA to drill, complete, or develop the two monitoring wells was ever sampled or tested to ensure they were not a source of contamination. Drilling rig antifreeze, motor oil, and diesel spills on the monitor well locations were noted in the driller's daily log posted on the EPA Region 8 web page and are a likely source of the low levels of organic compounds detected in the monitoring wells. This information was not addressed in the Pavilion Draft Report or considered as a path of contamination.

Neither of the two EPA monitoring wells are testing the water quality in the aquifers used by residents. The EPA data provided in the report shows that both monitoring wells were completed in natural gas reservoirs. The natural gas found in the monitoring wells matches that natural gas found in production wells and does not match the natural gas found in the landowner water supply wells. Water quality as tested from the monitoring wells does not match water quality from either natural gas production or water supply wells indicating contamination by drilling and development fluids. EPA sampling of water supply wells and monitoring wells failed to find any chemicals tied to natural gas development that ever exceeded USDW standards.

The EPA conclusion that hydraulic fracturing caused ground water contamination is limited to the data found in a single sample detect from single monitoring well located a natural gas field in central Wyoming. Yet this fact is lost in the public reaction to EPA's announcement and results in a worldwide damnation of hydraulic fracturing.

ORIGINAL GOAL OVERLOOKED: EPA's release of the Pavillion Draft Report on Ground Water before a complete scientific analysis has been accomplished is a disservice to the public, specifically the individuals living within the Pavillion natural gas field area who are looking to federal and state agencies for answers to their groundwater concerns. The Pavillion Draft Report ignores that shallow domestic and stock water wells in the Pavillion area have naturally occurring high sodium, high sulfate and high carbonate ionic content, and some wells produce methane gas. Landowners and groundwater users have known of these groundwater issues long before any natural gas wells were drilled in the area.

Some landowners moved into the Pavillion natural gas field during and after the natural gas wells were drilled. The driving force for this past six year testing and sampling effort is lost in the Pavillion Draft Ground Water Report; which is, solving the drinking water supply issues for these landowners. The draft report provides no data to show how these two EPA monitoring wells represent any water supply wells used by anyone in the Pavillion natural gas field.

The Pavillion Draft Report also ignores the September, 2010 Wyoming Water Development Commission report outlining five possible solutions to evaluate potential long term solutions for domestic water supply to landowners in the area.

COMPLEX GEOLOGY: The Pavillion Draft Report is limited in scope and inadequately addresses the complex geology and hydrogeology of the Wind River Formation in central Wyoming. Without knowledge of the shallow subsurface it is difficult to identify the origin of potential contamination. The EPA in the draft report declared that the Wind River Formation is a single Underground Source of Drinking Water, USDW. The geology is more complex than the EPA draft report indicates or states. Links between wells has not been adequately studied or identified. The sands are isolated lenticular within a shale matrix and are not able to be mapped over large areas. Therefore the Wind River Formation is many individual shallow aquifers and many individual deeper natural gas reservoirs. This is best thought of as series of stacked isolated sand lenses, visualized much like potato chips in a bowl. The Wind River Formation is the shallow groundwater aquifer as well as the deep natural gas reservoir. Natural gas from source rocks at depths below the Wind River Formation has been migrating to the surface for tens of thousands of years. The Wind River Formation does not contain any geologic horizon to prevent the gas migration. The shallow groundwater aquifer is recharged by rain, snow melt and irrigation run-off. See Attachment 3.

OTHER SOURCES OF POSSIBLE CONTAMINATION: Other possible sources of groundwater contamination in the Pavillion natural gas field remain unstudied. The potential for shallow groundwater aquifer contamination may exist from the drilling, completion, and maintenance of the domestic and stock water supply wells; from the location and use of septic systems, stock pens and feedlots; from the use of pesticides, fertilizers, and herbicides; from the recharge water quality from irrigation run-off; or from fuel stations and vehicle repair shops near landowner water supply wells.

ADDITIONAL TESTING PLANNED: The Pavillion Draft Report ignores the September, 2010 Wyoming Water Development Commission report outlining five possible solutions to evaluate potential long term solutions for domestic water supply to landowners in the area. In December, 2010, at the request of the State Geologist, the United States Geological Survey and the Wyoming Department of Environmental Quality signed a contract for the further testing of the EPA monitoring wells at Pavillion. Governor Mead budgeted money for these additional investigative efforts and has asked for EPA's cooperation in conducting additional testing. The Wyoming Congressional Delegation urges EPA to follow through with its commitment by working with the State to conduct additional testing and analysis prior to any peer review.

IMPORTANCE OF HYDRAULIC FRACTURING TO WYOMING: Almost 100% of oil and natural gas wells drilled in Wyoming are hydraulic fracture treated to be commercial; the exception is shallow coalbed natural gas wells in northeast Wyoming. Almost 100% of Wyoming's oil production, 153,300 barrels per day, and 36.2% of Wyoming's natural gas production, 2.4 billion cubic feet per day, comes from wells that are hydraulic fracture treated (OGCC September, 2010). In fiscal year 2010, approximately two billion dollars was received by the State of Wyoming from oil and natural gas taxes and royalties. See Attachment 2.

CONCLUSION: In conclusion, EPA dismissed requests to review data before it was publicized and has not addressed concerns with the data and the Pavillion Draft Report as raised by the Wyoming Oil and Gas Conservation Commission, the Wyoming Department of Environmental Quality, and the Wyoming Water Development Office. These concerns are related to the drilling, completion, development, testing and sampling of the two monitoring wells. The public outreach and technical accomplishments of the Working Groups were not acknowledged in the report. The EPA Pavillion Draft Report contains questionable, unverified poor quality data; state agency experts cannot support the EPA's analysis and conclusions. Additional short term sampling and a long term science based effort are being planned by the State of Wyoming and the USGS for the Pavillion area. This science based effort will utilize proven and repeatable science, along with critical analysis and full disclosure, and will lead to thoughtful conclusions about groundwater in the Pavillion area.

Thank you for the opportunity to present my prepared remarks.

Thomas E. Doll, PE

State Oil and Gas Supervisor

2211 King Boulevard

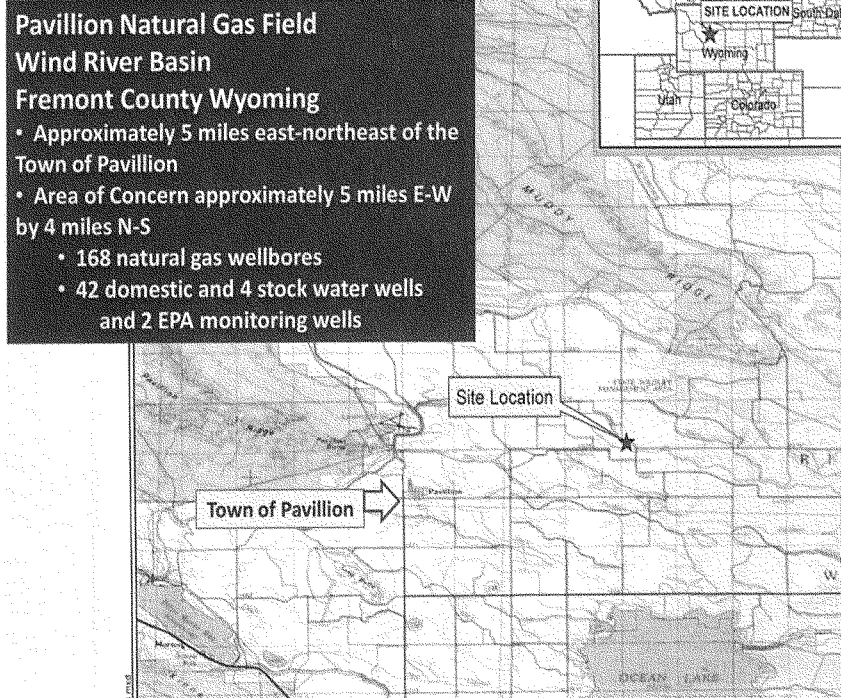
Casper, WY 82604

307-234-7147

Email: tom.doll@wyo.gov

Attachment 1

Area of Interest



Attachment 2**Facts about Hydraulic Fracturing in Wyoming**

Wyoming, since 2010, requires disclosure of all chemical compounds used in the well stimulation process. Disclosure of chemical compounds planned to be injected is required prior to the performance of the job. Disclosure of all chemical compounds actually injected is required post treatment.

Table 1 Hydraulic Fracturing Treatment in Wyoming

Year	Stimulated Well Count	Individual Stimulations
2005	914	3,448
2006	1,132	4,787
2007	1,044	5,171
2008	1,148	6,376
2009	746	5,675
2010	704	5,574
2011	820	10,186

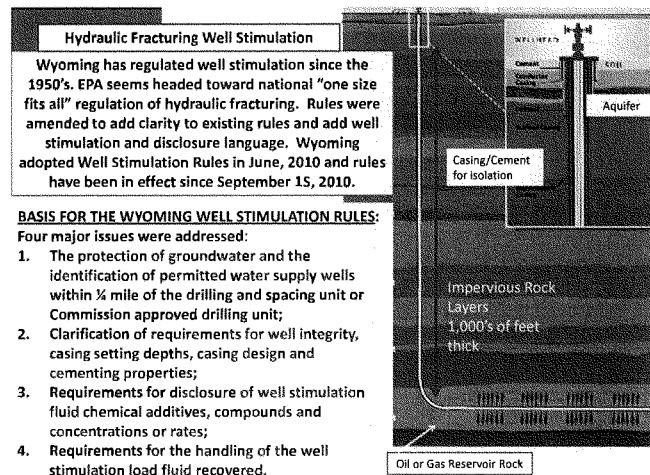
The trend in Table 1 reflects an increase in horizontal well drilling and multiple well stimulations in the horizontal wellbore.

Almost 100% of Wyoming's oil production, 153,300 barrels per day, and 36.2% of Wyoming's natural gas production, 2.4 billion cubic feet per day, comes from wells that are hydraulic fracture treated (September, 2010 data).

Almost 100% of oil and natural gas wells drilled in Wyoming are Hydraulic Fracture treated to be commercial; the exception is shallow Coalbed Natural Gas Wells in northeast Wyoming.

Wyoming has no documented cases of groundwater contamination caused by Hydraulic Fracturing. The Oil and Gas Conservation Commission scientists have not been able to utilize the EPA monitoring well data or the draft report to reach any conclusion regarding ground water contamination within the

Pavillion natural gas field. The draft report and conclusion made by EPA is based on a single and non-repeated detect of a chemical of known to be used in over 600 products.



Section 8. Application for Permit to Drill or Deepen a Well

Protection of Ground Water

(iii) Identification of all water supply wells permitted by the Wyoming Office of the State Engineer located within one-quarter mile of the drilling and spacing unit or the Commission approved drilling unit, whichever is less, and the depth from which water is being appropriated;

(iv) Formation depth, geological and hydrological detail from public records, published or otherwise known information of useable groundwater underlying the drilling and spacing unit or the Commission approved drilling unit. Consistent with Wyoming Department of Environmental Quality Chapter 8, as revised April 26, 2005, "Quality Standards for Wyoming Groundwaters," and for purposes of these rules, groundwater will be protected, except for Class VI Groundwater of the State that is unusable or unsuitable for use:

(A) Due to excessive concentrations of total dissolved solids or specific constituents; or,

(B) Is so contaminated that it would be economically or technologically impractical to make water useable; or,

(C) Is located in such a way, including depth below the surface, so as to make use economically and technologically impractical.

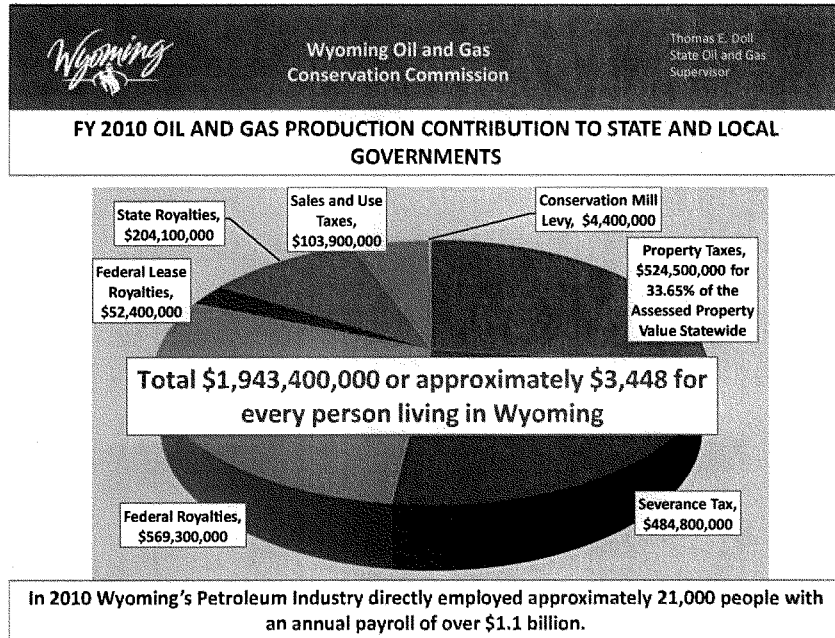
Section 8. Application for Permit to Drill or Deepen a Well

Well Integrity

(vi) Proposed casing program, including size, anticipated setting depths, API grade, weight per foot, burst pressure, tensile strength for both body and joint, yield pressure, if new or used casing is planned for the well, and other information required by the Supervisor. Note that prior approval of the Supervisor is required for use of non-API tubular.

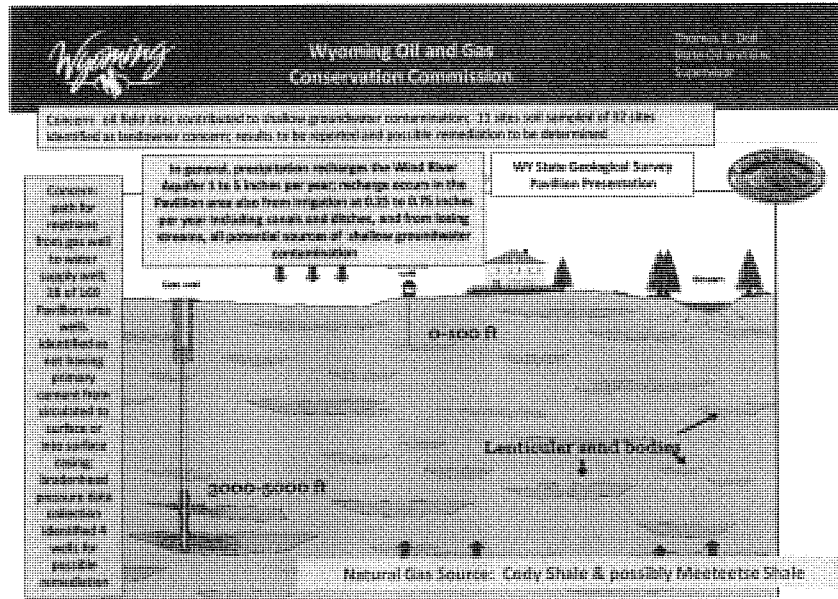
(vii) Description, type and setting depths of isolation techniques if used in openhole and uncemented liner stimulations in high angle and horizontal wells,

(viii) Description of the cementing program, including API class of cement, additives to be used, slurry density to be mixed, estimated volumes to be used, including percent of excess volume. For openhole completions, similar information is required for the cement program above the completed interval. The Supervisor must be notified of the intent and give prior approval for the use of non-API class cement and additives.



Attachment 3

Wind River Formation Cross-section Cartoon



Not to scale

Not all lenticular sands are charged with natural gas, some are wet, some are connected, some are not

Chairman HARRIS. Thank you very much.
 I now recognize our third witness, Ms. Kathleen Sgamma from the Western Energy Alliance.

**STATEMENT OF MS. KATHLEEN SGAMMA,
 VICE PRESIDENT, GOVERNMENT AND PUBLIC AFFAIRS,
 WESTERN ENERGY ALLIANCE**

Ms. SGAMMA. Thank you, Mr. Chairman, Ranking Member Miller and Members of the Committee. Thanks for the opportunity today.

Western Energy Alliance represents about 400 companies engaged in all aspects of environmentally responsible oil and gas development in Wyoming and across the West. There is no failsafe process, and accidents may happen with any human endeavor.

One of the main roles of environmental regulation is to ensure that the risk is managed properly, that appropriate procedures are in place to prevent public exposure, and in the event of an accident, that problems are corrected.

Oil and natural gas producers are held to high scientific standards to ensure operations are properly designed, executed and controlled. Because civil or criminal penalties can be levied on producers who fail to fulfill regulatory requirements, it is imperative that regulators are also held to high standards.

Regulators must be required to show that sound science and correct procedures were followed when establishing regulations and when determining if a company failed to meet a regulatory standard. If sound science and accepted regulatory practices are not followed, findings cannot stand up in court and arbitrary regulatory practices sow uncertainty.

As a democratic society, the legal culpability inherent in our regulatory system is not the only consideration. The court of public opinion is also important. Without public support, activities such as oil and natural gas development would not be possible.

My industry struggles against outrageous information in the public arena that overstates our environmental impact and propagates blatantly false information about hydraulic fracturing. Every day we hear members of the media and unaccountable environmental groups make statements about supposedly thousands of cases of contamination. Never mind that EPA Administrator Lisa Jackson and most regulators from large oil and natural gas-producing states have felt compelled to issue statements about the lack of cases of contamination from fracking. Once misinformation gets out in the public, it takes on a life of its own and is almost impossible to correct. This misinformation has caused local communities and citizens to fear a process that is safe. The fear leads to development roadblocks, depriving state economies of tens of thousands of jobs and billions of dollars of economic activity.

Furthermore, unfounded fears about fracking divert limited federal and state resources away from activities that truly pose a threat to underground sources of drinking water. The Groundwater Protection Council considers fracking low risk, especially compared to other threats such as agricultural runoff, septic systems, sewer lines and wastewater treatment sources.

The public trusts EPA to follow the line and use sound science as the foundation of its regulatory work. When EPA releases a re-

port stating that fracking may be the cause of contamination, the public expects that to be backed by science. However, in the case of the draft Pavillion report, EPA's own data contained within doesn't support the conclusions presented upfront. A conclusion with such broad implications should have first been tested through a scientific peer review of the work.

We are left wondering why EPA would jump to conclusions. Why would EPA release the report without state input and scientific peer review? These are disturbing questions to ask about an agency that should have the public trust and points to the fact that EPA is also a political body, not a disinterested scientific institution.

As this Committee knows, fundamental standards of science include objectivity, repeatability, transparency and peer review. It is hard to call something scientific if it doesn't include these basic elements, yet we have seen examples from EPA that do not. Industry is particularly concerned since Congress has charged EPA with conducting a scientific study of fracking. EPA's recent actions raise questions in our minds about the quality of the science for the broader fracking study as well.

The Pavillion report and what we have observed so far in the fracking study cause great concern to industry as we see a lack of transparency, unscientific methods and failure to perform peer review. I ask this Committee to help ensure that the issues of scientific credibility are resolved. I believe in general that better oversight is needed of EPA science. There is an inherent given EPA's regulatory and compliance roles and its ability to conduct objective science. Given that conflict, it is especially important that EPA science be properly peer reviewed. Western Energy Alliance recommends that standards of EPA-conducted science be tightened.

Fracking is vital to the supply of American energy. If we lose the public's confidence and cannot continue to develop oil and natural gas in the United States because of unfounded rumors and invalid science, America will deprive itself of significant job and economic growth and will continue to import energy from unfriendly countries.

Thank you for your time.

[The prepared statement of Ms. Sgamma follows:]

PREPARED STATEMENT OF MS. KATHLEEN SGAMMA, VICE PRESIDENT, GOVERNMENT
& PUBLIC AFFAIRS, WESTERN ENERGY ALLIANCE

***"Fractured Science: Examining EPA's Approach to Ground
Water Research: The Pavillion Analysis"***

Testimony:

Kathleen Sgamma

Vice President of Government & Public Affairs
Western Energy Alliance

February 1, 2012

Summary:

- Oil and natural gas producers are held to very strict regulatory and scientific standards that carry real legal and financial responsibilities to ensure operations protect air and water quality, and that risk of accident is minimized and properly controlled.
- Because civil or criminal penalties can be levied on producers who fail to fulfill regulatory requirements, it is imperative that EPA and other regulators are also held to high scientific standards.
- As a democratic society, the legal culpability inherent in our regulatory system is not the only consideration - the court of public opinion is also important. Without public support, oil and natural gas development would not be possible, and energy security and the economy would suffer.
- Outrageous information in the public arena overstates industry's environmental impact and propagates blatantly false information about hydraulic fracturing (HF).
- This misinformation has caused local communities and citizens to fear a process that is safe. This fear leads to development roadblocks, if not outright bans, depriving state economies of tens of thousands of jobs and billions of dollars in economic activity, and threatening American energy security.
- Unfounded fears about HF divert limited federal and state regulatory resources away from activities that truly pose a threat to underground sources of drinking water.
- The public trusts EPA to protect the environment, follow the law, and use sound science as the foundation of its regulatory work. When EPA releases a report concluding that hydraulic fracturing may be the source of contamination, the public expects accurate information.
- However, in the case of the Pavillion report, EPA's own data and methods have raised serious questions about the validity of the report. EPA's broader HF study has also led to concerns about unscientific methods, and lack of transparency and peer review.
- Better oversight is needed of EPA science. There is an inherent conflict between EPA's regulatory and compliance roles and its ability to conduct objective science. Given that conflict, it is especially important that EPA science be properly peer reviewed. Western Energy Alliance recommends that standards for EPA-conducted science be tightened so that all studies are peer reviewed by credible third parties before that science can be used for regulatory or compliance purposes.
- HF is vital to the supply of American energy. If we lose the public's confidence and cannot continue to develop oil and natural gas in the United States because of unfounded rumors and invalid science, America will deprive itself of significant job and economic growth, and will continue to import energy from unfriendly nations.

Full Testimony:

Mr. Chairman and Members of the Committee—thank you for the opportunity to appear before you today. I appreciate the opportunity to talk about the need for rigorous scientific standards in the regulatory arena.

There is no failsafe process. Human error and unforeseen circumstances can cause accidents with potential safety and environmental implications. The role of environmental regulation is to ensure that the risk of exposure is managed properly, that appropriate procedures are in place to prevent exposure, and in the event of an accident, correct the problems and bring operations back into compliance.

Oil and natural gas producers are held to high scientific standards to ensure operations are properly designed, executed and controlled. These high standards are intended to ensure that operations protect air and water quality, and that risk of accident is properly managed and controlled. Operators are held to very strict regulatory standards that carry real legal and financial responsibilities, and can even be held criminally liable in certain circumstances.

These strict standards require industry to use accepted practices and scientific methods to ensure compliance. Ensuring compliance with thousands of detailed regulatory requirements every day requires rigorous quality control and adherence to strict protocols and procedures.

Because civil or criminal penalties can be levied on producers who fail to fulfill regulatory requirements, it is imperative that regulators are also held to high standards. Regulators are required to show that sound science and correct procedures were followed when establishing regulations and when determining if a company failed to meet a regulatory standard. If sound science and accepted regulatory practices are not followed, findings cannot stand up in court, and arbitrary regulatory practices sow uncertainty in the industry.

Stable government and regulatory certainty in the marketplace enable industries to engage in productive economic activity on a large scale that creates jobs and national wealth. Since wealthy societies are those best able to protect the environment, we all have a stake in making sure our regulatory environment is predictable, based on sound science, and encourages responsible economic development.

As a democratic society, the legal culpability inherent in our regulatory system is not the only consideration - the court of public opinion is also important. Without public support, activities like oil and natural gas development would not be possible. My industry struggles against outrageous information in the public arena that overstates our environmental impact and propagates blatantly false information about hydraulic fracturing (HF) and other technical aspects of our industry. Every day we hear the media and unaccountable environmental groups make statements about supposedly thousands of cases of contamination from HF. Never mind that U.S. Environmental Protection Agency (EPA) Administrator Lisa Jackson and most regulators from large oil and natural gas producing states have felt compelled to issue statements about the lack of any cases of contamination from HF. Once misinformation gets out into the public, it takes on a life of its own and is impossible to completely correct.

Testimony - *Fractured Science*
 Kathleen Sgamma, Western Energy Alliance

February 1, 2011
 Page 4 of 6

This misinformation has caused local communities and citizens to fear a process that is safe given the safeguards, procedures, and monitoring that are required and implemented by industry. This fear leads to development roadblocks, if not outright bans as in New York State, depriving state economies of tens of thousands of jobs and billions of dollars in economic activity. Since wealth is the key to public and personal health, safety and the environment, these roadblocks are counterproductive to the very local communities that seek to protect their water resources.

Furthermore, unfounded fears about HF divert limited federal and state regulatory resources away from activities that truly pose a threat to underground sources of drinking water. HF presents a very low risk to drinking water, and has been safely conducted over 1.2 million times since 1949 with no documented cases of contamination. The Ground Water Protection Council considers HF low risk, especially compared to other threats to groundwater such as abandoned mines, agricultural runoff, septic systems, sewer lines, wastewater treatment sources and landfills.¹

The public trusts EPA to protect the environment, follow the law, and use sound science as the foundation of its regulatory work. When EPA releases a report concluding that hydraulic fracturing may be the source of contamination, the public expects accurate information. However, in the case of the draft Pavillion Report, EPA's own data contained within the report don't support the conclusions presented up front.² The report clearly has deficiencies that should have been addressed first with the state regulators who have intimate knowledge and technical experience with the aquifer in question. In addition, a conclusion with such broad implications should have first been tested through a scientific peer review of the work.

We have seen EPA jump to conclusions before - in the case of Range Resources in Parker County, Texas. EPA ignored historic data about the methane content of the drinking water aquifer, and rushed to blame Range Resources and HF. Later geochemical testing clearly showed the methane in domestic water wells was naturally occurring from the shallow formation near the aquifer, and not methane from the Barnett formation that Range was producing from.

We are left wondering why EPA would jump to conclusions? I believe that most EPA employees are dedicated to doing the right thing to protect the environment. In a situation like Pavillion where the conclusions were rushed out without proper review and verification, it raises the question of undue political influence. Why would EPA release the report without state input and scientific peer review? What's the rush to conclude something before independent verification is complete? Why does EPA refuse to release to the state of Wyoming information to back up the results of the Pavillion study?

These are disturbing questions to ask about an agency that should have the public trust, and points to the fact that, like it or not, EPA is a political body, not a disinterested scientific

¹ *Ground Water Report to the Nation: A Call to Action*, Ground Water Protection Council, 2007.

² *Draft: Investigation of Ground Water Contamination near Pavillion, Wyoming*, U.S. EPA, December 2011.

Testimony - *Fractured Science*
Kathleen Sgamma, Western Energy Alliance

February 1, 2011
Page 5 of 6

institution. As this committee knows, fundamental standards of science include objectivity, repeatability, transparency, and peer review. It's hard to call something scientific if it doesn't include these basic elements, yet we've seen examples from EPA that do not.

Industry is particularly concerned since Congress has charged EPA to conduct a scientific study of hydraulic fracturing. EPA's recent actions raise questions in our minds about the quality of the science for the broader HF study.

In fact, some companies participating in EPA's HF study have already noticed questionable procedures. For example, there is a lack of transparency on the detailed study design and plan. Without a rigorous, systematic plan, there are no clearly defined objectives, analytical methods, quality assurance and interpretation.

This lack of a rigorous plan is also leading to subjective selection of samples and study sites. A systematic plan should identify clearly how samples will be selected, and in the case of the HF study that means which sites will be selected for water sampling. In selecting sites and samples to test, objective criteria must be used. A study is scientifically invalid if samples are chosen not according to objective criteria but rather to fit the intended results or serve political ends. For the HF study, it appears that EPA is subjectively selecting sites outside of the study area rather than objectively according to a plan.

The Pavillion report and what we've observed so far in the HF study cause great concern to industry, as we see a lack of transparency, unscientific methods, and failure to perform peer review. Why is EPA so reluctant to provide to the public and state regulators detailed information on how it's conducting its study? How can the public be assured that EPA is conducting a correct, repeatable scientific study if it won't tell the public how it's going to ensure quality results?

I'd like to extend the issue a bit, as we've seen several regulatory efforts lately that are being rushed through without proper scientific basis. The recent combined NSPS/NESHAP rule for the oil and gas sector is a good example. In the proposed rules, EPA admits that certain scientific steps have been omitted, such as gathering air quality monitoring data, yet it proceeds with rules uninformed by that basic scientific data. Likewise, EPA grossly overestimates methane emissions from natural gas development by over 200% to justify the rule.³ Independent analysis demonstrates basic scientific errors and bad assumptions in EPA's technical support document that forms the basis of the overestimation.⁴ Clearly better independent peer review of EPA science is needed.

I ask this Committee to help ensure that the issues of scientific credibility are resolved, particularly as they relate to the HF study. I believe in general that better oversight is needed of

³ US Environmental Protection Agency, *Greenhouse Gas Emissions Reporting from the Petroleum and Natural Gas Industry: Background Technical Support Document*, 2010.

⁴ IHS CERA, *Mismeasuring Methane: Estimating Greenhouse Gas Emissions from Upstream Natural Gas Development*, August 2011.

Testimony - *Fractured Science*
Kathleen Sgamma, Western Energy Alliance

February 1, 2011
Page 6 of 6

EPA science. There is an inherent conflict between EPA's regulatory and compliance roles and its ability to conduct objective science. Given that conflict, it is especially important that EPA science be properly peer reviewed. Western Energy Alliance recommends that standards for EPA-conducted science be tightened so that all studies are peer reviewed by credible third parties before that science can be used for regulatory or compliance purposes.

HF is vital to the supply of American energy. If we lose the public's confidence and cannot continue to develop oil and natural gas in the United States because of unfounded rumors and invalid science, America will deprive itself of significant job and economic growth, and will continue to import energy from unfriendly nations.

Thank you for your time.

Kathleen Sgamma
Western Energy Alliance

Chairman HARRIS. Thank you very much, and I recognize our fourth and final witness, Dr. Bernard Goldstein of the University of Pittsburgh Graduate School of Public Health. Doctor.

**STATEMENT OF DR. BERNARD GOLDSTEIN,
PROFESSOR AND DEAN EMERITUS,
GRADUATE SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF
PITTSBURGH**

Mr. GOLDSTEIN. Good morning. Thank you for the opportunity to testify. I apologize but I will be showing slides. It is part of being a professor. I would lose my professorial appointment.

My three major points are that there is—that the public is genuinely concerned about the potential health impacts and there is genuine reason for the concern and that there is almost no support for the research needed to respond to the public, and that lack of support is both shortsighted and counterproductive.

There is a fair amount of public confusion, which I think is really important to put in context of this particular hearing. The public is hearing that hydro fracking is a new technology that now permits extraction. In our area of the country, it is the Marcellus shale. And oh, by the way, it has been around for decades so don't worry. It can't be both. Decades ago, hydro fracking was done with 50,000 gallons of water, straight shot down, vertical, no horizontal drilling. Now it is 5 to 8 million gallons. There is all these additional bells and whistles that have been added to it, and we are told, although there is a lot of secrecy, that the fracking chemicals have been changed.

We are also confused about the fact that just as we are hearing here, there is no proof that hydro fracking has ever caused groundwater contamination. Well, that is a technical definition of hydro fracking which has to do with the release 5,000 foot underground or 1,000 foot underground of these chemicals. It is not really what the public understands as hydro fracking, which is anything that happens with these chemicals from the time that the drill pad is leveled to 20 years from now when we hope everybody goes away and everything is restored to where it was.

So this confusion is very much behind causing even anger by folks. This is an analysis of the reasons given by those not in favor of Marcellus drilling, and you will see that health concerns are a large part of this. Part of the reason for concern is unnecessary secrecy. My example of how ludicrous this is comes from the Gulf oil spill. Secrecy about this particular component, this organic sulfonic acid salt at the bottom, this propriety drug, contributed greatly to the stress experienced by Gulf residents. It turns out that this secret ingredient is a commonly used over-the-counter stool softener we have often prescribed, and I can tell that at least one of us in this room has used. It is of no toxicological significance to humans. I don't know about the fish. But why do we keep this secret?

One of my major concerns as a toxicologist as a physician is the mixture issue. We have lots of chemicals that are being used. They are continually changing. We don't know what is in there. I can't be responsive to someone who calls and says my kid has such and such problems, I am worried about this disease, because I don't really know what is being done there. And not only do we have this

concern about the individual chemicals, there is this mixture issue but there is even a greater mixture issue having to do with the fracking fluids that return, the produce water, the flow-back water, which contain not only the residual fracking chemicals but also everything that has been brought up from underground. And we don't really know what is going to happen with these flow-back fluids.

I can't in this brief presentation do more than list some of the potential health issues that should be addressed, and I must respectfully disagree with the distinguished Chair about the importance of index cases. In my experience, index cases are simply not very germane to environmental medicine.

Let me cite our analysis of the Pennsylvania Department of Environmental Protection's data on violations by companies involved in Marcellus shale drilling. Some of these companies are to be commended. They have had no violations. Some should not be in business. And as long as that persists, we are going to have major problems.

And finally, it is disappointing that despite the fact that the various advisory committees have been put together, this is the President, the Governor of Maryland, the Governor of Pennsylvania, that really look at health and welfare and are concerned about protection of public health, we have examined these three advisory committees, there are 52 members and there is nobody with any health background in any of these advisory committees. No physicians, nurses, toxicologists, risk assessors, etc.

So let me conclude with what I think are three certainties of what are going to happen. First, there is going to be surprises. There already have been—bromides in water, earthquakes. There will be improved technology. Industry has to pay for their fracking chemicals. It is in their interest to recycle them. Industry should not be releasing the chemicals that come out in fact because they should be selling them. They want to sell them. But we found over these past 40 years that it requires a lot of oversight, a lot of rigorous oversight to make this happen. It won't happen by itself.

And finally, there certainly will be adverse health impacts that are going to be reported in these various areas. They will be statistically significant. That doesn't mean they are causal. There is enough different diseases in different areas. People are going to wake up and said we have never had this much pancreatic cancer or autism or leukemia before those drilling, those wells were drilled, and at that point, to try to figure out in retrospect what is really going on is a little too late. It is cost-ineffective to do it then. We need to start doing it now if we are going to be able to get the greatest benefit we can, or in fact, the decisions will be made based upon litigation, not based upon science.

Thank you.

[The prepared statement of Mr. Goldstein follows:]

PREPARED STATEMENT OF DR. BERNARD GOLDSTEIN, PROFESSOR AND DEAN
EMERITUS, GRADUATE SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF PITTSBURGH

The Public Health Implications of Unconventional Gas Drilling

For presentation to the
Energy and Environment Subcommittee,
Committee on Science, Space, and Technology
Feb 1, 2012

Bernard D. Goldstein, MD
Graduate School of Public Health
University of Pittsburgh
bdgold@pitt.edu

My name is Bernard Goldstein. I am a physician, board certified in Internal Medicine and in the subspecialty of Hematology. I am also board certified in Toxicology. My background includes appointment by President Ronald Reagan as Assistant Administrator for Research and Development of the US Environmental Protection Agency. I am an elected member of the American Society for Clinical Investigation and of the National Academies of Sciences Institute of Medicine for whom I have been a member or chair of over twenty committees involved with environmental health. Since serving in the US Public Health Service Division of Air Pollution over 40 years ago, I have written more than 200 papers or chapters on environmental health issues, including in the past year an invited review in the New England Journal of Medicine of the health implications of the Gulf Oil Spill. My current position is professor emeritus of environmental and occupational health and dean emeritus of the University of Pittsburgh Graduate School of Public Health. Our school was founded in 1948 with a commitment to be responsive to environmental pollution issues for which Pittsburgh was then infamous, and we maintain this commitment in addressing the threats posed by the very rapid development of unconventional gas drilling in our state. My testimony, of course, represents my own views and are not necessarily those of the University of Pittsburgh. I will speak to the issue of the public health impact of unconventional natural gas drilling.

My testimony today is largely based upon my experience as a physician, as a toxicologist, and as a government official who has worked in the field of environmental health for over 40 years. But, I must stress that it is also based upon personal discussion with community groups and individuals who are very concerned that their or their family's health has been or will be affected; and with physicians who are puzzled about the appropriate answer to the questions their patients are asking.

My overall theme is that it is in the nation's and in industry's best interests to maximize the yield of natural gas while minimizing the short-term and long-term environmental and public health costs, and that to do so we must seriously address the possibility of adverse public health impacts. I believe that that we are ignoring many of the lessons about how to approach potential environmental health issues that we have so painfully learned over the past forty years.

My three major points are that:

- 1) the public is concerned about the potential health impacts of unconventional shale gas development;
- 2) there is genuine cause for this concern, and

3) the current lack of almost any support for research directly related to the health effects of unconventional gas drilling is shortsighted and counterproductive.

Before presenting these three points in more detail, I believe it important that the context of this concern be addressed.

The public is confused, and in some cases rightfully angry, concerning the conflicting information they are receiving about two important aspects of unconventional shale gas drilling. The nation is hearing from industry, and from the government, that exciting new technology permits obtaining gas from deep underground shale formations; but we are also told that this has been done for decades so there is nothing to worry about. It can't be both. It is true that hydrofracking is a decades-old technology, but where previously perhaps 50,000 gallons of water was used in a relatively shallow vertical well, current technology uses 5 million or more gallons of water, goes much deeper and turns horizontally underground. Implying that they are the same is like saying that a two-ton bomb represents no greater risk than a hand grenade because they both are explosives. Further, although there is far too much secrecy about the issue, it appears that there have been substantial changes over the years in the components of the fracking mixtures which makes it very difficult to predict present outcomes from past experience.

A second contradictory issue concerns the subject of what is meant by hydrofracking. This committee is considering the controversial evidence from Pavilion, Wyoming concerning whether fracking chemicals released deep underground ever make their way to groundwater wells. To the public, however, hydrofracking is a general term that encompasses what the public is truly interested in – which is any problems beginning with the time the land is leveled for a drill pad, until decades from now when the land, hopefully, is restored. Public concern includes what happens to the flowback water, the impact of the trucks and the often noisy compressors, public safety and all of the other potential problems caused by unconventional gas drilling activity. To the public, reading about residents losing use of their wells, or drilling companies being fined for groundwater contamination, a focus that is solely on the issue presented by the Pavilion study seems like a subterfuge designed to avoid answering their questions about the overall impact of unconventional shale gas drilling on their environment and on their health.

Evidence that the public is concerned about the human health impacts of unconventional gas drilling is easy to obtain. Our own study of those who testified against drilling to the Natural Gas Subcommittee of the Secretary of Energy's Scientific Advisory Board shows that about two-thirds cited health concerns. Contributing to this concern is the level of secrecy about the specific chemicals being used. In the Gulf of Mexico, the secret ingredient in the dispersant, whose secrecy contributed to the stress experienced by Gulf residents, turns out to have been a commonly used over-the-counter stool softener of no toxicological significance – at least to humans.

Are public health concerns legitimate? Certainly. Let me begin with toxicology. There are many agents of toxicological concern in the fracking mixture, and many other agents about which we know too little. It is very hard to find a health complaint that has not been associated in the literature with at least one of these compounds. Let me at this point respectfully comment on the issue of waiting for an index case

to appear. The index case is a very valuable concept in medicine, particularly in infectious diseases – but in my experience is of very little value in environmental medicine. In a cholera outbreak, the original person with diarrheal disease from whose body fluids we identify *Cholera vibrio*, the bacterial cause of cholera, is truly an index case; and in retrospect we can identify the flight attendant who was the index case for HIV/AIDS in the United States. But the chemicals on the fracking list are those that can be expected to add to the burden of existing diseases or symptoms. They might cause leukemia or asthma, headaches or rashes, all of which have a background incidence. Let's imagine a community whose childhood asthma rate increases by 20% due to an environmental cause. None of us would want that to happen in our community, but, statistically, 5 out of 6 of the children would have had an asthma attack without the new environmental cause. There would be no index case as such, and we might not even notice unless a thorough study was done of the asthma incidence in relation to the environmental exposure. As far as I can tell, there is no study underway which thoroughly explores exposures and outcomes related to unconventional shale gas drilling activities - no study which takes advantage of the valuable advances in environmental health sciences which this committee has overseen.

The index case approach can be useful in environmental medicine when there are truly unusual outcomes, such as mesothelioma due to asbestos, or blue babies due to high levels of nitrite in groundwater. It is possible that unconventional gas drilling will cause index cases of unusual diseases over time given how little we know about the health implications of the fracking mixtures.

Two types of mixtures associated with unconventional gas development are of concern. The first is the mixture of fracking compounds themselves. Twelve different goals for these agents are shown. The website of the Interstate Oil and Gas Compact Commission states that there are dozens to hundreds of compounds that can be used in fracking. An even more worrisome mixture of agents is present in the flowback fluids which contain not only fracking compounds, but hydrocarbons associated with the natural gas plus dissolved minerals, brine constituents, and naturally occurring radioactive materials. (And the eventual disposal of these ever larger volumes of flowback water is still unclear). As a physician and a toxicologist, I am least worried about mixtures whose composition is reasonably predictable and whose effects have been well studied – just think of gasoline, or of coffee. Major advances in the toxicological understanding of mixtures in the past resulted from studies by NIEHS, ATSDR and EPA, that were funded due to public concern about mixtures of hazardous wastes at Superfund sites - and the number of hydraulic fracturing sites is now beginning to rival the number of Superfund sites. I urge congress to update these mixture studies by providing funding to apply modern toxicological advances to the chemical mixtures that are being used in, or result from, hydraulic fracturing.

There are many other health issues - too many to discuss in a brief time. There are legitimate concerns about air pollution levels, particularly during the intense fracking period when neighbors often perceive noxious odors. Ozone formation occurring many miles downwind is a possibility. The aggregate releases of ozone precursors from multiple wells may tip areas into non-attainment with the ozone standard - which is particularly ironic as the federally-required response to non-attainment may include limiting the industrial development that is perceived to be the benefit of shale gas drilling.

An additional reason for public concern is the mixed performance of industries engaged in unconventional natural gas drilling. The next slide in my handout is taken from the *fractracker* web site (www.fractracker.org). It shows the distribution of Pennsylvania Department of Environmental Protection violations for companies that have at least ten well starts. The names of the companies are on the web site. I have left them out of this presentation so as not to lose sight of the important issue – which is the wide range of performance of the different companies. To protect the public we need to better understand what factors are driving this wide disparity in performance and to ensure that best practices are enforced across the entire industry. Parenthetically, if the drilling industry wants to be judged as caring about the environmental and public health consequences of its activities, a good test will be whether it supports, or stonewalls, EPA's forthcoming delineation of best practices.

My third point concerns the current shortsighted and counterproductive lack of almost any support for research directly related to the health effects of unconventional gas drilling. It begins with the apparent failure of government to even want to hear from the expert environmental public health community. That is a strong statement, but it is backed up by our attached peer-reviewed analysis, accepted for publication in *Environmental Health Perspectives*, of the membership of three advisory committees established in the past year: by President Obama in his Blueprint for a Secure Energy Future; and by the Governors of Pennsylvania and Maryland. Of the 52 members of these three commissions we could identify none with any background in any health field. There are no physicians, nurses, pharmacists, public health practitioners, toxicologists or professional risk assessors. Similarly, neither state included its Department of Health among the total of eight state agencies from whom members were drawn in the two state advisory processes; and the Department of Health and Human Services was not among the three federal agencies specified to be involved in the ongoing federal effort. While health concerns were certainly prominent in the executive orders establishing these three advisory committees, and the two that have reported so far do have health recommendations, it is not surprising that research on public health issues is far behind where it needs to be. EPA, the subject of your hearings, has focused primarily on hydrogeological issues but commendably has begun to look at identifying the health and environmental hazards of the fracking compounds. Understanding exposure pathways for humans is important, but is not accomplished by looking at just one potential pathway of exposure, such as is being evaluated in the Pavilion study. Understanding exposure pathways so as to predict environmental and public health effects requires a broad evaluation of all activities, not only at the site, but including such issues as the impact of trucking and the disposition of the contaminated flowback fluid. Worker health and safety is also important. The whole panoply of exposure assessment technologies needs to be employed, including the study of air, water and soil, and of biological markers of exposure and effect in ecosystems and in humans. Further, studies of exposure and of effect require listening to the community. An initial attempt at a broad health impact assessment in Colorado was aborted by lack of ongoing support. Governor Corbett of Pennsylvania has indicated his support of funding the state Department of Health to begin health-related studies, and I hope this will occur.

Ignoring the public health implications of unconventional natural gas extraction is not going to work. This is not a one-time event in a single location whose health effects could be hidden by simply not looking for them. Let us not, five or ten years from now, find conclusive evidence that we are hurting

people or the environment. Such an impact, and the cost of the necessary but belated response, would severely detract from the promise to our nation of unconventional shale gas drilling.

I believe that in the coming decades we will extract the natural gas in the Marcellus shale and in other accessible shale beds in the United States. It is in the best interests of the nation to invest in understanding the potential adverse human health consequences of this activity. The most cost-effective time, and in fact the only cost-effective time, to make this investment is now rather than to wait until the inevitable clamor for such research when diseases begin to appear that are associated with natural gas drilling activities. Determining if such an association is truly causal or occurs solely by chance is always far more difficult to do in retrospect, particularly in the setting of media publicity, fear for the health of one's family, the inevitable litigation, and lost property values. We need a longer term view of how to most optimally and sustainably develop these resources.

I can summarize my testimony as stating that there are three virtual certainties.

- 1) The complex and evolving process of unconventional gas drilling will lead to unwanted surprises;
- 2) industry, given time and rigorous oversight, will do a better job of recycling the fracking chemicals, which they buy, and decreasing the release of hydrocarbons, which they sell; and,
- 3) Adverse health effects will be statistically associated with unconventional gas development activities

Finally, what is the rush. The National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling called for careful renewal of deepwater drilling in part because it is in our national interest to get this oil before the Cubans or the Venezuelans or the Chinese do so. But unless the Canadians can horizontally drill under Lake Erie to get to the Marcellus shale, that gas is not going to anyone but us.

Thank you for your attention. I welcome your questions.

Chairman HARRIS. Thank you very much, Doctor, and I sympathize with you because, you know, as an academician, whenever I would give a talk, I always gave it from slides. So then I get into the legislature and find you don't do that anymore. Thank you very much for your presentation.

Now we will begin, reminding Members that Committee rules limit questioning to five minutes. The Chair at this point will open the round of questions and I recognize myself for the first five minutes.

Thank you very much, Mr. Martin, for being here. I understand Dr. Anastas couldn't, so I appreciate you being here. I want to ask you, though, and just confirm for me a couple of just facts. First of all, is the only chemical that was found in those wells that was above drinking water standards for a public well was benzene. Is that correct? In the two monitoring wells, the two deep monitoring wells.

Mr. MARTIN. I am sorry, Mr. Chairman, but could you repeat your question?

Chairman HARRIS. Sure. What substances were found at concentrations above the drinking water levels that are accepted for public water supplies?

Mr. MARTIN. Benzene was the most notable example of what we—

Chairman HARRIS. Which other ones? Could you list them?

Mr. MARTIN. That is the only one, I believe.

Chairman HARRIS. The only one. Okay. So it was the only one. And it is true, it was only found in one of the two monitoring wells. Isn't that right?

Mr. MARTIN. No, I don't believe that is correct.

Chairman HARRIS. I suggest you look at your draft report, which suggests that monitoring well #1 did not have measurable amounts and monitoring well #2 had them.

Mr. MARTIN. I don't have the report in front of me, Mr. Chairman.

Chairman HARRIS. Well, I do. I suggest you also check, you had two measurements separated by six months. Is that correct?

Mr. MARTIN. Yes.

Chairman HARRIS. And isn't it true that the benzene level was one-half the original reported amount when you went in the second sampling in well #2?

Mr. MARTIN. Mr. Chairman, you have the data before you; I don't.

Chairman HARRIS. Well, this is your report. You signed on to this—you approved this press release, didn't you?

Mr. MARTIN. I don't know to what—

Chairman HARRIS. This is the press release from October 8th—I am sorry—from December 8th releasing the draft study, the company that released the draft study. You have read the report. I think you have read the report.

Mr. MARTIN. Multiple times, Mr. Chairman.

Chairman HARRIS. Very good. Well, I suggest you look at that table—so what we have done here is, we have said that we only have one contaminant. It was only found in one well, and oh, by the way, there is a twofold difference in the concentration in that

well and it fell from the time of the first measurement to the time of the second measurement. Is it true, because there has been testimony in front of this Committee, there have been 1.2 million applications of hydro fracturing in the United States and there still has not been a documented contamination of drinking water above the levels acceptable for a public system. Is that correct? There still is no documented case?

Mr. MARTIN. That is information to which I can't testify, Mr. Chairman.

Chairman HARRIS. Okay. So you certainly can't refute the testimony in front of this Committee previously on that?

Mr. MARTIN. I can't.

Chairman HARRIS. I know why you can't because there still isn't, and although the EPA might want to suggest that in this press release, I think that it may not be true.

Now, you state in your testimony that "Our analysis is limited to the particular geologic conditions in the Pavillion gas field and should not be assumed to apply to fracturing in other geological settings." Now, that is an extension of what you actually had in the press release because the press release didn't actually say and oh, by the way, don't extrapolate this, don't apply this to fracturing in other settings, and you also went on to say in testimony that these wells had "production conditions different from those in many other parts of the country." And having read the report, and having the testimony of a geologist, of someone with expert in the local geology, I can understand that. But I want to be clear. Regardless of what the peer review process determines about this report's findings and validities and all the rest, does the EPA think that the results of this investigation can be reasonably extrapolated to modern hydraulic fracturing being used, for example, in the Marcellus shale, which of course runs through my state?

Mr. MARTIN. Mr. Chairman, the circumstances, the conditions, the geologic conditions that exist with the Marcellus shale are significantly different. In the Pavillion case, we were looking at production that occurred in an underground source of drinking water, an aquifer, at depths as shallow as 1,200 feet where the most—the deepest domestic drinking water well was 800 feet. I believe in the Marcellus shale, you are looking at production occurring from 5,000 feet below ground, so they are very different.

Chairman HARRIS. So you believe that these results really can't be reasonably extrapolated to the Marcellus shale?

Mr. MARTIN. We have not proposed to do anything of that sort, Mr. Chairman.

Chairman HARRIS. Good. In light of that clarification, I want to give you an opportunity to comment on recent statements regarding the conclusion of EPA's draft report. After the issuance of EPA's Pavillion draft report, the Governor of Delaware said that this report validates his plans to veto gas drilling in the four-state Delaware basin. Was the Governor wrong to extrapolate your results to the Delaware River basin?

Mr. MARTIN. I have never met the Governor. I don't know him and I don't know the circumstances or the context and I am not about to tell him he was right or wrong, Mr. Chairman.

Chairman HARRIS. Well, I am just going to ask you based on your knowledge of the potential uniqueness of the geology in Pavillion, Wyoming, is it your impression that maybe the Governor should have thought a little longer about that or maybe looked into a little different or actually taken into account the geology of the Delaware River basin before coming to that conclusion? Because it sounds like that's what the EPA suggests, that you have to take local geology into account.

Mr. MARTIN. I am not in a position, Mr. Chairman, to criticize any governor.

Chairman HARRIS. Well, your former colleagues at the Environmental Defense Fund called the draft Pavillion report a "wakeup call on the need for stronger regulation nationally on hydraulic fracturing." Now, are your former associates wrong to interpret the results in this way, broadly extrapolated to hydraulic fracturing anywhere in any geologic formation?

Mr. MARTIN. I haven't talked with them, Mr. Chairman. I haven't seen their comments in context. I am not in a position to criticize anyone here other than to give you a better understanding of what we did at the Pavillion site.

Chairman HARRIS. Has your office had any communication with them at all?

Mr. MARTIN. Sir, there are 800 people in my office. I can't speak to whether anyone had had any—

Chairman HARRIS. Would the FOIA request that has been made regarding this information, would that be part of that FOIA request? Because the FOIA request is solicited email responses. Would we find that information out there if you are unable to say whether you have had any communication with them?

Mr. MARTIN. I can tell you definitively, I have not.

Chairman HARRIS. By any means?

Mr. MARTIN. Not about this particular—

Chairman HARRIS. Thank you very much.

Mr. Miller.

Mr. MILLER. Thank you, Mr. Chairman.

Mr. Martin, you said, or Dr. Harris asked if it was true that benzene was the only chemical that was above acceptable levels. Is benzene a known carcinogen? It is, is it not?

Mr. MARTIN. It is, Congressman.

Mr. MILLER. Okay. And I think in your testimony earlier you said that it was at 50 times the acceptable level?

Mr. MILLER. I did.

Mr. MILLER. So if it fell to half what it was earlier, it was still 25 times acceptable level. Is that correct?

Mr. MARTIN. I believe your math would be correct, sir.

Mr. MILLER. All right. Ms. Sgamma, from your biography, the biographical information provided to the Committee, your title is Vice President of Government and Public Affairs. That sounds like the title given to a lobbyist. Is that correct?

Ms. SGAMMA. That is my title, yes.

Mr. MILLER. All right. In looking at your educational background and your experience, it appears to be in information technology, computer stuff. The federal regs have a list of the scientific fields that are considered experts for purposes of hydraulic fracturing. IT

is not one of them, and it appears that you have no background in geology or toxicology or hydrology or public health or anything else that is one of the fields of expertise that are touched by hydraulic fracturing. Is that correct?

Ms. SGAMMA. I am not applying to be on the peer review of any of this report but I do—I am informed by my members, who do indeed possess those degrees and that expertise.

Mr. MILLER. All right. Of course, they are not here to answer questions.

Mr. Martin, we have heard that the contamination could have been caused by something else, by pesticides, by septic systems, by fuel stations, leaching underground storage tanks and that those were not considered. Did the EPA in fact consider and test for those other explanations?

Mr. MARTIN. Congressman, we did. In fact, we designed the first two rounds of testing to look very broadly at a wide range of contaminants that might be present. We have been able to rule out pesticides and other potential sources including nitrates from agriculture or from dysfunctional septic systems. We have looked hard for a set of sources. We eliminated none going in. We have eliminated several in the process.

Mr. MILLER. All right. There has been some subject—some—well, Dr. Goldstein in his testimony said part of the public's concern is the lack of disclosure of what the chemicals going into the ground are. I understand from Mr. Doll—Dole?

Mr. DOLL. Doll.

Mr. MILLER. Doll, that they are now disclosing going forward but how would it be helpful to you—and I am not sure how further that disclosure is—but how would it be helpful to the EPA or anyone else studying groundwater contamination to know what chemicals were being used in fracking? Would it be helpful? Mr. Martin?

Mr. MARTIN. Congressman, I believe it would be very helpful. We have actually been able to get from the company that operates this field MSDS sheets for some of the materials used in fracking, and that has been tremendously helpful.

Mr. MILLER. Okay. Well, how—you have been—ironically, you have been criticized by the Members of this Committee for a lack of transparency, but how would the transparency of EPA's work be compared to the transparency of the company doing the drilling, Encana, as well as the State of Wyoming?

Mr. MARTIN. Congressman, we have worked closely and well with Encana on a number of issues but we are still awaiting responses to a number of questions we propounded to them including the results of the split sampling that they took during several phases of this investigation.

Mr. MILLER. Dr. Goldstein, I understand that a conference recently of medical experts recently urged that the rapid expansion of fracking for natural gas be, the term was paused, so that there could be research to determine the potential harmful effects on human health. Dr. Goldstein, it appears that you do have both the disinterest and the expertise to qualify as an expert in this area. What do you think of the idea of pausing, at least slowing the expansion, which may happen anyway for economic reasons or appears to be happening, anyway, for economic reasons, but pausing

the expansion of fracking so that the scientific community can assess the risk of the technology?

Mr. GOLDSTEIN. I strongly support that, sir. The issue to me is if we have in Pennsylvania 20 years of Marcellus shale gas, we are going to get all of that gas. I see no alternative to the fact that we will drill all that gas. That is the only reasonable scenario. So what is the rush? It is not going anywhere. In the Gulf, our Deepwater Horizon commission said that we ought to be drilling in part because otherwise the Cubans or the Venezuelans or the Chinese might get that oil, but unless the Canadians can figure out how to frack underneath Lake Erie, that is staying with us and we are going to get it. We might as well optimize how we get it in such a way that we don't interfere with public health or the environment.

Mr. MILLER. Mr. Chairman, my time is expired, and I know how persnickety this Subcommittee is about the rules.

Chairman HARRIS. Well, thank you very much, Mr. Miller. We like to play by the rules. That is what we do.

The chair now recognizes the chairman of the Committee, Mr. Hall, for five minutes.

Chairman HALL. I have a question for Mr. Doll. On January 19, 2012, EPA Administrator Lisa Jackson sent a letter to Governor Mead responding to his concern about the amount of sampling conducted during the course of his investigation. Are you aware of that?

Mr. DOLL. Yes, sir, I am.

Chairman HALL. And in it, Administrator Jackson states "We have conducted four phases of sampling, each of which was designed in consultation with the state." Is that correct?

Mr. DOLL. Sir, that is what she states in her letter, yes.

Chairman HALL. Did this consultation take place? You have not been transparent so far as I have listened to you here today. Can you give me an answer to that?

Mr. DOLL. Are you asking me the question, sir?

Chairman HALL. No, I am talking now to Mr. Martin.

Mr. MARTIN. I am sorry, Mr. Chairman. We consulted with a number of parties and certainly including the state at each phase of this process including the development of sampling plans for the first two phases, the design of the well, the monitoring wells that were constructed in the summer of 2010.

Chairman HALL. I will get back to Mr. Doll. Did this consultation take place?

Mr. DOLL. The way I understand it, sir, from the Department of Environmental Quality, they were involved in the initial sampling that occurred in the 2008 time frame.

Chairman HALL. What do you mean, involved in?

Mr. DOLL. They were notified and were aware that the sampling events were going to occur in 2009 and 2010. They were also informed at the time because it wasn't with my agency the speculation that I can address only as speculation is that they were informed that the monitoring wells were going to be drilled about the time that the drilling rig was moving to the site.

Chairman HALL. How involved was the state in the development of sampling and monitoring those plans?

Mr. DOLL. I am not aware that we were involved at all, sir.

Chairman HALL. What would you have recommended to EPA if you had been consulted? You were not consulted, were you?

Mr. DOLL. No, sir, we were not. The Oil and Gas Conservation Commission was not.

Chairman HALL. Even though they contend that they were and they have so testified under oath that they were?

Mr. DOLL. They may have contacted by email the head of the Department of Environmental Quality but not the Oil and Gas Conservation Commission.

Chairman HALL. Well, they might have sent them an email. That is not consulting, that is their own arrogant approach to it. I think they just sent them an email. They didn't consult with them. You are not testifying that they consulted with them, are you?

Mr. DOLL. No, sir, I am not.

Chairman HALL. Then since the states are responsible for regulating drilling protocols, did EPA apply for a permit or submit a drilling plan to the State of Wyoming so far as you know?

Mr. DOLL. Not as far as I know, sir.

Chairman HALL. Okay. Do you have any idea, Mr. Martin, why would the EPA Administrator claim that her agency consulted with the state on designing a sampling plan if it had not occurred?

Mr. MARTIN. Mr. Chairman, Mr. Doll and I—

Chairman HALL. You haven't known when they asked you other questions about that.

Mr. MARTIN. I am sorry, sir?

Chairman HALL. You have not been able to testify. You wouldn't cross the Governor or anybody if you had information in front of you.

Mr. MARTIN. I think—

Chairman HALL. You are under oath now. You know that, don't you?

Mr. MARTIN. I am, Mr. Chairman. I guess I am. I believe we conducted significantly greater consultation than Mr. Doll might be aware of. Early in the process, the Department of Environmental Quality for the State of Wyoming was designated as the lead agency for the State of Wyoming as part of this process. We consulted with them. We actually consulted with Encana in designing the monitoring wells that were constructed in 2010. We have significantly greater consultation with the state than perhaps Mr. Doll is aware of.

Chairman HALL. I understood that EPA will be selecting a panel of outside peer reviewers to take a look at its work. Mr. Martin, can you assure me that at least one person recommended by the State of Wyoming will be named to this peer review panel?

Mr. MARTIN. I believe, Mr. Chairman, that the Administrator has told the Governor that she expects that there will be at least one expert who meets all of the other qualifications for membership in an external peer review process, that there will be at least one person from Wyoming on the peer review panel.

Chairman HALL. The Pavillion case that we are examining today reflects a troubling effect by EPA to build a case for regulating and even shutting down unconventional oil and gas production around the country and they are doing that all over the country, even out

in Wyoming, and the EPA has it handed to them time after time by this Committee. I am sorry to say the liberal press hasn't printed it properly but they always say they need more investigation. But we have had people who have had years and years of experience and been here under oath that have testified there is not any way in the world that fracking could have affected the drinking water in the examples that were given to them. Do you understand that?

Mr. MARTIN. Yes, sir. Is it a question or—

Chairman HALL. It is important to recognize what EPA is doing in Wyoming is not isolated. They are going after fracking everywhere they can. I guess that is what I am trying to tell you, that they have been through most of the jurisdictions here and have absolutely had no proof, nothing testified under oath that would imply that fracking had damaged drinking water, not that I know of.

Chairman HARRIS. Thank you very much.

Chairman HALL. I would like to—let me enter in two documents into the record that raise questions about EPA's commitment to getting the science right on hydraulic fracturing.

Chairman HARRIS. Without objection.

[The information appears in Appendix II:]

Chairman HARRIS. Thank you very much, Mr. Chairman.

I recognize the gentleman from New York, Mr. Tonko.

Mr. TONKO. Thank you, Mr. Chair.

Mr. Doll, in reviewing your testimony, there at least appear to me to be some inconsistencies so that I would ask that perhaps you would clarify some points for me if you could, please. I will run through a few of these and then would like your comment. You indicate that the residents of Pavillion brought their concerns about water quality to the state in 2005, on page two of your testimony, and the state's investigation showed no impact from oil and gas development. But the drilling company entered into a voluntary remediation program in 2008 with the state, and I quote "because hydrocarbon impacts were discovered in groundwater." That is from section 2.2 of public participation plan of Pavillion, Wyoming, dated April 2008. This conclusion apparently was based on a study done by Wyoming's Department of Environmental Quality. So could you reconcile that for me?

Mr. DOLL. Yes, sir, I will. The work that was done in Pavillion by the Department of Environmental Quality goes back even before 2005. These are old—this is an old oil and gas field area. There were some pits that were identified and cleaned up and further testing was done in that 2005 to 2008 time frame, and I believe that was why those pits were identified and put into the voluntary remediation program. There were over 60 pits reviewed, and then several, I think three or four, I am not sure, because that is the Department of Environmental Quality, but I think three or four were put into this voluntary remediation program. We have a group of individuals that are involved in a working group looking at these pits and sites that were identified by landowners as concern, and reviewed that data again and found one other area that upon testing found that needed to be added to the voluntary remediation program. So that is hydrocarbons that were probably

hauled in. This gas that is being produced in the Wind River formation is a dry gas with very little liquids associated with it in terms of water or any kind of petroleum hydrocarbon.

Mr. TONKO. And on page 5 of your testimony, you state that other possible sources of groundwater contamination remain unstudied. But notes from the April 2011 meeting indicate that they were researched by the pits working group which stated other potential sources including Greg Oberley of EPA said a records search into septic systems, dumps, oil and chemical storage sites is a work in process. And that Kathy Brown of DEQ reported that a DEQ database search did not identify any potential sources but she will need to do a paper records search to confirm. John Fenton said he needed more time to research county records and work with county planning to identify potential sources, there again from the meeting notes of April 11 from the pits working group under item #3.

Mr. DOLL. Congressman, you are absolutely correct. Those are continuing to be a work in progress. These are part of the working groups that have been meeting. We met four times in 2011. None of this has been addressed in the draft report on Pavillion. It is a work in process, groups independent of the EPA's efforts on these two monitoring wells and what is put into that draft report.

Mr. TONKO. So are they unstudied or—

Mr. DOLL. They are—well, there are no conclusions drawn. The study data has not been accumulated that I am aware of, so it is a work in process. So if I misspoke, it was only because the working group, it is a work in progress.

Mr. TONKO. I appreciate that. I also observed that several of the statements in your testimony suggest that you do not believe the residents' wells are contaminated, that all substances are from natural sources. If so, why has the state offered five alternative methods for supplying water that you refer to in your testimony?

Mr. DOLL. The—sir, the five methods that were studied, that study was done by the Wyoming Department of Water Development, and the Wyoming Water Development Commission—excuse me—put out a report in September of 2011 stating that there were five potential solutions for those landowners for water. It did not address cause or that there was a requirement for that. They were tasked by the previous Governor, Governor Freudenthal, to do that study and that is what that is referring to in my written testimony.

Mr. TONKO. So then are you suggesting there is no well water contamination?

Mr. DOLL. What I am suggesting, sir, is that that report is out there and that there is an effort by the current Governor, Governor Mead, and state agencies to make sure that these people have clean drinking water. That may be a source. They will probably have to form a rural water district to be able to do that but that is something that the landowners themselves must initiate, not the State.

Mr. TONKO. Mr. Chairman, I would ask that we put the documents that I referenced into the record, please.

Chairman HARRIS. Without objection.

[The information appears in Appendix II:]

Chairman HARRIS. Thank you very much.

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

Mr. MCNERNEY. Thank you, Mr. Chairman. Thanks for holding this hearing. I want to thank the witnesses for coming forward today. This is a contentious issue.

In my mind, there is two potential problems with hydraulic fracturing. One is the actual contamination, and the other is the public perception of health risks from possible contamination. They are not unrelated, but they are separate in a sense, and in my mind, the Environmental Protection Agency's involvement and test program will help address both of those problems. It will help make sure that—it will help identify contaminations and sources of contaminations, and it will help us put procedures in place to make sure that there are standards on the cement and casings to prevent contamination, which is a serious issue, but also help satisfy the public in terms of openness and transparency, that they are satisfied that the tests are being done and that everybody has access to the data. So what the EPA is doing in terms of doing the tests, releasing the data and now they are going to go through the peer review process, this is all part of what has to happen in order to satisfy the public, in my opinion.

So Mr. Martin, we have heard a lot about hydraulic fracturing in the last several months including potential contamination from waste disposal and storage and inadequate cement outside the production casing. Can you briefly discuss the EPA's draft findings pertaining to the cement outside of the casings of some of the wells? In other words, what have you found about well integrity with regard to cement in casing?

Mr. MARTIN. Well, Congressman, what we found was that most of the production wells did not have surface casing that went below the depth of the deepest domestic drinking water well in the underground source of drinking water, the aquifer. We found weak or absent cement in many of the wells at depth, and that was one of the reasons we hypothesized that a potential pathway for vertical migration of the materials that we found at the deeper levels of the aquifer. It is a potential pathway. We posited several potential pathways. We were unable to identify any one as the most likely or the pathway.

Mr. MCNERNEY. Okay. Good. If you look at the theory, it is good. They have these casings in cement and it is all sealed, but if there is integrity problems with the cement, then the whole thing goes out the window, and we need to make sure that there are procedure and standards in place to prevent that. We need the gas and everybody wants to get to it. We just need to make sure that it is done properly. In my opinion, your involvement with the EPA is going to help us get there.

Mr. Goldstein, I understand you have concerns such as problems with inadequate cement. Can you discuss this as well, please?

Mr. GOLDSTEIN. Yes. It goes back to what the public is hearing. The public is hearing that there is no problem with hydraulic fracturing, none gets to the surface, and at the same token, they are reading in the newspaper how a company has been fined a million dollars and communities on drinking water because a cement casing blew. Well, it is all assumed to be hydro fracking. The fact that

it is a cement casing or the fact that there were drums on the surface about to be put underground and a truck backed into it and released the contents of the drums, these were all fracking fluid. They were all groundwater contamination from hydro fracking in the broader sense of the term. It is occurring. We are reading about it. So we can't ignore that this is going to happen. And as I showed you, some of the companies are, at least in terms of Pennsylvania's Department of Environmental Protection not following the rules very closely.

Mr. MCNERNEY. Well, what should we do in your opinion to make this as safe a procedure as possible?

Mr. GOLDSTEIN. I basically believe that we will know better whether industry, which is trying, I think, in many cases, as we have heard, very hard to do the best they can. We will know how serious they are in a few months when EPA comes out with its draft best control technology, and will industry support that, work to get the best control technology or will they stonewall these rules because they don't like the rules? That to me will be the test of how industry really responds.

Mr. MCNERNEY. Is the Pavillion activity by the EPA, is that going to be beneficial in terms of us getting there, in terms of understanding what the potential problems are?

Mr. GOLDSTEIN. Well, I hope so. I go back to the time I was Assistant Administrator at EPA, a contentious time under President Reagan. There are two types of studies we do. Some fit very well into what Chairman Harris described as a superb scientific study initiated by EPA. Some are more responsive. They are more public health-oriented studies in that you are responding to the public. You haven't designed how they put those wells down and what has been released. It is not a matter of putting a well down and every 500 foot releasing a tracer and see if it came up in a randomized approach. This is a matter of being responsive, and as I read this report, I think it has got all the hedges and all the appropriate responses, and I would like to see what happens with the peer review. I hope it is a good peer review that they use.

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

Chairman HARRIS. Thank you very much, and we will have one other round of questions. I am going to again apologize to the witnesses for keeping you past noon, but this is such an important hearing.

Mr. Doll, in your testimony you note that "the draft report provides no data to show how these two EPA monitoring wells represent any water supply wells used by anyone in the Pavillion natural gas field." In your view, do the findings of the deep monitoring wells relate to drinking water issues cited by the complainants?

Mr. DOLL. Mr. Chairman, I do not believe that the report defines that or defends that properly. The actual information that we have seen from the data tells us that this gas and water that is found in these two monitoring wells is different than the gas and water that is found in the shallow drinking water aquifer. It is all the same formation. There is no barrier between the source rock at great depth and the formation that produces natural gas and serves as the aquifer.

Chairman HARRIS. So you don't believe that those 622 pages released last night are going to change your opinion? I guess we have to wait to see what was released.

Mr. DOLL. I would hate to speculate on what would be their—

Chairman HARRIS. Sure, and I am going to apologize for the Federal Government for taking so long to release that.

Mr. Martin, Interior Secretary Salazar has been quoted as saying "The jury is still out" on the validity of the Pavillion study. Similarly, experts in the Interior's Bureau of Land Management viewed the draft report and communicated a number of concerns with the conclusions of the EPA the week before it was released to the state. Specifically, BLM's comments, they "questioned the statistical validity of the two EPA monitoring well locations," highlighted that there is "a serious lack of data if one is going to arrive at a specific source for the observed contamination", third, raised "concern over the well development process" and said that "arriving at conclusions at this stage is hasty, in my opinion" and finally BLM concluded that "the nature and extent of the contamination possible pathways and site conceptual models are not yet understood to the degree at which I would be comfortable assigning the source to anything including hydraulic fracturing." Why do you think that the experts, that your experts are right and BLM's are wrong? And have you discussed this at all with the Department of the Interior?

Mr. MARTIN. Mr. Chairman, we had a series of meetings with both BLM and BIA as well as with the state and with Encana including one working group meeting with all of the stakeholders as well as certainly including the Bureau of Land Management. We are going to conduct an exhaustive, thorough peer review process. We are going to evaluate comments like that, which I have not seen, to be honest, and we are going to abide by the results of that peer review process.

Chairman HARRIS. Well, thank you. Let me ask a question. Ms. Sgamma's testimony, or I guess it is not the testimony but it is the critical review of the draft report prepared for the American Petroleum Institute, so it is not that witness's. It says "The EPA draft report jumps to the conclusion that hydraulic fracturing fluids are the source of many of the compounds found in the water samples from their two deep monitoring wells and that those materials have migrated to shallow or ground water." Is that a fair representation of the conclusion of the study, that hydraulic fracturing fluids are the sources of many of the compounds found in the water samples?

Mr. MARTIN. I believe we said that it is likely the source.

Chairman HARRIS. Really? On page 33 and 39 are the two places in the report, and you have already testified you have read the report and you know, I would point to you the page that had the other figures, but let us talk about page 33 and 39 because that is where the conclusions are listed, and the word "likely" is only used in one place, and it is only used to say that gas production activities have likely enhanced the gas migration. That is the only place "likely" is used. The other two places—and Dr. Goldstein would appreciate this. It says that the data best supports. Now, in medicine, if you have 10 differential diagnoses but one really isn't likely, what you say is well, you know, the data best supports this one but there are these other nine ones, and then you would say,

well, do I treat that because it is not likely, it is best supported if that treatment would make the other ones worse or result in the death of a patient if you misdiagnosed. Can you describe what the difference is between best supports and likely, because the press release—and see, the whole purpose of this hearing is to say look, you are jumping the gun. The press release says “likely” but the draft report actually doesn’t say “likely” about the migration of hydraulic fluid contamination. Could you address that? That is very important because that is the crux here because the press report said “likely.” The EPA concluded that it is likely that hydraulic fluids were the contamination, the source of contamination, but that is not what the draft report says to my reading. Why is my interpretation wrong?

Mr. MARTIN. Well, Mr. Chairman, I think I would say that we looked at a wide range of hypotheses including some that we have been able to discount based on the results that we have encountered in our research that all of the materials that we found at depth including the synthetic organic compounds, and there is a range of them, broader than what Mr. Doll referred to, to the fact that there are breakdown products of some of the materials that we found there. There is benzene, toluene, ethyl benzene and xylene, very, very high alkalinity levels that we found, the absence of strong buffers, the fact that potassium hydroxide was used as a cross linker and a solvent and aluminum chloride was used, things that account for the presence of both high potassium and chloride levels as well as the very high alkalinity, the caustic level of alkalinity. There is a number of different—

Chairman HARRIS. Sure, I understand all that, but I assume a scientist wrote this report.

Mr. MARTIN. Absolutely, sir.

Chairman HARRIS. So why didn’t they use the word “likely” with regards to hydraulic fracturing fluids? They didn’t use the word “likely.” You used the word “likely” in your testimony and your press office used the word “likely” in the press release. But the scientists didn’t. They said “best supports,” and I am going to use the exact words “best fitting and best supports.” Now, I have written many scientific papers, and when my P value wasn’t high enough, this is what I used. When I couldn’t say it is likely or—and likely, of course, we all know, you an attorney by training, I understand, that is just more likely than not. That is the 51 percent test. It is not a P value of less than .05, it is not 95 percent likely, it is just likely. But the report, the scientists in the report didn’t even use the word “likely.” Why did you choose to use the word “likely” in your testimony? You agreed with the conclusion that it was likely the source, and the press release used the word “likely.” Why?

Mr. MARTIN. Mr. Chairman, I guess I believe that those are equivalent, that we haven’t—we have said a number of times that we haven’t—

Chairman HARRIS. Mr. Martin, I will—and I accept your answer but I will tell you, there is a world of difference between “best supports” and “likely.” As an attorney, you ought to understand that. Because my understanding is, the word “likely” has a very specific meaning in a court of law.

I now recognize the Ranking Member, Mr. Miller.

Mr. MILLER. Dr. Goldstein, you are on a panel with a lawyer and a lobbyist, and you seemed to be twitching at this last line of questions and answers. Do you have anything to—do you have an opinion about the questions that Mr. Martin has been fielding?

Mr. GOLDSTEIN. Quite clearly, the word “likely” is a problem. It always has been a problem. I think “likely” can be used in a situation where there is far less than 50 percent. I am sure you use it in that way. I don’t know why—it doesn’t sound any real different to me is what I am hearing. Likely, best supports, they are just sort of different ways of sort of saying the same thing. Now, they could be interpreted in different ways quite clearly, and as I say, I read through the draft report having read some of the press accounts of it, and I thought again as a former Assistant Administrator that it was appropriately hedged based upon not really having the data.

By the way, I would say that this Pavillion report, well, it doesn’t have the data because as it says over and over again, this would be really a simple thing to do if there had been baseline studies. If you don’t have baseline studies, you are responding to what is public. You can’t conceivably have a perfect randomized control trial. You are going to have some degree of uncertainty. I think what this tells us is that those companies which are paying for water sampling of local community folks, local groundwater are doing the right thing and those who are not were just stirring up a lot of trouble for themselves because these kind of studies will come up again and they are going to be the ones who are going to be sued for basically contaminating water.

Mr. MILLER. Dr. Goldstein, I know that faculty humor is kind of an acquired taste, but there is a joke that administrators hate having scientists on their panels, on their committees because when the information changes, they change their opinion and you never know where they stand.

Mr. GOLDSTEIN. Senator Muskie said it very well. He wanted one-handed scientists so he wouldn’t on the one hand this and on the other hand that.

Mr. MILLER. That was Harry Truman’s line about economists.

Mr. Chairman, in my—in all the confusion of this hearing, I failed to move two documents into the record. The first is a report conducted in 2010 that is a survey of the health of residents of Pavillion. The participants again reported various health effects—headaches, sore throat, nausea, sinus problems and other illnesses that are known to be associated with the contaminants that the EPA found in the drinking water in 2009.

And the second—and I believe both of these have been provided to the majority staff. The second is a letter to the Subcommittee from Pavillion Area Concerned Citizens, the Powder River Basin Resource Council, the Western Organization of Resource Councils. This also was provided to the Subcommittee with the perspectives of people who are actually affected by the contaminated groundwater, none of whom were invited to appear at this hearing today. It urges the Subcommittee to support the EPA’s draft report.

Chairman HARRIS. Without objection.

[The information appears in Appendix II:]

Mr. MILLER. Mr. Doll, you said that you were doing the work of the citizens of that area but you don't contend that the various folks who are members of these organizations, particularly the concerned citizens—what is the name of it again, the letter that I just introduced, the Pavillion Area Concerned Citizens. They are not outside agitators, right? They are not—they didn't come in from Oakland or Greenwich Village just to request this review, right? They really live there in Pavillion and have right along. Isn't that right?

Mr. DOLL. I don't know who the membership is, to be honest with you. I don't know if it represents all of the landowners there or not.

Mr. MILLER. Do you know John Benton?

Mr. DOLL. John Fenton?

Mr. MILLER. Fenton?

Mr. DOLL. Yes, I do.

Mr. MILLER. Okay. Has he been right there in Pavillion right along?

Mr. DOLL. I don't know when he moved to Pavillion, no, sir, I do not.

Mr. MILLER. He is not an honest-to-God Wyomian, or whatever the phrase is?

Mr. DOLL. Wyomingite. I don't know when he moved to Pavillion. It was after the gas wells were drilled is what I understand but I don't know the date.

Mr. MILLER. Okay. Dr. Goldstein, your written testimony and your oral testimony, you said that the industry claims that hydraulic fracturing—the industry claims both hydraulic fracturing is an innovative new technology and don't worry, it has been around for years, decades, no problems with it, and that there is some contradiction in that. Do you think that we have sufficient—or how would you state—how would you describe the state of the science on natural gas drilling and fracking, and do policymakers have enough information to make informed decisions to protect public health?

Mr. GOLDSTEIN. It is easiest to answer the second question. No, I don't think they do. I think that the idea that this has been around for so long and therefore don't worry about it is simply inappropriate. This is equivalent to when you have got five million gallons versus 50,000 gallons of fluid with changing chemical structure. You know, it is equivalent to saying well, there is no difference between a two-ton bomb and a hand grenade because they are both explosives, and we know about explosives. This is a tremendous increase in technology. We have in front of us all the time the industry folks in their commercials saying there is a wonderful new technology we are bringing that is going to get this gas. That is great. It is a wonderful new technology but we have to be careful with it.

Mr. MILLER. My time is expired, and I want to help the Committee abide by the rules.

Chairman HARRIS. Thank you very much, Mr. Miller.

I recognize the chairman of the Committee, Mr. Hall from Texas, for five minutes.

Chairman HALL. Thank you.

Mr. Martin, what involvement did the EPA headquarters have with your study?

Mr. MARTIN. The study, Mr. Chairman, was conducted by scientists within the Office of Research and Development and scientists at Region 8, which is the region that I run. We involve scientists from elsewhere in the agency on occasion including the regional laboratory out of Pennsylvania, I believe it is. They were the people who did the work and wrote the study—or wrote the report, rather, sir.

Chairman HALL. Did the EPA people or who reviewed the study plan?

Mr. MARTIN. The study plan?

Chairman HALL. Yes.

Mr. MARTIN. To the best of my knowledge, Mr. Chairman, that was just the scientists working on the report. I certainly never saw the study plan. It would have been developed, the original one, under the last Administration. It would have been 2008, so some years ago.

Chairman HALL. Did they review the protocols?

Mr. MILLER. The protocols are standard and are in use throughout the agency, and I don't believe anyone outside the scientists working on this report were involved in evaluating or identifying protocols, Mr. Chairman.

Chairman HALL. Did they approve of your media plan and your outreach to the media on a draft, a non-peer-reviewed report?

Mr. MARTIN. I believe so, sir.

Chairman HALL. Tell us exactly what oversight or involvement EPA headquarters had with the Region 8 on this report and the media release, if you can do that.

Mr. MARTIN. Well, Mr. Chairman, we briefed the upper levels of management periodically as we were developing the report, as the scientists were developing the report, more precisely. We—I know the Administrator met with Encana and spoke with the Governor of Wyoming late in the process. We have worked closely with the agency including the folks to whom I report and making sure that we were releasing the report in the way in which we could—the way in which best comported with the scientific report, a draft scientific report to which we plan to seek expert peer review. I mean, it is a very long, winding story, Mr. Chairman.

Chairman HALL. Well, I agree with you there. In light of the use of Superfund authority to conduct this investigation and the differing results that came from Region 8 and the Office of Research and Development, I am interested in the relationship with EPA headquarters in carrying out the report, what that relationship actually was. That is what I am trying to get to.

Mr. MARTIN. Well, the Assistant Administrator, Mr. Anastas, who was unable to be here today, was certainly involved in assuring that we were applying the strongest science, the best science and applying all of the protocols that apply here.

Chairman HALL. Let me ask you this. How much has the EPA currently spent on the investigation and what does it plan to spend in the future?

Mr. MARTIN. The first part of your question, Mr. Chairman, is easier to answer. It is roughly \$1.7 million. We are now about to

embark in a conversation with the State of Wyoming, the tribes, USGS and others about additional investigation at the site, and I don't know what that will cost or who will pay for it.

Chairman HALL. When will you know?

Mr. MARTIN. We haven't had our first meeting. We are hoping to do that soon so I am guessing relatively soon, sir.

Chairman HALL. All right. I thank you, sir.

Chairman HARRIS. Thank you very much, Chairman.

We will have one more round of five minute questions. We will hold you a little bit longer because we need to get down to the very end of this and know what is going on.

Mr. Doll, in the draft report, EPA found "a wide variety of organic chemicals" in its two monitoring wells, and I am sure that is the basis of the conclusion that Mr. Martin has testified to that, you know, these are hydraulic fracturing fluids, but could this be the result of EPA drilling its two monitoring wells into gas-producing zones? I mean, my understanding is, they actually had blowout preventers on top of these wells. They were supposed to be drilled, you know, into water aquifers, a little unusual. I have a well in my backyard. I don't think I put a blowout preventer on it when it was drilled. Could some of the contamination, well, what is claimed to be contamination, be the result of EPA drilling its two monitoring wells into gas-producing zones?

Mr. DOLL. Mr. Chairman, the experts from the Oil and Gas Conservation Commission, the Department of Environmental Quality and the Water Quality Office all believe that this is induced contamination due to the drilling and completion of these two wells.

Chairman HARRIS. And is it true, I think I read in the report that actually there had been, I guess it is called a blowout or something, at a well in the area that was actually drilled for water, a relatively shallow well drilled for water. Is that correct?

Mr. DOLL. That is correct. That happened—

Chairman HARRIS. A much shallower well than the EPA monitoring wells, because I think that well was only several hundred feet.

Mr. DOLL. The well was—

Chairman HARRIS. The blowout well.

Mr. DOLL. Yes. That particular well was permitted to be a shallow water supply well but was drilled beyond that permitted depth and hit into a zone where the fluid, the drilling fluids were actually evacuated from the well bore in a loss of fluid and then natural gas entered it.

Chairman HARRIS. And at what depth was that? Do you recall?

Mr. DOLL. I believe that was in that 900- to 1,000-foot range.

Chairman HARRIS. So that was in the range of the EPA monitoring wells?

Mr. DOLL. Yes.

Chairman HARRIS. Okay. I think a landowner did that, right?

Mr. DOLL. Yes, that is correct.

Chairman HARRIS. So they weren't doing a monitoring well, they were just trying to drill for water and found gas?

Mr. DOLL. That well as permitted to be a water supply well, yes.

Chairman HARRIS. So it not beyond the pale that the EPA drilled for water and found gas either at that depth?

Mr. DOLL. You should expect depth the deeper you go in this formation.

Chairman HARRIS. That is what I thought.

Mr. Martin, was EPA aware of this strong possibility and is that why the agency used blowout preventers when they drilled the wells? I mean, my understanding is, they add significant cost. Now, I understand that to the U.S. government, cost sometimes doesn't mean a whole lot, but I assume the EPA had a reasonable reason to believe that they could have a blowout and that is why they spent, you know, the hard-earned taxpayer dollars to put a blowout preventer on top of this well. Is that correct? I mean, did the EPA assume that they in fact could be drilling into a gas strata—

Mr. MARTIN. Well, Mr. Chairman—

Chairman HARRIS. —gas containing?

Mr. MARTIN. Sorry.

Chairman HARRIS. Yeah.

Mr. MARTIN. Mr. Chairman, we knew that—I have forgotten the name of the individual who was drilling that well. We knew that he had experienced a blowout at about, I think it was 500-some feet, which was unusual. We had some anecdotal evidence we are continuing to investigate, but given the fact that a blowout occurred, yes, we installed blowout protectors on the two drill rigs that drilled both of our monitoring wells out of concern for the safety of the workers.

Chairman HARRIS. A concern, but knowing that in fact you could be drilling into gas. Mr. Doll, let me address this question to you. You don't have to have a blowout when you drill into a—because my understanding is that the shallower strata, the gas could be under much less pressure. I mean, you could have gas under much less pressure.

Mr. MARTIN. That is correct, sir.

Chairman HARRIS. So in fact, you could drill into it and not even know that you are drilling into a gas-containing substance because there is no blowout. I mean, it is not like a blowout preventer would show that there is a rise, you know, a spike in pressure, wow, we hit something that is high pressure. You could drill that well, conduct everything and you know, by golly, you actually have some natural gas in what you find in the bottom of that well.

Mr. DOLL. Typically, the use of water or just native mud that is mixed from the cuttings as you drill will be enough to control any of the low pressure that would encounter until you see your surface casing. Then after you have cemented it back to surface, you would put on your blowout preventer and drill deeper and that is required if you are drilling a gas well to depths close to 3,000 feet into the natural gas zone.

Chairman HARRIS. Right.

Mr. Martin, exactly why did you choose that deep? What was the rationale behind it, the monitoring wells, the depth? Why did you choose specifically to drill into a depth where you know or I guess if you communicated with the U.S. Geological Survey, you would know, or with the local, you know, Wyoming authorities, that you would know that there was a chance that you would be hitting natural gas while you are drilling a water well?

Mr. MARTIN. Mr. Chairman, we were—the formation and the activity that has occurred there over the course of 50 or 60 years is complex so I think several of us have alluded to the fact that legacy pits, they are not pits attributable to the current operator but that there are legacy pits that are contributing significant contamination to a relatively shallow part of the aquifer, that there are domestic drinking water wells, municipal wells and stock watering wells that are drilled from relatively shallow depths to as deep as 800 feet, and we were looking to drill a well that sort of sandwiched those, a set of wells that are somewhat deeper but shallower than the production zone. So we chose about 800 feet in depth below ground surface and about 1,000 feet in depth below ground surface. The shallowest fracking has occurred at 1,200 feet. The shallowest fracking in the area of these two wells has occurred around 1,600 feet. So we were trying to sandwich the domestic drinking water wells and the other wells so that we could get some better sense of whether there was a source of contamination that is deeper than those drinking water wells.

Chairman HARRIS. Let me just follow up, and I will give the Ranking Member the extra time to even it up.

But Mr. Martin, you used the word, and words are important, and you know, I am going to disagree with the doctor, and you have written scientific papers too. You know, you use words very specifically in your conclusions, and I disagree, I think the word “likely” by the way has a very different meaning from “best explanation,” a very, very different meaning. To a scientist, I think it is a very, very different meaning.

But Mr. Martin, let me ask, because you say the word “producing well.” But that is what is significant here because you could have small amounts of gas, not enough to produce at lower levels, and I think Mr. Doll’s testimony, somewhere in here what I read is that at those shallower levels, you could have low pressure that no one would drill to to produce because you couldn’t get gas out of it for commercial purposes, but it is there. So although you attempted to do what you are calling sandwiching, you are not sandwiching where—you are not saying—and again, I am drawing the extrapolation to Marcellus shale where you have got, you know, a mile of bedrock between the two. You don’t have a mile of bedrock here. You have got, and my understanding of the geology is, you know, you have got this bowl of potato chips, and by this connection, there is connection between the two and some of the superficial potato chips that have sand in there actually have low-pressure gas but no one would drill into to produce. To produce, you would have to drill lower. So do you agree that you drilled into a location that was known—because we know we had a blowout somewhere between 500 and 800 feet, 500 and 900 feet—known to have gas in it? Known, I mean, and look, everybody knew there was a blowout there that occurred at a depth shallower than you drilled your monitoring well.

Mr. MARTIN. We had mud logs, Mr. Chairman, that suggested that in fact you wouldn’t find those levels of natural gas at that depth but the fact that there had been a blowout at shallower depths also suggested that something perhaps has changed, and you are absolutely right, there is no lithologic barrier that we know

of that would prevent the migration of either gas or either fluids vertically from the production zone, and in fact, we posited several hypotheses by which that is occurring, and that is the reason we chose those depths, to get some sense of whether in fact there is a deeper source that we could intercept with those monitoring wells.

Chairman HARRIS. Well, thank you very much, and I defer to the Ranking Member, and you have 8-1/2 minutes to go.

Mr. MILLER. I won't use it all, Mr. Chairman.

Curiously, the draft report that we have been discussing all morning is not part of the record, and someone reading the transcript of this hearing might wonder if the draft report was written in crayon, so it does appear that the draft report should be part of the record and I move that it be part of the record.

Chairman HARRIS. I understand that we have no objection to parts of it, and it is sizable, I know, because I read it through and it has got a lot of appendices and things, but I will offer that our staff will work it out, and we will include parts of it. We will include parts of the draft report in the record.

Mr. MILLER. Okay, and I assume that will be anywhere the word "likely" appears.

Chairman HARRIS. It only appears once.

Mr. MILLER. Dr. Goldstein, you were very critical today of three advisory panels that have looked at hydraulic fracturing, fracking. You have been very critical of their composition. Based upon your experience with EPA during the Reagan Administration, you are very familiar with the EPA. I assume you are familiar with EPA Science Advisory Board, and could you assess for us the composition of the SAB hydraulic fracturing, the fracking panel?

Mr. GOLDSTEIN. Well, they have a broad representation of the sciences. SAB, I think, is an excellent organization that does a very good job of representing all of the different scientific disciplines.

Mr. MILLER. Okay. Chris Portier is the director of the National Center for Environmental Health at the Federal Centers for Disease Control and Prevention in Atlanta, and before that, he was in the triangle area of North Carolina, so I have met him, I know him and I know his reputation, which is very good, and he has called for studies into hydraulic fracking's impact on public health, effect on public health. He said more research is needed for us to understand public health impacts for natural gas drilling and new gas drilling technologies. That is similar to your own testimony today. Do you have a general sense of where the greater weight of scientific opinion is on the need for greater research?

Mr. GOLDSTEIN. I think Dr. Portier is correct in that. He, Dr. Birnbaum, who is the head of the National Institute of Environmental Health Sciences, have also expressed themselves on the need for research on the mixtures issue. We had with oversight of this Committee a lot of research on mixtures during the time of the Superfund because you had unknown mixtures could appear. This needs to be repeated with using the new toxicological approaches, using molecular biology to better understand what mixtures—how mixtures threaten the potential for adverse effects.

Mr. MILLER. Mr. Chairman, I yield back.

Chairman HARRIS. Well, thank you very much.

I want to thank all the witnesses for their testimony and the Members for their questions. Again, I apologize as yet again for the delay at the beginning.

The Members of the Subcommittee may have additional questions for the witnesses, and we will ask you to respond to those in writing. I will ask, because time is somewhat of the essence because the comment period is limited on this study, that you be timely if at all possible, and I will just leave that at that. Leave it to your own figuring what "timely" is. The record will remain open for two weeks for additional comments from Members.

The witnesses are excused and the hearing is adjourned.

[Whereupon, at 12:30 p.m., the Subcommittee was adjourned.]

Appendix I

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

*Responses by Mr. Jim Martin, Region 8 Administrator,
Environmental Protection Agency*

Enclosure

**EPA Responses to Hearing Questions for the Record
Fractured Science: Examining EPA's Approach to Groundwater Research – the Pavillion
Analysis
February 1, 2012**

**The Honorable Andy Harris
U.S. House of Representatives
Committee on Science, Space, and Technology**

1. Despite the release of a significant number of documents, EPA is still withholding information critical for making informed and useful comments on the Pavillion analysis. Attached is a letter dated February 8 to EPA Region 8 Enforcement Attorney Michelle Marcu outlining a number of items EPA has failed to disclose.
 - a. Please provide a timeline for the disclosure of these documents and data.
 - b. Explain why this information was not released at the time of the release of the draft report or on January 31 when EPA disclosed an additional 622 documents.
 - c. Is making data unavailable to the public or only available subject to FOIA requests in compliance with EPA's peer-review procedures for studies such as the Pavillion report?

Response to 1. EPA has made hundreds of scientific and technical documents available on our public Pavillion website. The February 8 letter attached to your questions concerns a Freedom of Information Act (FOIA) request for a much larger collection of documents, which we are in the process of addressing. Several requests were consolidated into one FOIA request. Given the breadth of the request, we anticipate that we will be able to complete our response by September 27, 2012. Meanwhile, as set forth in the response to Questions 1.a. and 1.b. below, EPA will continue to provide and post on its Pavillion website releasable records that are of interest to the public.

Responses to 1.a. and 1.b. Understanding and commenting on the draft report does not require access to every document generated during its development. The report itself, with its references, provides all of the information "critical" to this review. As noted, we have made a very large amount of additional scientific and technical information publicly available, and will continue our efforts to do so.

Beyond that, we face the considerable task of responding to Encana's extensive FOIA request for "all communications" related to Pavillion. Below is a timetable of our response to this request, along with our other relevant public information activities.

Contrary to the statements in Ms. Brown's February 8 letter, EPA has been responsive to Encana's various previous requests for information, and provided a significant amount of information even before Encana submitted its FOIA Requests:

- On June 8, 2010, before the drilling of EPA's monitoring wells, EPA provided Encana the Quality Assurance Project Plan for the wells' construction.
- On August 5, 2010, EPA representatives met with Encana to orally share the Phase 2 sampling results before the public meeting in which EPA released the data.
- On June 17, 2011, EPA provided the Quality Assurance Project Plan for Sampling of the Monitoring Wells. (Ms. Brown also asked for this document in the Consolidated FOIA Request.)
- On November 17, 2011, in response to a request from Encana, EPA provided, by email, a link to EPA's Pavillion website, where EPA posted gas chromatograms from the Region 8 Laboratory.
- On November 29, 2011, in response to a request from Encana, EPA provided, by email, 42 files and extensive additional information regarding construction, completion and sampling of the monitoring wells, field logs for drilling and sampling, and analytical methods used by EPA's Robert S. Kerr Environmental Research Center.

Since receiving Encana's FOIA requests, EPA has provided many additional Pavillion-related documents directly to Encana, and has also posted a substantial amount of information online for access by the public at large, including Encana. EPA has referred Ms. Brown to two relevant pages on EPA's Pavillion website: the home page (<http://www.epa.gov/region8/superfund/wy/pavillion>), and the Pavillion Site Documents page (<http://www.epa.gov/region8/superfund/wy/pavillion/docs.html>). The home page contains the main documents and links such as the Draft Report, the Federal Register notices, ATSDR's Health Consultation Document, the January 2010 Sampling Results Fact Sheet, and the Final Analytical Report. The home page also contains links to 58 figures. Further, as we informed Ms. Brown in emails on January 31 and February 2, 2012, EPA's Pavillion Site Documents page contains many additional documents. As of today's date, EPA has posted more than 800 documents on the Site Documents page, most recently on May 10, 2012. Together, these pages provide information that is encompassed within many of Encana's requests, and provide the vast majority of technical information relevant to the review of EPA's draft report, "Investigation of Groundwater Contamination near Pavillion, Wyoming," dated December 8, 2011.

As we are able to do so, EPA intends to continue to provide releasable records to Encana, and to post them on the website. In particular, we expect to be able to provide Encana with records (to the extent they exist, in addition to those already posted) that are responsive to Encana's more precise requests. As indicated above and detailed below, however, EPA has already posted publicly, and provided to Encana, documents that may be responsive to many of these more precise elements of Encana's FOIA request:

- The Monitoring Well Installation Work Plan Narrative) to the May 2010 Final Monitoring Well Installation Work Plan. [Requests 1.1 and 5.1 of the Consolidated FOIA Request]. *Already*

posted on the Pavillion website. In a March 15, 2012 letter, Ms. Brown acknowledged that Encana has viewed this document on the website.

- *Product specifications, including model names and numbers and equipment serial numbers where applicable, for all equipment installed or placed in either of the two EPA deep monitoring wells. [1.6, 5.6]. EPA provided the information in EPA's possession to Encana by email dated November 29, 2011, before EPA received Encana's FOIA requests. To repeat that information: the pump used is the J-class Sandhandler Submersible Pump, model no. 7JS3S4-PE, manufactured by Franklin Electric. EPA has an owner's manual for this pump, which has been posted on the website as of March 26, 2012. The company's documents do not refer to this pump as "explosion-proof," and EPA will remove this characterization from the final report. In its March 27 letter, EPA advised that Ms. Brown can obtain the information about this pump from the manufacturer's website.*
- *Records concerning the source and preparation of the standards used for adamantane, 1,3-dimethyldamantane, 2-butoxyethanol, tris(2-butoxyethyl) phosphate, squalene, and terpinol in water samples. [1.9, 2.2, 3.2, 5.9]. EPA has posted information for the EPA Region 3 Laboratory. In the near future, EPA expects to publicly post information for the Region 8 Laboratory.*
- *Records of the analytical method development done by the Robert S. Kerr Environmental Research Center or Shaw Environment and Infrastructure Inc. for all methods used in connection with water samples from the Pavillion Field area [1.10, 5.10]. For all of the analytes in Phases 1-4, EPA either used standard EPA analytical methods, or followed standard EPA analytical methods for method development where needed to improve detection limits or address identified concerns with the methods. These modifications were made for semi-volatile organic compounds including glycols. Glycols analysis conducted by the Region 3 laboratory was performed using High Performance Liquid Chromatography with tandem Mass Spectroscopy (HPLC-MS-MS). An HPLC-MS-MS method does not currently exist for glycols analysis. EPA SW-846 Methods 8000c and 8321 were followed for method development and Quality Assurance/Quality Control procedures, in order to improve detection limits and eliminate false positives. Shaw, Inc. analyzed for glycols using Gas Chromatography with Flame Ionization Detection (GC-FID) following EPA standard method 8015. Additional technical memos surrounding the Shaw/ORD glycol analysis were posted on March 30.*
- *MSDSs for all products and other chemicals used in connection with drilling, installation, cleaning and decontamination, and sampling of the two EPA deep groundwater wells, including drilling chemicals, pipe dopes, solvents, cleaners, adhesives (including electrical or other tape), lubricants, and sealing agents. [1.5, 5.5]. On November 29, 2011, EPA provided this information to Encana by email; the information is also posted on EPA's Pavillion website. On March 22, 2012, EPA posted the MSDS for the Wellguard/Jetlube product at <http://ftp.epa.gov/r8/pavilliondocs/WellDrillingInformation/DrillingAdditivesMSDS/>.*
- *Sampling and Analysis Plans, Quality Management Plans, and Quality Assurance Project Plans (QAPPs) associated with the October 2010 Field Sampling Event. [1.7, 5.7]. As indicated above, in June 2010 EPA provided Encana with QAPPs for drilling and sampling. On March 26, 2012, EPA posted QAPP versions 1-4 were at*

http://ftp.epa.gov/r8/pavilliondocs/OA_Documents/QAPPs/. EPA posted QAPP version 5 on or about January 30, 2012.

- Documents concerning EPA's soil gas sampling efforts in the Pavillion Field area or any evaluation of the same [1.8, 5.8]. *EPA has posted all soil gas sample results on EPA's Pavillion webpage. Eight dedicated vapor probes were installed on three properties. Analytical results (fixed gases and light hydrocarbons) for soil gas sampling and gas samples collected from well casing of deep monitoring wells have been posted under Site Documents, Raw Lab Data, Phase 3 and 4, since January 30, 2012.*
- Chromatograms from Region 8 (including Region 8 Lab), Region 3 (including Region 3 Lab), Kerr, Shaw, or any other lab that EPA had analyze water samples from Pavillion. [1.13, 2.6, 3.6, 5.13]. *In an email dated November 29, 2011, EPA provided to Encana Region 8 Lab chromatograms for Phase 3 and 4 of the investigation. In January 2012, EPA posted on EPA's Pavillion website most chromatograms for other EPA Laboratories. EPA has encountered file formatting issues, but we anticipate that we will post the remaining chromatograms in the near future.*
- Mass spectra from Region 8 (including Region 8 Lab), Region 3 (including Region 3 Lab), Kerr, Shaw, or any other lab that EPA had analyze water samples from Pavillion using gas chromatography/mass spectrometry (GC/MS), high performance liquid chromatography (HPLC), or equivalent methods [1.14, 2.7, 3.7, 5.14]. *Mass spectra data originated by Shaw, Inc. and the Region 3 laboratory have been included as part of the raw lab data files found on the website in the Laboratory Data Report and the Sample Data Reports, respectively. As for the Region 8 laboratory, the mass spectra data have been included in the raw lab files in the Lab Data Packages. The Region 8 laboratory returned to their instrumentation to recover the individual mass spectral images; these data were posted on April 18th.*
- Records of "citizens' complaints of taste and odor problems," and a "public petition" referenced by the Congressional Research Service. *EPA posted records related to citizen concerns on March 26, 2012 at <http://ftp.epa.gov/r8/pavilliondocs/OtherDocuments/DocumentsRelatedToCitizenConcerns/>.*
- Similarly, we expect to be able to provide Encana with various specific documents (again, to the extent we have not already done so) that are mentioned in otherwise broad requests:
- Laboratory reports from Kerr, Shaw, and Region 3 for water samples from the Pavillion Field area. [1.12, 2.5, 5.12]. *EPA has posted this information on EPA's Pavillion website.*
- Documents related to the two deep monitoring wells, including:
 - a. *Records associated with the drilling, installation, or sampling of the monitoring wells. [2.1, 3.1, 5.2]*
 - b. *Records of the methods and materials used in drilling the two EPA deep wells to join lengths of well casing together and the methods and chemicals used to clean and decontaminate well casing and down hole drilling and monitoring equipment before its being placed down hole, including verification swab samples. [1.3, 5.3]*

- c. *Records on disposal of cuttings, drilling fluids, muds and other materials, and any other products or chemicals used in drilling and installation of the two deep monitoring wells. [1.4, 5.4]*
- d. *Records related to the discrepancies in reporting limits, detections, and analytical results between or among the analytical results from Region 3 (including Region 3 Lab), Region 8 (including Region 8 Lab), Kerr, Shaw, or any other laboratory that EPA had analyze water samples from the Pavillion Field area. [1.11, 2.4, 3.4, 5.11]*

As described above, beginning in June 2010 EPA provided to Encana technical information detailing the drilling, construction, completion and sampling of EPA's monitoring wells, as well as documents pertaining to sample analysis and results. Additionally, EPA publicly posted the information on our Pavillion website.

In her February 8 letter, Ms. Brown identified several types of records to which she requested that EPA assign urgent priority. Several have already been addressed above; below we respond to the remainder using the numbers in Ms. Brown letter:

- 3. Documentation of the specific locations at which the July 7, 2011 PAV 01 and PAV 02 water samples were obtained.
Samples labeled Pav 01 and Pav 02 on the analytical report dated 7/22/2011 (Technical Directive 8OA778SF) were archived samples from the October 2010 (Phase 3) sampling and were not collected during a separate sampling event. Monitoring wells MW01 and MW02 were only sampled in October 2010 and April 2011. These samples were obtained from MW01 (Pav 01) and MW02 (Pav 02, and were acidified at the time of collection with hydrochloric acid. The report's reference to a 7/7/2011 collection date refers to the date that the samples were taken from the archived sample and poured into sample containers that were then submitted to the lab for analysis. The purpose of this analysis was to evaluate effects of acidification on organic constituents remaining in the archived samples.

It is unlikely that EPA will be able to release records responsive to broad requests that will require cross-office search and substantial review, which includes Encana's various "all communications" and "all records" requests, before the estimated date provided (September 27). These types of records are not provided to the public to comment on for a draft report.

Response to 1.c. EPA's approach to making data publicly available for the peer review is in compliance with our procedures for peer review. Reviewers will have access to all the supporting data generated during the course of the investigation.

- 2. During the hearing I asked you about your response to the Department of Interior's Bureau of Land Management's (BLM) comments on the Pavillion draft. You stated you had not seen the

comments. I have attached a copy of BLM's comments to these questions. Please provide a response to the concerns raised by these Federal experts.

Response: Thank you for providing a copy of BLM's informal electronic mail comments to the State of Wyoming. Subsequently BLM provided formal comments to EPA on March 1, 2012. The comments have been submitted to the public comment docket as part of the peer review process.

3. In your testimony you noted that "we are in discussions with the U.S. Geological Survey (USGS) about partnering in the sampling of the monitoring wells." USGS is the recognized expert in this area, and has been evaluating water quality and geology in this region of Wyoming since the 1880s. For example, the agency found in 1959 – before oil and gas production in the Wind River Basin began – that "the quality of the water in the shallow aquifers generally is unsatisfactory for domestic water use."
- a. USGS has also found elevated concentrations of potassium and chloride in Pavillion-area groundwater since the early 1990s. They have evaluated the complexity of the aquifer in the Wind River Basin, and have conducted extensive work on permeability near Pavillion. Were the experts from USGS consulted during the development of the plan for the monitoring wells or prior to the commencement to the drilling of the monitoring wells? If not, why not?

Response: In the draft EPA report, EPA referred to the findings of several USGS publications that describe water resources in the Wind River Basin. USGS scientists also were consulted prior to Phase 2 sampling regarding the potential use of strontium isotope measurements to support the Pavillion ground water investigation. EPA relied heavily upon several USGS and Wyoming Geological Survey reports¹ in understanding groundwater conditions in the area, and referred to the findings of several of the USGS publications in the draft report (e.g., see pages 4, 17, 18, and 20 of the EPA Draft Report). EPA has been primarily concerned with conditions in the Wind River aquifer, which is the primary source for domestic and public water supply wells. In the "Summary and Conclusions" of the 1959 USGS report referred to in the Committee's question, the following statement is made: "This source (i.e., the Wind River formation) provides the best present and future supply of ground water in the area. Although generally not available in

¹ Bartos, T.T., Quinn, T.L., Hallberg, L.L., and Eddy-Miller, C.A. (2008). Quality of shallow ground water in three areas of unsewered low-density development in Wyoming and Montana, 2001. U. S. Geological Survey Scientific Investigations Report 2008-5012, 118 p.

Daddow, R.L. (1996). Water resources of the Wind River Indian Reservation, Wyoming. U.S. Geological Survey Water-Resources Investigation Report 95-4223, 121 p.

Morris, D.A., Hackett, O.M., Vanlier, K.E., Moulder, E.A., and Durum, W.H. (1959). Ground water resources of Riverton irrigation project area, Wyoming Geological Survey Water-Supply Paper 1375, 205 p.

Plafcan, M., Eddy-Miller, C.A., Ritz, G.F., and Holland, J.P.R. (1995). Water resources of Fremont County, Wyoming. U.S. Geological Survey, Water-Resources Investigations Report 95-4095, 133 p.

quantities large enough for irrigation, the water yielded by the formation is adequate in quantity and of suitable quality for municipal, domestic, and stock use” (Morris, et al., 1959).

Question #3 references a statement from the 1959 report that shallow ground water quality was unsatisfactory prior to oil and gas production. This is a reference to the unconsolidated alluvial and colluvial ground water generally 50’ or less in depth. Very few private water wells in the area of concern (and none of the public water supply wells in the town of Pavillion) are shallow enough to be potentially located in alluvial or colluvial deposits. Thus, the aforementioned statement is not relevant to the quality of water in the drinking water wells in the Pavillion area.

4. EPA chose to not classify the Pavillion investigation as a “Highly Influential Scientific Assessment,” which would have required that the case be held to the highest scientific standards as well as the most rigorous peer review process available. According to the Office of Management and Budget (OMB) as well as EPA’s Peer Review Handbook, a highly influential scientific assessment includes any assessment that “could have a potential impact of more than \$500 million in any year” OR that is “novel, controversial, or precedent-setting or that has significant interagency interest.” Why was the Pavillion investigation not considered a highly influential scientific assessment and subject to more rigorous peer review?
 - a. In light of the fact that oil and gas activities generate almost \$2 billion a year in revenues in Wyoming alone and that the going rate for one company’s holdings in the Pavillion gas field was valued at \$50 million before the EPA draft report, why did EPA find that the investigation could not “have a potential impact of more than \$500 million?”
 - b. In light of the fact that EPA’s report generated international press coverage in 4 different languages within 24 hours of being released and that the report currently generates more than 600,000 search results on Google, why did EPA find that the investigation was not “controversial”?
 - c. In light of the fact that, according to the first line of the Associated Press’ coverage stated that EPA “announced...for the first time that fracking...may be to blame for causing groundwater pollution, “why did EPA find that the investigation was not “precedent-setting”?
 - d. In light of the fact that the Department of Interior, USGS, the CDC, SEC, and the Department of Energy are all examining hydraulic fracturing and that more than half of the wells in Pavillion are regulated by the Bureau of Land Management, why did EPA find that the investigation did not have “significant interagency interest”?

Response (Questions 4a-d): EPA classified the draft report as “Influential Scientific Information” (ISI) rather than a Highly Influential Scientific Assessment (HISA) because the Pavillion investigation is a single study rather than the type of broad assessment involving an evaluation of a body of scientific or technical knowledge that comprises a HISA (as defined by OMB). Such a classification, however, does not limit the rigor of the peer review. In recognition of the high profile of this investigation, the Agency is using the peer review procedures for the

draft report that are equivalent to those required for a HISA, including higher standards for ensuring reviewer independence from the agency and making agency responses to the peer reviewers available to the public. In fact, EPA has gone one step beyond the HISA requirement of simply making the final peer review charge publicly available by soliciting public comments on the draft charge to the reviewers.

5. Under the Information Quality Act, “dissemination” of any scientific information by federal agencies is subject to certain standards, including peer review procedures, in order to ensure high scientific quality and to avoid regulatory actions driven by the release of potentially faulty information. To avoid these standards, the draft report on Pavillion was classified as a “pre-dissemination.” What is a “pre-dissemination,” and how does this designation apply to the release of a 120-page report which included conclusions and an accompanying press release sent to tens of thousands of people and media outlets?

Response: According to OMB’s Information Quality Bulletin for Peer Review (Peer Review Bulletin), “pre-dissemination” refers to the period prior to official dissemination of a government science document. The Peer Review Bulletin states that there are situations in which public participation in peer review is an important aspect of obtaining a high-quality product through a credible process.” The Peer Review Bulletin can be located on the White House website at <http://www.whitehouse.gov/sites/default/files/omb/memoranda/fy2005/m05-03.pdf>, page 27. Given the particularly high profile of the draft report on Pavillion, EPA publicly announced the availability of the complete 120-page draft report for public review and comment, thereby enabling the peer reviewers to be able to consider public comments during their deliberations. Specifically, the Federal Register notice, which can be located on the federal register website at <https://www.federalregister.gov/articles/2011/12/14/2011-32064/draft-research-report-investigation-of-ground-water-contamination-near-pavillion-wyoming> stated, “EPA is releasing this draft research report solely for the purpose of pre-dissemination peer review. This draft research report has not been formally disseminated by EPA. It does not represent and should not be construed to represent any Agency policy or determination.”

6. Since drilling depth, casing, and materials requirements are regulated by the states, what protocol did EPA follow in drilling its monitoring wells? Why did the agency not apply for a permit or submit a drilling plan to the state of Wyoming? Did EPA follow all local and State regulations despite the fact that it did not apply for a permit?

Response: The protocol for drilling and completion of EPA’s monitoring wells is described in detail in the draft report on pages 5-11. EPA followed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) policy for drilling and installing monitoring wells. For CERCLA investigations, EPA is not required to apply for a drilling permit. EPA sent the drilling plans to the Wyoming Department of Environmental Quality (WDEQ), and the drilling plan was revised to incorporate comments that were provided to EPA from WDEQ.

7. EPA's finding of high pH in the wells is cited in the report as an indication of hydraulic fracturing's contribution through potassium hydroxide. However, according to the driller of these wells, the sparse quantities of this chemical used has near-neutral pH. However, materials used in developing EPA's monitoring wells, like dense soda ash, have a much higher pH value and more closely match EPA findings. What evidence can you provide that EPA's monitoring wells did not cause or contribute to elevated pH levels? Is it possible that cement intrusion and soda ash used in the drilling fluids were more likely to have caused the elevated pH?

Response: No, it is not likely that the use of soda ash in drilling fluids or cement intrusion was responsible for the elevated pHs reported for the EPA monitoring wells. Dense soda ash was not used while drilling MW02 (as indicated in the drilling contractor and subcontractors' log and associated data and information posted on Region 8's Pavillion Internet page: <http://www.epa.gov/region8/superfund/wy/pavillion/index.html>). Soda ash was used during the drilling of MW01, but tests show that the addition of additives, including soda ash, into drilling mud resulted in a pH varying between 8 and 9 (p.5), much less than the pHs of 11.2-12.0 reported in the monitoring wells (Table 3 on p. 24, and p. 33). Additionally, the alkalinity in the deep monitoring wells was dominated by hydroxide (OH⁻). If dense soda ash (sodium carbonate, Na₂CO₃) were the cause, alkalinity would be dominated by carbonate (CO₃) (p. 20 of draft EPA report).

Water quality data indicate that cement intrusion did not occur. Aqueous samples from the deep monitoring wells were highly undersaturated with respect to cement phases (e.g., portlandite) which would not be expected if cement intrusion had occurred (p. 20 of draft report). Sand baskets were placed (welded) above the well screens (as illustrated in Figures C21 and C22, p. C13 of draft report) in order to prevent cement intrusion during well completion.

- 7a. Can you explain why the potassium levels detected in EPA's first monitoring well declined by more than 50 percent from October 2010 to April 2011, while the potassium level in EPA's second monitoring well increased during that same period?

Response: Temporal and spatial variability of cation concentrations is not unexpected in ground water monitoring studies, and conclusions about temporal trends cannot be drawn without more time-dependent data. EPA has agreed to further sampling, and an evaluation of temporal trends will be conducted as more time-dependent data are collected. Potassium concentrations in both monitoring wells were between 8.2 and 18.3 times higher during both sampling events compared to the mean value of domestic wells sampled in the Pavillion area, as discussed in the draft EPA report (Figure 12 and p. 20).

8. EPA does not indicate that the water it used to make the drilling fluids to drill the deep monitoring wells was properly tested. Is it possible that this water could have been a contributing source to the contamination?

Response: Municipal water from Riverton, WY was used to mix bentonite for both MW01 and MW02 (p. 5 of the draft EPA report). EPA obtained the analytical summary report for municipal water for samples from the City of Riverton. Although not all of the contaminants detected in the deep monitoring wells are routinely tested by the City, volatile and semi-volatile organic compounds are part of their standard set of tests. No volatile or semivolatile organic compounds of concern were detected in the City of Riverton's public water supply (with the exception of byproducts of chlorine disinfection), whereas benzene, toluene, ethylbenzene, xylene, and naphthalene were detected in MW02. In addition, the two wells received water from the same truck, but the contaminants and their levels in the deep monitoring wells differed. This strongly suggests that the contaminants detected in the wells did not come from the truck.

9. As far as the actual installation of the monitoring wells is concerned, did the EPA take samples and perform baseline testing on the materials used, including sampling of the production water prior to it being pumped down the wellbore, sampling of the drilling mud in similar fashion, or sampling of the steel and other materials used in the construction of these wells?

Response: Yes, well drilling and construction materials were analyzed and managed to prevent the potential introduction of contamination. EPA collected and analyzed samples of bentonite (drilling mud) and additives used for drilling monitoring wells (results reported on p. 5-8 of the draft EPA report). Casing was washed prior to use (draft EPA report, p. 8). As previously noted (refer to response to Question 8), the municipal water from Riverton, WY was used to mix bentonite for both MW01 and MW02 (p. 5 of draft report).

10. How did EPA ensure that the monitoring wells were drilled into the same formation as the complainants' wells, thus sampling the bad water in question? If this is not the case, or the agency cannot ensure this, then how can the study be seen as addressing these initial complaints or questions?

Response: The monitoring wells and Pavillion private and public drinking water wells were drilled into the Wind River Formation. The Wind River Formation, the same formation in which the complainants' wells are completed, meets the definition of an Underground Source of Drinking Water (USDW) as defined in Title 40, Code of Federal Regulations (40 CFR) Section 144.3 (p. 4, draft EPA report).

11. How did EPA determine that their monitoring wells were sufficiently purged prior to sampling, in order to eliminate all borehole storage, and water introduced for development of the wells?

Response: Simultaneous monitoring of multiple stabilization criteria (general water quality parameters) and water level monitoring ensured that the wells were sufficiently purged prior to sampling and that only formation water entered the purge and sample train (p. 11-12, draft EPA report).

12. Did EPA complete a comprehensive review of background or baseline data for the chemicals of interest (especially methane, organic acids, and miscellaneous organic compounds) prior to completion of the study? Can they demonstrate that such analysis was completed for the actual site, or by use of analogous settings? Are the methane concentrations observed in domestic wells atypical of analogous geologic settings?

Response: EPA conducted a comprehensive examination of all available background water quality information. There is virtually no baseline water quality information for private drinking water wells for methane or other organic constituents. In the absence of baseline data, other background information was identified and analyzed. This included a review of ten mud-gas logs recorded in the mid-1970s and early 1980s, which did not indicate gas shows (distinct gas chromatographic peaks) within 1000 ft below the ground surface at any location (p. 27, draft EPA report), suggesting that methane was not previously widely present in the aquifer at high concentrations (and therefore in domestic wells) within 1000 ft in depth. It should also be noted that synthetic organic chemicals (e.g., glycols) detected in MW01 and MW02 do not occur naturally in ground water.

13. The sampling methods used in this investigation did not follow standard EPA guidance for sample collection and processing, particularly for Superfund sites (i.e., low flow sampling protocols). Rather, the EPA used sampling methods that had not been approved by the Agency. Can you explain this deviation?

Response: Sampling methods used in this investigation followed standard EPA practice for sample collection and processing. These methods were defined in the Agency-approved Pavillion Quality Assurance Project Plan (QAPP). Sampling procedures were audited in a technical systems audit conducted in the field and found to be consistent with the methods detailed in the QAPP. Low flow sampling procedures (stabilization of water level elevation) were utilized at monitoring well MW01 and samples were collected when stabilization criteria of indicator water quality parameters were achieved. The low flow sampling procedure was not feasible at monitoring well MW02 because of the low yield (slow recharge rate to the well). In MW02, the water level was drawn down to the level at which pump cavitation (and degassing in well) occurred. Sampling activities took place during the recovery/recharge phase. Sample collection and preservation criteria and associated quality control information were reported in the draft EPA report (Tables B1 and B2).

14. Did EPA complete an independent validation of laboratory data prior to issuance of the report, and if not, how did it address the presence of “target compounds” in blank samples, and the failure to confirm the presence of certain compounds (e.g., glycols) with multiple analytical methods?

Response: For the Pavillion investigation, EPA followed Category I Quality Assurance (QA) requirements, the highest level of QA practice. Audits of Data Quality (ADQs) were conducted

by an EPA QA manager or a contractor (independent of this investigation) for analyses conducted at EPA's Region 8 laboratory in Golden, CO, EPA's Region 3 laboratory in Fort Meade, MD, EPA's ORD laboratory in Ada, Oklahoma, and Isotech Laboratories in Champaign, IL. The presence of target compounds in blank samples were reported (refer to Tables B7 – B12 of the draft report) and each reported value was evaluated based on criteria established in the QAPP to determine whether the data should be used or disqualified. There were no whole data sets that were declared “unusable” for the EPA draft report. In the case of multiple analytical methods for glycol, it was concluded that glycol analysis with gas chromatography using a flame ionization detector (GC/FID) gave false positive results, so these data were not used (as discussed on p. 27 of the draft EPA report). Glycol analysis with HPLC/MS/MS was used, as this is a more sensitive method with lower reporting limits. The stable carbon isotopic portion of the analysis conducted by Zymax in Phase II was not used because values were inconsistent with historical published data, whereas samples collected by EPA and Encana that were analyzed by Isotech were used. Samples having up to 3X the concentrations of substances detected in blanks were disregarded, as specified in the QAPP.

15. During the hearing, you stated that EPA has eliminated several potential sources of contamination.
 - a. For the shallow drinking water wells, what potential pathways of contamination did you identify? Provide a description of which pathways EPA has scientifically eliminated and the rationale for that determination. What potential pathways remain?

Response: EPA considered agricultural practices, septic systems, household/farmstead dumps, and oil and gas production practices as potential sources that could be affecting drinking water wells, which range in depth from approximately 50 feet to approximately 800 feet. Pesticides were detected in only four wells in the low part per trillion range. Nitrates were detected in 21 wells, but most of these detections were just above the reporting limit of 0.5 ppm. One well exceeded the Maximum Contaminant Level of 10 ppm nitrate. Since the well was located directly adjacent to a livestock holding area, this is the most likely source of the nitrate contamination in that instance. EPA concluded from these data, which showed an absence of significant pesticide or nitrate detections, that neither agricultural practices nor septic systems were likely sources. Organics such as Diesel and Gasoline Range Organics were present in domestic wells on a widespread basis, pointing away from a specific localized source such as a dump. Phase 2 of our investigation confirmed that historic gas production pits remained one source of contamination of the shallow aquifer. Other gas production sources could not be ruled out without further evaluation via deep monitoring wells (i.e., Phases 3 and 4).

- b. For the deep monitoring wells, what potential pathways of contamination did you identify? Provide a description of which pathways of contamination EPA has scientifically eliminated and the rationale for that determination. What potential pathways remain?

Response: EPA installed two deep monitoring wells at the beginning of Phase 3 to determine whether the source for contamination in drinking water wells was at a shallow or deep depth. As discussed in the above response, the absence of significant pesticide or nitrate detections had already ruled out agricultural practices and septic systems as potential sources. Gas production sources were not ruled out, and contamination (such as synthetic organic compounds, potassium, chloride, etc.) in the deeper monitoring wells suggests activities related to gas extraction and hydraulic fracturing were leading to upwardly migrating contamination (refer to draft EPA report).

- c. Does EPA believe that there is a single source of contaminants for both the shallow drinking water wells and the deep monitoring wells?

Response: No. It is unlikely that surface sources such as production pits are affecting groundwater at the depth of EPA's deep monitoring wells, though they are causing shallow groundwater contamination as stated in EPA's draft report and Pavillion Phase 2 Analytical Results Report. Conversely, some of the same contaminants (such as synthetic organic compounds) that were identified in the deep monitoring wells were not identified in samples from the drinking water wells. If the pits were the only source, these contaminants would be expected in both the shallow and deep wells due to downward migration.

16. The report published December 8, 2011 is identified as a draft report and EPA has indicated that the report will be finalized after the upcoming peer review. Does this mean EPA's investigation of the Pavillion ground water is complete? Will there be more investigative phases associated with the public drinking water supply associated with the initial objective of investigating the reason for the foul smelling, bad tasting private drinking water supply? Will there be additional investigative studies associated with the presence of frac fluids?

Response: On March 8, 2012, Wyoming Governor Matthew Mead, the Northern Arapaho and Eastern Shoshone Tribes, and EPA Administrator Lisa Jackson, issued a joint statement indicating that EPA will partner with the State and the USGS, in collaboration with the Tribes, to conduct another round of sampling of EPA's deep monitoring wells in the Pavillion area. EPA also plans to resample the domestic wells in closest proximity to the monitoring wells in order to be consistent with earlier rounds of sampling. To ensure that the results of this testing are available for the peer review process, EPA is delaying the convening of the peer review panel on the draft Pavillion report until the additional data from USGS and EPA are publicly available. In the meantime, EPA's draft report will continue to be open to public comment. Beyond this, EPA will consider, in consultation with other stakeholders such as the State of Wyoming and the Tribes, whether additional investigative steps would be useful in better understanding the circumstances at Pavillion and the opportunities to resolve concerns associated with contamination of the drinking water aquifer. As a point of clarification, the citizen concerns about drinking water quality that prompted EPA to initiate the investigation in consultation with

State and Tribal authorities concerned private wells outside the Town of Pavillion and were not associated with the Public Water Supply wells operated by the Town.

17. In your testimony, you state the EPA had three external scientists review the sampling data and analysis.
- When were these three experts provided information and how long a period did they have to review the information. Please provide dates.
 - Please submit a complete list of the data and analysis the three experts were provided.
 - Did the experts review the draft report or the conclusions? Were these experts aware of EPA's conclusions when they were provided the sampling data and analysis?
 - Please provide the Committee with the names of the three experts and their qualifications.

Responses:

- EPA conducted a peer consultation using three experts. The peer consultation panel received review materials on October 13, 2011. The panel members provided their comments to EPA by the end of the following week.
- The following materials were provided to the peer consultation panel for their review:²
 - Draft EPA Research Brief of the Pavillion investigation
 - Additional text detailing on sampling procedures and analytical methods
 - Summary of subsurface sample locations, depth of sample collection, times (phases) of sampling, target analytes, laboratories utilized, and analytical methods
 - Geochemical results for Pavillion ground water
 - Geochemical impacts in deep ground-water monitoring wells
 - Aqueous analysis of light hydrocarbon
 - Gas and headspace analysis of light hydrocarbon
 - Isotopic data for dissolved, gas phase, and headspace analysis
 - Detected dissolved methane concentration in domestic and monitoring wells
 - QA data table of sample collection containers, preservation, and holding times for ground-water samples
 - Quality Assurance/Quality Control (QA/QC) requirements for:
 - analysis of metals and major ions
 - analysis of dissolved gases, DIC/DOC, VOCs, low molecular weight acids and stable isotopes of water
 - analysis of semi-volatiles, GRO, and DRO
 - LC/MS/MS analysis of glycols
 - analysis of $\delta^{13}\text{C}$ of dissolved inorganic carbon
 - $\delta^{13}\text{C}$ and δD of light hydrocarbons for aqueous and gas samples
 - analysis of fixed gases and light hydrocarbons for aqueous and gas samples
 - portable gas analyzers

² These materials were also included in the draft EPA report and are posted on the EPA Pavillion website.

- 12) Summary of quality control samples, purpose, method, and frequency to support gas analysis
 - 13) Summary of analytes, instruments, calibration, and check standards for portable gas analyzers
 - 14) Monitoring well construction schematic
- c. The peer consultation panel reviewed the draft research brief. The results and findings in the draft report are the same as they were in the draft research brief. Additional discussion of methods, results, and findings was provided in the draft report at the recommendation of the peer consultation panel.
- d. Members of the peer consultation panel were selected based on their academic background, professional experience, research experience, publication record, experience serving on peer review panels, and absence of professional or financial conflicts of interest. Peer consultation panel members included:
- 1) Dr. Jennifer McIntosh
Department of Hydrology and Water Resources
University of Arizona
 - 2) Dr. Stephen Osborn
Geological Sciences Department
California Polytechnic University – Pomona
 - 3) Dr. Avner Vengosh
Nicholas School of the Environment
Duke University
18. How will the peer review process work? Who will select the members of the peer review panel?
Will the peer review panel have access to all the data and analysis, including data and information EPA has withheld from the public? How will the charge questions be developed?
Will the panel be asked to give a unanimous review, or will the comments from individual panelists comprise the review?

Response: The draft report will be reviewed by up to seven individuals with expertise in the relevant scientific and engineering disciplines. The contractor is responsible for selecting the reviewers and ensuring that the panel is absent conflicts of interest, independent of the agency, appropriately balanced, unbiased and impartial, and qualified. Reviewers will be selected based on a careful consideration of their scientific credentials, professional accomplishments, and recognition by professional societies. The background experiences of the candidates will also be considered to ensure that the panel represents a diversity of scientific perspectives and disciplines.

EPA believes that the draft report, which contains a full list of references and over 50 pages of detailed appendices, provides all the information necessary to complete a scientific review of this

document. To enhance public understanding and in the interest of transparency, we have made more than 750 additional documents available on the EPA Pavillion website. Reviewers and the public will also have access to the results of the additional sampling effort being conducted this spring by USGS and EPA.

The draft charge questions were developed by EPA and posted on the website. The public was provided the opportunity to submit comments on the draft charge, and EPA will consider these comments in preparing the final charge questions. Comments from individual reviewers, which will be made publicly available, will comprise the review (i.e., the panel will not develop a consensus report). EPA will make the peer reviewers' comments and the Agency's responses to the reviewers' comments available to the public at the time that the revised report is made available to the public.

*Responses by Mr. Tom Doll, State Oil & Gas Supervisor,
Wyoming Oil & Gas Conservation Commission*



Commissioners

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Governor Matthew H. Mead, Chairman Thomas E. Doll, State Oil & Gas Supervisor

March 2, 2012

U. S. House of Representatives

Committee on Science, Space, and Technology

2321 Rayburn House Office Building

Washington DC 20515-6301

Attention: Andy Harris, M.D.

Chairman

Subcommittee on Energy & Environment

Fractured Science: Examining EPA's Approach to Groundwater Research into the Pavillion Analysis

Hearing February 1, 2012

Transcript Edits for the Record from Mr. Tom Doll, State Oil and Gas Supervisor, Wyoming Oil and Gas Conservation Commission.

I offer the following Transcript Edits to my Testimony of February 1, 2012:

- 1) Please refer to the Transcript, page 80, Lines 1793 and 1794: "Mr. Doll. I believe that was in the 900- to 1,000-foot range."
 - In my testimony of February 1, 2012, I regret that I misspoke regarding the depth of the Meeks well. I was not sure of the depth and should have stated so during my testimony rather than guessing at the depth.
 - For the record, the Meeks well was drilled to a depth of 540 feet when natural gas was encountered.
- 2) Please refer to the Transcript, page 81, Line 1807: "Mr. Doll. You should expect depth the deeper you go in this formation."
 - The question from Chairman Harris related to expectation of where gas could be found. My testimony would be more accurate to replace "depth" with "natural gas".

- Line 1807 should read “Mr. Doll. You should expect natural gas the deeper you go in this formation.”
- 3) Please refer to the Transcript, page 82, Line 1853: “encounter until you see your surface casing. Then after you”.
- To clarify my comments about well control using drilling mud until the surface casing is set, the word “see” should be replaced with “set”.
 - Line 1853 should read “encounter until you set your surface casing. Then after you”.

Sincerely,

A handwritten signature in black ink, appearing to read "Thomas E. Doll". The signature is fluid and cursive, with the first name "Thomas" being more prominent.

Thomas E. Doll, PE

State Oil and Gas Supervisor



Commissioners

Donald B. Basko

Ryan Lance

G. Bruce Williams

Thomas A. Dean

Wyoming Oil & Gas Conservation Commission

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Governor Matthew H. Mead, Chairman Thomas E. Doll, State Oil & Gas Supervisor

March 2, 2012

U. S. House of Representatives

Committee on Science, Space, and Technology

2321 Rayburn House Office Building

Washington DC 20515-6301

Attention: Andy Harris, M.D.

Chairman

Subcommittee on Energy & Environment

Fractured Science: Examining EPA's Approach to Groundwater Research into the Pavillion Analysis

Hearing February 1, 2012

Answers for the Record from Mr. Tom Doll, State Oil and Gas Supervisor, Wyoming Oil and Gas Conservation Commission

Response to The Honorable Andy Harris

1. *During the hearing, when Mr. Martin was asked about cement casings he stated, "We found weak or absent cement in many of the wells at depth, and that was one of the reasons we hypothesized that a potential pathway for vertical migration of the materials that we found at that deeper levels of the aquifer. It is a potential pathway. We posited several potential pathways. We were unable to identify any one as the most likely or the pathway."*
1. a) *Do you agree with EPA's analysis of the cement bond logs regarding weak or absent cement in the wells and what that means for well integrity?*

I do not agree with the statement "weak or absent cement in many of the wells at depth". The stated "many" may ultimately be less than four wells out of 168 drilled wells in the Pavillion field. I do agree that poor well integrity, either insufficient casing set depth or improper proper cement volume and height could result in a pathway for vertical migration of fluids. That statement is applicable to water supply wells as well as natural gas wells. A hypothesis could be formed that poor well integrity exists to a much greater extent in the water supply wells and provides a pathway for vertical migration within the shallow aquifer itself. Wyoming Oil and Gas Conservation Commission (WOGCC) rules are specific to oil and natural gas well integrity, Chapter 3, Sections 8, Section 22, and Section 45.

During 2009, the WOGCC Project Geologist provided the Supervisor a spreadsheet that included the historical Pavillion natural gas well integrity data from the WOGCC website. This spreadsheet was

updated the Project Geologist's 2007 era review of the 168 natural gas wells drilled in the Pavillion field. This spreadsheet was provided to an EPA Region 8 consultant in mid-2008. The data was tabulated from the WOGCC web site for each natural gas well including but not limited to casing size, casing set depth, cement volume and type used, comments regarding the cementing practices including comments regarding circulation of cement to the surface on the surface casing cement job and on the primary casing cementing job.

In 2010 a consultant for EPA Region 8, Denver, contacted the WOGCC Project Geologist with a listing identifying concern with well integrity of 36 natural gas wells of the 168 natural gas wells drilled in the Pavillion area gas field. The EPA consultant and WOGCC Project Geologist discussed these identified wells and agreed to engage in further research to ensure well record completeness. This collaborated and agreed to list of 36 wells was reviewed by the Pavillion Well Integrity Working Group during 2011. The operator, Encana, cooperated with the Working Group review by providing additional well information and cement bond logs to supplement WOGCC records. Additional well completion data is being provided by Encana as well. Some of the Tribal natural gas, wells under BLM regulatory oversight, may have missing information related to well integrity. BLM is represented on the Working Group and is reviewing Tribal well data.

The Well Integrity Working Group reviewed the well list and requested Encana to perform a bradenhead pressure test at each well on the identified well list. A pressure gauge is installed on the wellhead between the surface casing and the production casing annulus. A positive bradenhead pressure between the surface casing and the production string though not conclusive could indicate communication behind or between the casings. Thirty-four of the 36 identified wells were tested. Four of the 34 natural gas wells had a positive test for casing-annulus pressure. One of these four wells with a positive pressure test, Pavillion Fee 31-10, is approximately 900 feet from the EPA monitoring well MW01. Pavillion Fee 31-10 had surface casing set at 598 feet. The EPA drilled MW01 has surface casing set at 100 feet, was drilled to 790 feet, was not cemented using API guidelines, nor was a cement bond run by EPA.

None of this information was included in the EPA Pavillion groundwater report. The spreadsheet prepared by the WOGCC Project Geologist, which was expanded to include the water supply well data known in the area, was distributed to all participants attending Working Group meetings, including the EPA, on April 28, 2011 and was posted on the WOGCC web page with all Working Group minutes in December 2011.

The Working Group continues to review the natural gas well data for a potential pathway for vertical migration of fluid or gas. This review continues as a work-in-progress with additional well testing on the four identified wells anticipated and possible well remedial work may be recommended.

1. *b) Would you agree that Mr. Martin's admission that EPA was unable to identify any one as the most likely pathway undermines the conclusions of the draft report that the contaminants found in the deep monitoring wells were most likely the cause of hydraulic fracturing?*

I agree that EPA was unable to find a specific pathway for contamination of any type. EPA does not make the case for any mechanical, geological, physical or hydro-geologic means for fluid movement horizontally or vertically from deep natural gas wells to the two monitoring wells or to the shallow water supply wells. The EPA did not take into account the complex geology of the Wind River Formation.

The EPA monitoring wells were drilled with one completed in the shallow water supply interval, MW01, and one completed in the deeper natural gas reservoir, MW02. This is evidenced from analysis of the offset natural gas well electrical logs and EPA water analyses from the Draft Report that indicate that the MW01 water samples from 790 feet have geochemistry analogous to the shallow water supply wells, whereas the MW02 water samples from 970 feet have geochemistry analogous to the deeper natural gas dominated zones.

The EPA identified a single detection of a single chemical compound out of nine samples analyzed by three different laboratories. EPA did not verify whether or not this chemical compound was even used in hydraulic fracturing treatments in Pavillion. Instead, EPA did a literature search for the chemical compound in Material Safety Data Sheet (MSDS) until the chemical compound was found to be used in a foaming agent used in hydraulic fracturing treatments. The EPA did not consider other uses for this chemical compound such as solvents, cleaners, and surfactants.

1. c) *What other potential pathways exist and how are they plausible sources of contamination?*

In all EPA water well sampling and testing done to-date in the Pavillion area, EPA did not fully investigate the 42 domestic and 4 stock water supply wells for contamination from landowner septic systems (only two domestic wells were sampled for nitrate related to sewage). The identification and proximity of water supply wells to septic systems and leach fields has not been addressed.

The Pavillion area is heavily irrigated by pivot systems and flood irrigated through a series of surface ditches throughout the growing season. Irrigation run-off and recharge of Five Mile Creek and the Wind River shallow aquifer has not been fully investigated or tested. Most domestic and stock water wells were sampled in the winter months with no ongoing irrigation run-off or recharge. Due to low annual precipitation in the Pavillion area, irrigation run-off is a major source of shallow aquifer recharge and contributes to Five Mile Creek flow.

Other possible sources of contamination include an abandoned town landfill located northwest of the Town of Pavillion on Five Mile Creek. This site is up gradient of the domestic and stock water wells within the Pavillion natural gas field. This dump site is known to local residents but was not brought to the attention of the EPA or the Working Group members studying Landowner Identified Sites.

Run-off from landowner stock pens and feedlots was not identified or tested. The proximity of water supply wells to stock pens and feedlots is unknown. Isolation of the water supply wells to prevent contamination has not been addressed.

The use of pesticides, fertilizers (only one domestic well was sampled) and herbicides has not been fully identified, investigated or tested. These chemicals are used extensively in this irrigated bottom land as many landowners grow alfalfa and native hay. Area landowners provide weed free alfalfa to a Pavillion area plant that pelletizes alfalfa that is marketed outside of Wyoming. EPA has not investigated storage sites, application rates and frequency for these classes of chemicals.

The identification and testing of soil contamination at current and abandoned shops, garages, fuel stations or vehicle repair shops, commercial and private, has not been addressed. These sites are potential direct sources for long term contamination to the shallow aquifer from diesel and gasoline fuels, lubricants, solvents, and anti-freeze used in farm, ranch and transport equipment.

2. *During the hearing, Mr. Martin explained the reason behind the depths chosen for the monitoring wells, stating, "we were trying to sandwich the domestic drinking water wells and*

the other wells so that we could get some better sense of whether there was a source of contamination that is deeper than those drinking water wells.” Given your knowledge of the Wind River Formation, and the complex geology of this region, is EPA’s reasoning for the depths and locations chosen for its monitoring wells a scientifically supported or logical rationale?

The EPA sampling and testing results taken in 2009 and 2010 and reported in August, 2010 could not conclude at what level contamination existed or identify the source of the chemicals identified in groundwater except that methane was found in some domestic water supply wells. Yet before that data and conclusion was reported to the public in August, 2010, EPA had already drilled the two deep monitoring wells in the Pavillion natural gas field. EPA provides little to defend its decision to expend the monies to drill monitoring wells. The explanation for the location of the wells seems unscientific and weak. It is obvious that the Wind River formation’s complex geology was not taken into consideration in determining either the well location or the well depth of these monitoring wells. No logic or rationale is presented for locating the monitoring wells other than that they are each located on the surface of a landowner with a claim of groundwater contamination. No logic or rationale is presented for the depths chosen for the monitoring wells. These depths are greater than any domestic or stock water well and do not reflect the water quality or methane content of the shallow water supply wells used by people living within the Pavillion natural gas field.

EPA monitoring well MW01 is located near 219 Indian Ridge Road on the Randall property in NE-NE Section 10, Township 3 North, and Range 2 East. Pavillion Fee 31-10, a producing natural gas well is located in NW-NW Section 10, Township 3 North, Range 2 East, and is approximately 900 feet from the EPA monitoring well MW01. Pavillion Fee 31-10 had surface casing set at 598 feet. MW01 had surface casing set at 100 feet and was drilled and cased to 790 feet but a cement bond log was not run by EPA. The EPA also located the MW01 within 600 feet of the Tribal 41X10 location, a reclaimed drill site that was plugged and abandoned by Shell in 1973. Note also that the MW02 well is located near 124 Harris Bridge Road on the Locker property, at SW-NW Section 12, Township 3 North, Range 2 East, and is approximately 300 feet from the Tribal Pavillion 12-12, a producing natural gas well located at SW-NW Section 12, Township 3 North, Range 2 East, and is also located near a landowner junk yard. Tribal Pavillion 12-12 had surface casing set at 635 feet and MW02 had surface casing set at 100 feet and was drilled and cased to 970 feet but a cement bond log was not run.

3. *Mr. Doll, you described the unique hydrogeology of the Pavillion gas field as a complex “bowl of potato chips”. In light of this complexity, were the two monitoring wells with only two data sets collected by EPA sufficient to interpret flow and cause-and-effect relationships between hydraulic fracturing and drinking water? Does the detection of a contaminant in one well indicate any statistical significance or confidence in the conclusion that was reached?*

The EPA was incomplete and inadequate in addressing the impacts of the geology of the Pavillion area in the Draft Report on Investigation of Ground Water Contamination in Pavillion, WY.

EPA misrepresented the complex geology and hydrogeology of the Wind River formation in central Wyoming. EPA used a simplistic stratigraphic model that assumes continuous sand bodies implying vertical and horizontal fluid and natural gas migration. EPA fails to grasp that an inadequate geological understanding results in flawed analysis and erroneous conclusions regarding any source of contamination from natural or other sources. The Wind River formation's complex geology was not taken into consideration in determining either the well location or the well depth. Two sampling events, the first in October 2010 and the second in April 2011, at the two EPA monitoring well sites are not sufficient to interpret horizontal or vertical fluid or natural gas migration in this complex geology. The visualization of potato chips layered in a bowl illustrates how the individual sand lenses are oriented across the natural gas field and how some could be in contact or communication vertically and horizontally with each other while most sand lenses are not.

The guidelines provided by USGS specific to sampling the Wind River Formation (2005) provides detailed monitoring well design and spatial setting for sampling. State and federal agency and USGS scientists would not to rely on only two monitoring wells and only two sampling events to make any conclusion as to complex cause and effect relationships in fluid and natural gas migration in this complex geology. In addition, the detection of a single chemical compound was found by only one of the three laboratories; was found in only one of nine samples analyzed; and was not found in any other samples. That result should have been a red flag to EPA that the sampling frequency and sample numbers were statistically insufficient to verify the detection or make general causative conclusions. The only scientific conclusion to be drawn by EPA from this single detection should have been that additional testing was required to get a representative sample of formation fluid. The scientific method requires testing and verification.

Repeatability and verification were not provided by EPA over the entire sampling data set from these monitoring wells. EPA claims to have used "lines of reasoning" but these are not clearly developed and they do not reflect any application of the scientific method to "test and verify". The EPA methodology is a convergence of reasoning to an unsupported conclusion that more reflects "analysis by description" and that certainly obscures facts that conflict with the EPA hypothesis. This is the poor unsupported science that leads EPA to their predetermined outcome that hydraulic fracturing caused groundwater contamination at Pavillion.

4. *You state in your testimony that the EPA did not follow USGS recommendations for drilling and sampling monitoring wells, and that this mistake may have resulted in the detected chemicals being introduced by the drilling itself.*
1. a) *Can you elaborate on the specific misstep EPA made with respect to USGS guidance, and why this is important?*

The USGS published a Scientific Investigations Report in 2005, number 2005-5027, in cooperation with the Wind River Environmental Quality Council, titled "Monitoring-Well Network and Sampling Design for Groundwater Quality, Wind River Indian Reservation, Wyoming". The Pavillion natural gas field is located in north central Fremont County Wyoming near the center of the 3,500 square mile Wind River Indian Reservation. The USGS report details monitoring well design for groundwater quality monitoring specific to the Wind River Indian Reservation. The USGS Report was not referenced in the EPA Pavillion report therefore was not likely known or used in this project design. By not following USGS design for Wind River Formation monitoring wells and sampling protocols, the entire scientific basis for and results from the EPA Pavillion project are in question.

The technical and scientific experts from the WOGCC, Department of Environmental Quality (WDEQ), and Water Development Office (WDO) provided EPA Region 8 with over 4 pages of questions and concerns related to the drilling, completion, development, testing, sampling and analysis of the two monitoring wells in early November, 2011. The majority of those questions and concerns remain unanswered. These state agency experts cannot make any conclusions based on the EPA monitoring well data or the report but do contend that the organics detected in the samples were introduced during well activities.

Many examples could be provided to support the state agency expert's contention, but the main concerns relate to the following possible scenarios regarding introduced contamination:

- The tanker truck used to haul the water for drilling and developing (or injecting water) contaminated the wells. Contamination in the form of hydrocarbons was detected in the MW02 well, the deepest and the first well drilled. No hydrocarbon contamination was found in MW01, the second and shallowest monitoring well drilled. The EPA report provides no evidence that the truck was ever steam cleaned, flushed or sampled, not even once prior to and or at any time during its use on this project. Hydrocarbons, poor quality water from unknown sources, or rust, mud, trash, or hydrocarbon residue in the tank from other job activities prior to this project, could be enough to contaminate the monitoring wells with the organic chemicals at the levels detected. No evidence is provided that the tanker truck was dedicated solely to hauling water for these wells or was this truck the only tanker truck used to haul water. The organic chemicals detected in the April 2011 sampling event were substantially less than those found in the original sampling event of October 2010. This is evidence our experts used to conclude that the induced organic contaminants were cleaning up with decreasing concentration detected with subsequent production of the monitoring well. Additional production and subsequent testing should lead to lesser and potentially to a non-detect of organics.
- The drilling mud materials as mixed in the make-up water were not properly sampled at the time of use. Some mud samples were identified as being taken in July 2011, over one year after the wells were drilled. The mud samples taken by EPA were diluted them 100 to 1 for testing. The EPA used a non-API dilution method with no explanation provided. Typically, the drilling rig contractor maintains a mud system for optimum drilling rate, bit life, well control, and with mud properties required to carry cuttings out of the hole. Mud is weighed in the API balance scale and mud properties including mud filter loss or filtrate are reported. Mud filtrate was not collected by EPA and its properties were not sampled and analyzed. As the drilling mud is pumped through the bit at depth and under pressure, a mud cake is formed on the porous Wind River formation sand lenses as they are drilled through. In lost circulation circumstances, whole drilling mud can be pumped into the sand lenses. Due to the pressure differential, mud filtrate is forced into the formation much like liquid coffee from grounds is forced through the filter and the coffee grounds remains on the filter. When the Wind River formation was produced from the EPA monitoring wells, the first fluid recovered contained mud filtrate. The pH, potassium, sodium, chloride and other chemicals found and reported by EPA are directly attributed to the drilling mud and mud filtrate invasion into the porous Wind River formation sand lenses.
- The report indicates that the some of the steel casing run in the wells was washed off at a car wash in Riverton. Surfactants are used at a car wash. The report does not detail how clean the interior of the casing was, only that the external casing area was washed. Rust, mill varnish, particulates could contaminate the wells when the casing was run in the hole. Some of the casing and the tubing were sprayed from a garden hose to clean them at the

well site. This garden hose uses water hauled to the site by the tanker truck, stored onsite, and pumped by the rig pump through the hose.

- On November 30, 2011 at a public meeting in Casper, the chief EPA scientist for the project said no lubricant or thread sealer was used on the casing or tubing when run into the well. Steel casing and tubing threads and couplings, specifically the crossover from steel casing to the stainless steel casing and screen, must be properly and sufficiently lubricated to allow the threads to be tightened to the proper manufacturers torque to ensure a seal and the provide connection integrity. Lubricants and sealants used on well casing and tubing are a source of organics contamination at the levels detected.
- EPA did not follow a pump and displacement method during the cementing of the steel casing and stainless steel screen in the monitoring wells. EPA used "tremie pipe" run into the annular space between the outside of the steel casing and the inside of the drilled hole. No mention of decontamination of the tremie pipe was provided in the Draft Report. EPA mixed an insufficient volume of cement necessary to fill the well for the calculated annular volume. A cement bond log was not run by EPA in either monitoring well, yet EPA has been critical of natural gas well cement bond logs. Mud, drill cuttings and cement were left in the wells from the total depth of the well up to or across the stainless steel screen. The first fluids produced from the screens would include soluble products from the drilling mud, drill cuttings, and cement, all possible contamination pathways at the parts per billion levels detected in the monitoring wells.

Each well had a downhole electric submersible pump installed on the end of tubing to recover samples of Wind River formation fluid. The pump is attached to steel tubing and lowered into the well. The power cable (from the pump to the electric service panel on the surface) is typically laid out on the ground. As the pump is lowered and attached to the tubing the power cable is picked off the ground and clamped or taped to the outside of the tubing. Around any drilling rig the potential for soil contamination exists from the drilling mud, diesel fuel, motor oil and antifreeze used on the rig, as well as gasoline or diesel used for fuel for the power generator. The power cable could have been drug through such spills or leaks as it was lowered in the hole thus providing a pathway downhole for organics at the levels detected. Contamination from spills could have been picked up by the cable as it was picked up off the ground and lowered in the hole. Notes from the EPA indicate a diesel spill on the MW01 site was of such volume that the landowner Randall was concerned about the cleanup. A diesel spill at the rig is certainly a source of organics contamination at the parts per billion levels detected in the monitoring wells. The EPA did not file a spill report as per Commission Rule Chapter 4, Section 3.

5. *Is it possible for water that does not exceed EPA's maximum contaminant levers to still taste or smell bad? What can cause this? Has the State identified potential sources of the bad taste and bad smell in the water in Pavillion?*

Drinking water that meets the Safe Drinking Water Act (SDWA) standards may still have a taste or odor. In Pavillion, as early as the 1800's groundwater was identified as poor quality. In 1959, the USGS documented Pavillion water as unsatisfactory for domestic use due to high concentrations of naturally occurring sulfates, total dissolved solids and pH. The Town of Pavillion has five Wind River

Aquifer water supply wells treated to meet SDWA standards. The fact that a majority of Pavillion residents have good drinking water from the town supply or have good quality private water supply wells is only now being published in area newspapers. These individual water users admit to having been silent too long regarding Pavillion water supply issues (Casper Star Tribune, February 26, 2012).

Drinking water with iron and high dissolved solids (hard water) has a bitter, metallic tang and may stain porcelain sinks or leave a residue on faucets. It is curious to note that none of the water samples taken by EPA from the two monitoring wells were analyzed for iron. For unknown reasons, EPA did not consider iron in their analyses, electing not to expend the effort to properly preserve the samples or do an iron analysis. Pavillion domestic water supply wells contain high concentrations of iron and have a metallic taste.

The bad smell in the water is the rotten egg odor of naturally occurring sulfate dissolved in the water. Pavillion domestic water supply wells contain high concentrations of naturally occurring sulfates and can exhibit a bad odor and still meet SDWA standards. Charcoal filtration of this water can eliminate the odor.

In addition, several Pavillion domestic water supply wells contain evidence of bacteria as reported in August 2010 from the 2009 and 2010 samples. Observations of filters find a jet black material which is captured on the filter media along with a clear slim. These bacteria thrive in an unclean sulfate and iron rich water environment in the domestic well. Well maintenance and potential bacteriologic contamination in the 42 domestic water supply wells has yet to be addressed by EPA even after testing and analysis performed since 2009. Proper domestic well maintenance can eliminate the bacteria and provide a high degree of water quality for the landowner. WOGCC, WDEQ, and Wyoming Rural Water personnel have discussed proper well maintenance and cleanup procedures with various Pavillion landowners. Some continue to ignore this advice and continue to claim contamination from the Pavillion natural gas field (Casper Star Tribune, February 26, 2012). EPA truly did not concentrate on the domestic supply well water quality as the bacteriological testing done in 2009, 2010, and 2011 did not sample for fecal coli form bacteria which could identify a serious public health issue.

6. *As Wyoming's representative to the Interstate Oil and Gas Compact Commission (IOGCC), how would you characterize the stringency of Wyoming's regulations of oil and natural gas production, including hydraulic fracturing, compared with other States?*

Wyoming has regulated well stimulation since the 1950's. In June, 2010 Wyoming adopted well stimulation rules addressing protection of groundwater and the identification of permitted water supply wells within ¼ mile of the drilling and spacing unit or the Commission approved drilling unit; clarified requirements for well integrity, casing set depths, casing design and cementing properties; individual requirements for disclosure of well stimulation fluid chemical additives by name, by type, by compound Chemical Abstracts Service number, and concentration; and included requirements for the handling and accounting of well stimulation fluid recovery. Wyoming is the only state that requires chemical compound disclosure as part of the permit approval process prior to initiation of the well stimulation process. All states require the disclosure of chemical compounds to be reported post-stimulation. Attached is a copy of a comparison of hydraulic fracturing fluid disclosure laws from nine states including Wyoming (Inside Climate News, February 15, 2012).

Wyoming works with Interstate Oil and Gas Compact Commission (IOGCC) member states to review and develop well stimulation rules and regulations. The WOGCC web page is the envy of IOGCC members and is used by the public, the oil and gas industry, federal and state agencies. The site provides access to well records and production data. Approximately 17,000 reports are scanned into the OGCC database each month and consist of as few as two pages to several hundred pages per report. Well data is available by accessing the WOGCC web page at <http://wogcc.state.wy.us> then selecting "Completions" from the left hand column of the home page. A screen with two calendars allows the selection of dates and the operator name may be entered as an option. The result is a screen with a listing of all wells, or listing of wells for the specific operator, for those dates selected. A click on the desired icon for a specific well will provide the well information including permits, reports, and production data. This allows public access to all chemical compounds planned and actually used in the well stimulation as per OGCC rules Chapter 3, Section 45.

7. *Since EPA did not consult with the Wyoming Oil and Gas Conservation Commission, you agency was not able to provide advice with respect to EPA's development of the deep monitoring wells. What information or suggestions would you have provided to EPA regarding their choice of site location, depth of drilling, drilling practices, local hydrogeological conditions, etc?*

The Commission would have collaborated with EPA, USGS, BLM the Tribes, WDEQ and other state agencies in developing and implementing a monitoring well program. A GIS representation of the Pavillion natural gas field, permitted and known water supply wells, pits, dumps, houses, feed lots, irrigated lands, etc. would be identified and mapped.

The purpose and need for the monitoring wells would be understood by state, federal and Tribal shareholders. The scientific objective and results anticipated would have been clearly stated and documented. Previous EPA Pavillion sampling and test results did not provide a source of contamination in the domestic water supply wells. Had the shareholders participated in an open and collaborative discussion, the objective of drilling two monitoring wells may have been different.

Had the WOGCC been consulted and allowed to collaborate in the planning of the two EPA monitoring wells we would have suggested well locations and well depths that would be representative of the aquifer used by the landowners in the Pavillion natural gas field. All known natural gas wells, producing and abandoned, would be identified. The Wyoming State Geological Survey (WSGS) would take the lead regarding identification of the geology and hydrogeology related to well sites and well depth. The Wind River Basin as a whole has been studied by WSGS and WSGS ongoing focus on the Pavillion area would result in a stronger understanding of the geology of the Wind River Formation.

Proper hole diameter, casing size, and cementing properties and procedures would be designed to ensure well integrity and zonal isolation. The overall project design and scientific objectives would be met with the appropriate wellbore design. Procedures and protocols would be discussed, documented and a consensus reached.

All state, Tribal and federal agency personnel would be knowledgeable of the project details and participate in the design of the wells and with the scientific protocols to prevent contamination of the Wind River Formation by the placement of the wells and meet the scientific objectives. The use of third parties to sample, transport, provide laboratory analyses and quality control and quality assurance would be evaluated and selected.

The monitoring wells would have been permitted with WOGCC as the Pavillion area is known to have shallow natural gas production. Typically, monitoring wells are permitted by the Office of the State Engineer (WSEO). The EPA Pavillion Report provides that the two monitoring wells had 4 inch steel casing. The WSEO does not require a permit for monitoring wells with 4 inch diameter casing. In this case, however, the WOGCC permit would provide public information for each well's location, proposed depth and completion program by requiring a detailed drilling and completion plan.

The drilling mud system would be designed to prevent contamination by mud filtrate loss and yet control the well. All mud properties would be measured by API methods and documented. The likelihood of encountering natural gas would have been discussed, understood and accounted for. The drilling rig would be equipped to properly handle natural gas.

A team would be selected for well site observation with at least one supervisor or designated representative from each agency to be onsite at all times, and specifically during each critical well operation, to document procedure, decontamination, and proper rig activity related to their scientific discipline. Documentation would be mandatory and detailed.

The activity would be managed as a science project. All equipment used to drill the well including mud pumps, drill pipe, handling tools, piping and water storage systems would be degreased, steam cleaned and decontaminated as necessary and maintained throughout the job to prevent becoming a source of contamination to the Wind River Formation. All water trucks would be dedicated to this monitoring well project, degreased, steam cleaned, decontaminated, and maintained. Each load of water used at each drill site would be tracked and documented as to source, sampled and tested to insure no hydrocarbon or other chemical compound contamination. All casing, screens, pumps, tubing, power cables, in fact anything entering the well will be inspected, documented, and degreased, steam cleaned, or sandblasted as is necessary to remove mill scale, particulates, oil and greases, then stored onsite in plastic wrap. All such equipment would be cleaned again prior to running into the well.

WOGCC rules, Chapter 3 and Chapter 4, will be followed. Surface casing will be of sufficient length to be 100 to 120 feet below the deepest offset permitted water wells. All casing and tubing connections will be properly lubricated and torqued to manufacturers specifications. Lubricants will be sampled, volume used documented, and application will be with care reflecting the science project.

Proper cementing techniques would be detailed and employed, such as the pump and displace method rather than the use of a pipe lowered between the casing and the hole. All cement will be API grade. Proper excess volume will be mixed and pumped to ensure proper coverage and isolation. The isolation of the zone of interest may include mechanical tools such as packer elements and ports rather than a screen.

All fuels, lubricants, solvents, cleaners, degreasers, mud and additives, well products, cements and additives, in fact all chemical compounds on location, solid or liquid, would be sampled and preserved as delivered to location and as used or mixed on location, documented as to source, manufacturer, with all custody transfer, compound use, compound name and type, concentration as delivered and as used or mixed on location, when and how applied, to include Chemical Abstracts Service (CAS) number and appropriate Material Safety Data Sheet (MSDS), etc.

The well cleanup and development would include the use of nitrogen rather than water injection. If water injection is required for development then all water used would be documented, sampled and tested, and treated as necessary to prevent formation damage and to

minimize contamination to the Wind River Formation. Total fluid volumes injected and recovered would be accurately measured and documented. Any natural gas recovered would be measured and properly vented using proper safety protocols and as per the OGCC rules.

Once the well is ready for long term production, the wellhead will be properly isolated and secured. All production equipment will be steam cleaned and decontaminated prior to being run into the well. All sampling equipment would be handled as if in a laboratory environment with strict adherence to protocol throughout, including documentation, preservation, proper handling and chain of custody.

This is only a portion of the suggestions that would have developed over the planning and implementation of such a science project. The key to the successful design and implementation would be early and often technical meetings with all stakeholders present.

Thank you for this opportunity to address your questions.



Thomas E. Doll

State Oil and Gas Supervisor

Wyoming Oil and Gas Conservation Commission



Commissioners

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Governor Matthew H. Mead, Chairman Thomas E. Doll, State Oil & Gas Supervisor

March 2, 2012

U. S. House of Representatives

Committee on Science, Space, and Technology

2321 Rayburn House Office Building

Washington DC 20515-6301

Attention: Brad Miller

Chairman

Subcommittee on Energy & Environment

Fractured Science: Examining EPA's Approach to Groundwater Research into the Pavillion Analysis

Hearing February 1, 2012

Answers for the Record from Mr. Tom Doll, State Oil and Gas Supervisor, Wyoming Oil and Gas Conservation Commission

Response to The Honorable Brad Miller

1. *After the hearing I received a letter (attached) from the Pavillion Area Concerned Citizens (PAAC), which also include an enclosure of a letter from the State Engineer's Office. The PACC apparently watched our February 1st hearing very closely, and were specifically concerned with comments that appear to be inaccurate related to the drinking water well blowout. In your testimony you stated that you believed that the blowout happened at a 900 to 1000 foot range. The enclosure provided by PACC says that the blowout happen at 540 feet –*
 - *"The Wyoming Oil and Gas Conservation Commission's opinion of what caused the problems in the first Meeks #2 well was that the "blowout" was the result of the water well driller drilling to 540 feet, finding a good sand, and blowing the hole dry in an attempt to determine water deliverability. Because this is a gas bearing zone, the unloaded hole proceeded to produce gas"*

The State Engineer's Office letter to one of the Pavillion residents not only acknowledges the danger of drilling to 540 feet, but also approves a second well permit to drill even deeper to 700 feet. The PACC letter and its enclosure illustrate that the residents of Pavillion do not trust the State government to regulate the oil and gas industry.

- *Mr. Doll we hear from the industry that state governments should be responsible for regulating oil and gas drilling and you state that "Wyoming has historically regulated hydraulic fracturing." Why should the Federal government trust a state to regulate its own oil and gas drilling, when that state is willing to approve the drilling of a water-well into a gas bearing zone? Why didn't the state turn down this permit? In the State Engineer's Office letter two recommendations are made for drilling into a gas bearing zone, why are these recommendations and not requirements?*

The Wyoming State Engineer's Office (WSEO) has statutory responsibility for granting rights to the water of the State. The Wyoming Oil and Gas Conservation Commission (WOGCC) has statutory responsibility for oil and natural gas activity in the state. The WOGCC does not have statutory authority for water supply wells or monitoring wells.

A permit for appropriation of the water must be granted by the WSEO along with the application for permit to drill the well. The letter referred to is dated April 7, 2008, and signed by Patrick Tyrrell, State Engineer. The State Engineer was aware of the first Meeks water supply well "blowout" and the comments made by WOGCC as quoted. The State Engineer, in the letter, provides a warning to the landowner that the probability of encountering natural gas is high in this well to be drilled deeper than the original well that encountered a flow of natural gas at 540 feet. The State Engineer quotes the statute W.S. 41-3-391 that states "an application for a permit for a well in any areas not designated as a critical area shall be granted as a matter of course..." I cannot speak for the State Engineer but I believe the statute quoted in the letter is clear as to his course of action.

The WSEO letter provides two recommendations for the landowner to follow based on WOGCC recommendations to the WSEO for permitting water supply wells to be drilled into a gas bearing zone in the Pavillion Field. These recommendations to the WSEO were an outcome of an internal study completed on the original Meeks well "blowout". WOGCC does not regulate the drilling of water supply wells and as such made recommendations to the State Engineer specific to drilling water supply wells in the Pavillion natural gas field.

The Federal government should trust the State of Wyoming to regulate oil and natural gas well drilling as the WOGCC has been doing since the 1950's. The personnel of the WOGCC are experienced in the unique geology and drilling, completion and production conditions encountered in Wyoming through plug, abandonment and reclamation. WOGCC successfully administers EPA's Underground Injection Control Program and has since mid-1980. WOGCC has an orphan well program to plug, abandon and reclaim wells and well sites. This intimate and current knowledge is specific to Wyoming. A federal, one-size fits all, rule approach will not be effective or efficient as it would be, among other concerns, too cumbersome and slow to react to changes in technology or regulatory need.

Much of the groundwater found in most of the geologic basins across Wyoming contains natural gas. A good example is the Powder River Basin of northeastern Wyoming which produces approximately 2.5 billion cubic feet per day of methane from wells completed in shallow coals in the Fort Union aquifer. The WOGCC, WDEQ, WSEO, Wyoming Rural Water, and Wyoming Water Development Office have been collaborating to study and provide conclusive answers regarding the groundwater concerns of all citizens in the Pavillion area and to provide a clean water solution.

Wyoming promulgated chemical compound disclosure rules for well stimulation and clarified casing and cementing requirements in 2010. Wyoming is the only state to require disclosure of chemical compounds planned to be used in well stimulation as part of the permit approval process prior to the initiation of the stimulation process. Disclosure to the Commission of the actual chemical compounds used in the well stimulation is required post-stimulation. The reuse, recycling and disposal of fluid flowback must be reported.

In my testimony of February 1, 2012, I regret that I misspoke regarding the depth of the Meeks well. I was not sure of the depth and should have stated so during my testimony rather than guessing at the depth.

2. *Mr. Doll during the hearing Mr. Martin mentioned that the state of Wyoming has not shared split sampling that they took during several phases of the investigation.*
 - *Mr. Doll, did the state take split sampling during the investigation? If the State did take split sampling during the investigation, why has it not been shared with EPA? If the State did not take split sampling during the investigation, did the state do any sampling before or during the investigation? If not, why not?*

I am not aware if any state agency participated in split sampling of the monitoring wells during the investigation, the WOGCC did not. Contrary to Mr. Martin's comments, the WOGCC was not informed in advance of the EPA plan to drill monitoring wells within the Pavillion natural gas field. To my knowledge, based on a personal conversation, the Wyoming Department of Environmental Quality (WDEQ) was not informed until the drilling rig was ready to drill the first well, MW02.

I am aware that the WOGCC Project Geologist was informed in February 2011 via email and telephone correspondence by a counterpart in EPA Region 8 that two monitoring wells were drilled by EPA in the summer of 2010. That notification was six months after the two wells were drilled and occurred three months after the first sampling event. WOGCC personnel were informed verbally by EPA Region 8 staff on April 20, 2011 at the Working Groups public meeting that the second sampling event had occurred.

At no time were WOGCC personnel informed or provided advance notice of sampling events therefore we had no chance to collect split samples had we desired to do so. I have no knowledge of or if WDEQ or other state agency personnel were informed in advance of the sampling events.

3. *Mr. Doll when Chairman Hall asked you "What would you have recommended to EPA if you had been consulted? You were not consulted, were you?" You answered back, "No sir, we were not. The Oil and Gas Conservation Commission was not." You go on to say, "They may have*

contacted by email the head of the Department of Environmental Quality but not the Oil and Gas Conservation Commission."

- *Mr. Doll as a representative of Governor Mead, as you stated in your testimony, can you please tell me the extent of the communication between the Wyoming Department of Environmental Quality, on office under the Governor, and the EPA pertaining to the Pavillion investigation?*

WOGCC personnel were informed in February 2011 that two monitoring wells were drilled by EPA in the summer of 2010. That notification was six months after the two wells were drilled and three months after the first sampling event. WOGCC personnel were informed verbally by EPA Region 8 staff on April 20, 2011 at the Working Groups public meeting that the second sampling event had occurred.

My testimony on February 1, 2012, as quoted, is based on a personal conversation I had with the Director of WDEQ. About the time the drilling rig was moving to the first well location, I understand an email from EPA was received by WDEQ personnel informing them that the drilling of the first monitoring well was scheduled. The testimony of February 1, 2012 was my recollection of that conversation.

I cannot provide comments regarding the extent of the communication pertaining to the Pavillion investigation between the WDEQ and EPA. I have no direct knowledge of or involvement in those communications. The EPA Pavillion investigation has been ongoing since 2008.

Thank you for this opportunity to address your questions.



Thomas E. Doll
State Oil and Gas Supervisor
Wyoming Oil and Gas Conservation Commission

List of Attachments

Inside Climate News "Fracking Fluid Disclosure Laws", table, February 15, 2012

Casper Star Tribune, Front Page, February 26, 2012



Fracking Fluid Disclosure Laws

Nine states require energy companies to disclose information about fracking fluids they use.
Here's how those laws stack up against proposed U.S. BLM rules.

2/15/12

State or federal agency	What must be disclosed (excluding proprietary compounds)	Must chemical concentrations be disclosed?	What about proprietary information?	Where is the information posted?	When is the information disclosed?
U.S. Bureau of Land Management draft regulations (Applicable only to wells drilled on federal land).	Names of products, chemicals and their CAS numbers.* Chemicals are listed by well but not matched with the products they go into.	Yes, but not for specific products.	Unclear if it would be disclosed to regulators or hidden from both regulators and the public. Operators seeking exemptions must cite the specific regulation that applies to each exemption, and explain why that product or chemical is considered proprietary.	Operators would disclose the information using BLM Form 3160-5 (Sundry Notices). It's unclear if the data would be posted online.	A list of proposed chemicals is due at least 30 days before fracking begins. An updated list is due after well completion.
Arkansas	Names of products, chemicals and their CAS numbers. The chemicals are listed by well but not matched with the products they go into.	No. Operators disclose the percent by volume of the products used in a well, but not the concentrations of individual chemicals.	Disclosed to director of the Arkansas Oil and Gas Commission. The information must be provided to health care professionals who require it. The chemical family is disclosed to the public. Operators seeking exemptions must apply to the Commission director.	Posted on state website	A list of proposed products and chemicals is due before fracking. When fracking is done, updated lists are submitted for each well.
Colorado (Rules effective April 1, 2012).	Names of products, chemicals and their CAS numbers. Chemicals are listed by well but not matched with the products they go into. Landowners within 500 feet of a well will receive information on how fracking works and how to do baseline water testing.	Yes, but not for specific products.	Disclosed to Colo. Oil and Gas Commission and to health care professionals in an emergency. The chemical family of each proprietary compound will be disclosed to the public. Operators seeking exemptions must certify that the exempt compound is a trade secret. That statement is provided under penalty of perjury—if the information is a lie, the person who signed the form could go to prison.	Posted on FracFocus.org**	Within 60 days of fracking activity.
Louisiana	List of products used. If a product is considered hazardous by Occupational Safety and Health Administration standards, then its chemical ingredients and concentrations must also be released.	Yes, but only for chemicals in hazardous products.	Operators must disclose the chemical family, but the exact chemical name is not disclosed to regulators or the public. Operators must follow state or federal laws that require disclosure to health care professionals. Operators can claim exemptions for compounds they consider trade secrets.	Posted on FracFocus or a state website within the Louisiana Dept. of Natural Resources Office of Conservation	Within 20 days of well completion.
Michigan	Material Safety Data Sheets must be filed for hazardous chemicals and matched with the products they go into.***	No. Operators disclose a range, not the exact concentration.	Not disclosed to regulators or the public. Operators can label chemicals they consider trade secrets as "proprietary" on Material Safety Data Sheets. Only the concentration range is disclosed.	Material Safety Data Sheets posted on state website	Within 60 days of drilling completion.
Montana	Names of chemicals and their CAS numbers. Chemicals don't have to be matched with the products they go into.	No. Operators provide maximum concentration, not actual concentration.	Operators must disclose the chemical family, but the exact chemical name isn't disclosed to regulators or the public. Proprietary chemicals must be disclosed to health care professionals in an emergency. Well operators can decide whether products or chemicals are proprietary.	Companies can post the information on FracFocus or give it to the Montana Oil and Gas Board.	Before fracking begins and after fracking is complete.
Ohio	Material Safety Data Sheets, which list products' individual chemical components and their CAS numbers.	No. Operators disclose a range, not the exact concentration.	Not disclosed to regulators or the public. No specific requirements for medical disclosure, but a regulator from the Ohio Dept. of Natural Resources said he's confident the information would be provided to health care professionals in an emergency.	Posted on state website	60 days after drilling is complete.



Fracking Fluid Disclosure Laws

Nine states require energy companies to disclose information about fracking fluids they use. Here's how these laws stack up against proposed U.S. BLM rules.

2/15/12

State or federal agency	What must be disclosed (excluding proprietary compounds)	Must chemical concentrations be disclosed?	What about proprietary information?	Where is the information posted?	When is the information disclosed?
Pennsylvania	Names of products and chemicals. Chemicals don't have to be matched with the products they go into. CAS numbers are required only for chemicals listed on Material Safety Data Sheets.	Yes, but only for chemicals considered hazardous. Operators also disclose the concentration of each product as a percent of the total fracking fluid.	Disclosed to regulators. Members of the public seeking access can submit a request to the Dept of Environmental Protection. The request is passed to the operator, which then makes its case to the DEP. The DEP makes the final decision.	Not posted online but available on request from the Dept. of Environmental Protection.	Within 30 days of well completion.
Texas (Rules became effective Feb. 1, 2012).	Names of products, chemicals and their CAS numbers. Only hazardous chemicals are matched with the products they go into.	No. Operators disclose the actual or maximum concentration of only hazardous chemicals.	Companies are not required to disclose trade secret information unless the attorney general or court determines the information is not entitled to trade secret protection. A landowner or state agency can challenge trade secret classification. The information cannot be withheld from health care professionals in an emergency.	Posted on FracFocus	Within 30 days after well completion, although deadlines may vary slightly.
Wyoming	Names of products, chemicals and their CAS numbers. It's unclear if the chemicals would be matched with the products they go into.*	No. Operators disclose product concentrations but not the concentrations of individual chemical components.	Disclosed to the supervisor of the Wyoming Oil and Gas Conservation Commission but not to the public.	Wyoming website*	Both before and after fracking.

Source: updated from a table created by ProPublica in June 2011:

<http://www.propublica.org/article/critics-find-gaps-in-state-laws-to-disclose-hydrifrac-chemicals>

*CAS numbers are the unique codes that the Chemical Abstracts Service assigns to individual chemical compounds.

**FracFocus.org was set up by regulators and the industry for voluntary disclosure of fracking compounds.

***The Occupational Safety and Health Administration requires Material Safety Data Sheets for chemicals considered hazardous to worker safety.

*The agency did not respond to requests for information.

El Financiero's News Source

... ..

Some Pavillion residents rue being caught in the controversy over hydraulic fracturing

Story by **ROBERT FROST**
Illustration by **JOHN ROSS**

1. **General Information:**

2. **Project Details:**

3. **Timeline:**

4. **Budget:**

5. **Risks:**

6. **Conclusion:**

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great for him in his old age and health
and a fine old man.

ST. LOUIS (UPI) — The power of water has helped cut income at the town's millinery, now almost gone, and the town's millinery is now almost gone.

Franklin, who worked in the Los Angeles "Times Green room" and the late Los Angeles Times, said that the FBI "has a very different picture of the newspaper that's out there, from the inside in Washington and New York."

[illegible]

The time for turning the tide is now, according to many, and it may be that time that people have waited for the better of a decade after several incidents, including a natural gas flare outside the town, and a natural gas flare that killed several people.

The club is now made up of members from many parts of the county and many districts. The members are very active in their own districts, and the club is a very active organization.

1. The first step in the process is to identify the problem or issue that needs to be addressed. This involves gathering information and understanding the context of the problem.

1. The following information is being furnished to you for your information only. It is not to be used for any other purpose.

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED

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The money in this federal fund was awarded the Medal for Merit for the author of the book and the value and potential change of the all over national and industrial production of goods in the country in the past.

operation was finding in which water, mud and chemicals are pumped under pressure to break open fractures in the rock and force oil to the surface.

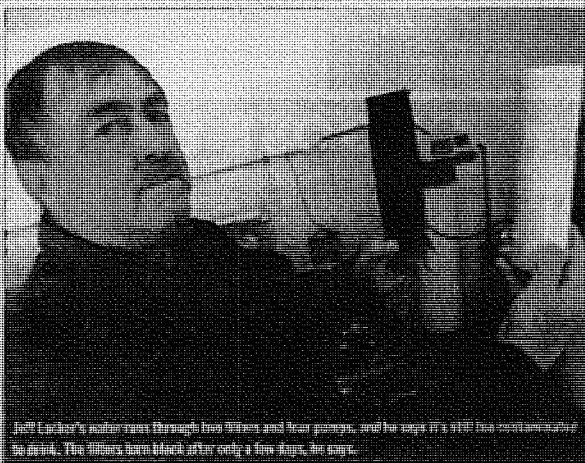
The machine worked a timing device in
various parts of the U.S. as described above.
The results were reported to several South
American countries.

The two companies are in building and the building boom created many careers during the 1960s and 1970s and many have moved into the private and the construction is expected to continue.

The reliability of the evidence has suffered due to the damage done to it. It is the history, the lack of evidence given, that is the problem. It is those elements that are the problem, the lack of evidence, that is the problem.

[illegible]

THE UNIVERSITY OF CHICAGO



Jeff Zucker's motherhood through two wives and two parents, and he says it's still his relationship to alcohol. The Times says that after only a few days, he says:

*Responses by Ms. Kathleen Sgamma, Vice President,
Government & Public Affairs, Western Energy Alliance*

***“Fractured Science: Examining EPA’s Approach to Ground
Water Research: The Pavillion Analysis”***

**Response to Questions:
Kathleen Sgamma
Vice President of Government & Public Affairs
Western Energy Alliance**

March 6, 2012

1. The Wyoming Oil and Gas Conservation Commission (WOGCC) has been regulating well construction, casing, and cementing since 1951. These are the important components of developing oil and natural gas that ensures that drilling and completion, including hydraulic fracturing (HF), are safe. With proper well construction and integrity, there is no pathway for drilling and completions fluids or hydrocarbons to migrate from the wellbore to underground sources of water. In addition to an exemplary safety record for decades, Wyoming was the first state in the nation to institute rigorous HF fluid disclosure rules in 2010.

The Ground Water Protection Council, an organization of state groundwater and environmental protection agencies whose mission is to promote the protection and conservation of ground water resources, analyzed state regulatory practices and issued a report in May 2009 that finds that HF “is managed best at the state level where regional and local conditions are understood.”¹

GWPC finds that “Based on over sixty years of practical application and a lack of evidence to the contrary, there is nothing to indicate that when coupled with appropriate well construction, the practice of hydraulic fracturing in deep formations endangers ground water.”

GWPC is joined in its mission of ensuring states properly regulate HF by the Interstate Oil and Gas Compact Commission (IOGCC), also a body of state regulators, in this case the state oil and gas divisions including WOGCC. IOGCC’s STRONGER (State Review of Oil & Natural Gas Environmental Regulations) program conducts reviews of states’ environmental regulations to help them identify areas for improvement. IOGCC also provides model regulations and other support to state regulators to ensure their regulations are protective of the environment. This network of support by and for state regulators, combined with the decades of experience states have regulating well construction and HF, demonstrate that the state level, not the federal, is the correct level to regulate oil and gas operations.

2a. I believe that the public has many valid concerns about energy development. Oil and gas development causes temporary disruption to local communities, as heavy equipment such as drilling rigs, HF tanks and pump engines are moved in for a short time. Increased traffic, noise and odors can be a nuisance during the short development phase. These disruptions must be balanced with the job creation and economic growth that accompanies the development.

¹ *State Oil and Gas Regulations Designed to Protect Water Resources*, Ground Water Protection Council, U.S. Department of Energy, and DOE National Energy Technology Laboratory (NETL), May 2009.

Communities have a right to be concerned that industrial activities like oil and natural gas development are properly regulated and protective of public health. State regulators work hard to ensure that public health and the environment are protected, yet are often unfairly maligned by environmental groups or second guessed by the EPA.

On the other hand, unfounded concerns are raised by environmental groups with an agenda of stopping any oil and natural gas development, and in many cases, any development at all. There has been a concerted effort by groups to scare local communities about the impacts of development as a means of shutting down development. Misinformation propagated by these groups has caused local communities and citizens to fear a process that is safe given the safeguards, procedures, and monitoring that are required and implemented by industry. This fear leads to development roadblocks that can deprive local and state economies of tens of thousands of jobs and billions of dollars in economic activity. Since wealth is the key to public and personal health, safety and the environment, these roadblocks are counterproductive to the very local communities that seek to protect their environment.

Wild claims about cases of contamination are made on a regular basis, and the media continue to perpetuate information that has been proven time and again to be false. Despite scientific information published by GWPC, IOGCC, EPA (see the 2004 HF study), and state regulators, the media and environmental groups focus on anecdote and blatantly false information, no matter how often that misinformation has been discredited. I think that is a the significant factor in exaggerated public concerns – not industry secrecy.

Ironically, the filmmaker of *Gasland*, who chose to interrupt the committee hearing, turn it into a publicity stunt, and obfuscate by hiring someone to impersonate an ABC News crew, has been very successful at propagating false information about oil and natural gas. The lies in his film have been so blatant that Colorado, Texas and Pennsylvania regulators have felt compelled to issue statements pointing out the blatant false information in *Gasland*. It's unfortunate that the Ranking Member felt compelled to hold up the hearing to give further publicity to a propagandist.

Despite the disclosure of chemicals used in HF in Material Safety Data Sheets, local communities have called for easier access to information on HF fluids. Industry has addressed that concern by voluntarily disclosing via FracFocus.org. Industry has also worked with state regulators in Colorado, Wyoming, Montana, New Mexico, Texas and other states to develop disclosure regulations that protect intellectual property rights while providing emergency responders and the public with more information. In addition, industry practices are well regulated and disclosed to the public.

2b. Dr. Goldstein's unsubstantiated claims about people getting cancer, autism or leukemia from oil and gas wells are very surprising, since normally scientists do not make unsubstantiated, broad claims without data.

Dr. Goldstein has already determined that there will be health effects without citing any data. His comments both at the hearing and in other public forums are needlessly scaring local populations, and display his inexperience with how oil and gas regulatory processes protect local populations.

Carcinogenic chemicals are used in industrial and household activities on a daily basis. If handled properly and not ingested or inhaled, the carcinogens found in household products do not lead to cancer. The same holds true for chemicals used in industrial applications. Manufacturing facilities that handle chemicals follow strict procedures to ensure that workers and the general population are not

exposed. If there is no route of exposure of a substance to the general population, it will not result in cancer, no matter how potentially carcinogenic a substance may be in a high enough dosage.

In order for populations to experience a health impact from oil and gas development, there would have to be a pathway of exposure from any harmful substances to the local population. Well integrity is the main component to ensure that any substances used in drilling or HF cannot communicate with aquifers. State regulations in all producing states are designed to ensure that wells are properly constructed so that fluids and hydrocarbons are properly contained. Once fluids are returned to the surface, operators must properly dispose of them in accordance with the Clean Water Act and the Safe Drinking Water Act.

The best sources of data on the health effects of oil and gas development are long-term health studies of oil and gas workers, since they are much more likely to be in direct contact with any substances than the general population. An extensive review of oil and gas related studies in the National Institute for Occupational Safety and Health (NIOSH) Health Hazard Evaluation database found few chronic illnesses.² The most comprehensive, long-term study of workers showed no evidence of increasing cancer incidence or mortality. I have included the details as an attachment.

Dr. Goldberg's insinuation about autism is especially inflammatory, given the current lack of understanding of the causes of autism. The National Institute of Neurological Disorders and Stroke, states that "Scientists aren't certain about what causes ASD, but it's likely that both genetics and environment play a role. Researchers have identified a number of genes associated with the disorder. Studies of people with ASD have found irregularities in several regions of the brain. Other studies suggest that people with ASD have abnormal levels of serotonin or other neurotransmitters in the brain. These abnormalities suggest that ASD could result from the disruption of normal brain development early in fetal development caused by defects in genes that control brain growth and that regulate how brain cells communicate with each other, possibly due to the influence of environmental factors on gene function. While these findings are intriguing, they are preliminary and require further study."

Suggesting that oil and gas activity will cause abnormal rates of autism in communities is irresponsible and is not a credible statement.

In addition, I would suggest that the committee obtain further information from Dr. Goldberg to put the chart he displayed during the hearing of violations per well into perspective. The data showed zero to approximately 2.7 violations on average. However, the chart gave no perspective on the types of violations. Companies must comply with hundreds of detailed regulations on a well site, and small, technical violations that arise from missing or incorrectly filled out paperwork are not the same as serious violations that could result in a safety or environmental infraction. Without information on the nature of the violations, the data are not very meaningful.

² *Literature Review of Oil Industry Worker Exposure*, Quality Environmental Professional Associates, April 2008.

*Responses by Dr. Bernard Goldstein, Professor and Dean Emeritus,
Graduate School of Public Health, University of Pittsburgh*

RESPONSE TO FOLLOW-UP QUESTIONS

Bernard D. Goldstein, MD
University of Pittsburgh
Graduate School of Public Health
bdgold@pitt.edu

Energy and Environment Subcommittee
Committee on Science, Space and Technology

Hearing of February 1, 2012

In response to the questions of the Honorable Andy Harris

- 1; In your testimony, you discussed the failure of advisory committees on natural gas issues to include members with a health background. In light of EPA's decision to not request nominations for environmental health practitioners as part of the peer review process for the Pavillion analysis, do you think this peer review process will improve understanding of exposure pathways for humans?

Response: The three advisory committees that my colleagues and I commented on were broadly aimed at the potential impacts of unconventional natural gas drilling. In each case the executive orders establishing these advisory committees stated their concern about health. But, no one with any human health expertise, even broadly defined, is among the 52 committee members. (See <http://ehp03.niehs.nih.gov/article/info:doi/10.1289/ehp.1104S94>)

In contrast, the review of the Pavilion study is solely focused on how a specific study was designed, carried out, and interpreted. As it was not directly a study of human health, nor does the study report specifically discuss human health implications, an expert in human health is not needed for the study peer review.

2. The only time you mentioned Pavillion in your written testimony is when you stated that "Understanding exposure pathways for humans is important, but it is not accomplished by looking at just one potential pathway of exposure, such as is being evaluated in the Pavillion study." Can you expand on these limitations?

Response: There are many potential pathways for groundwater contamination by fracking fluid, including the delivery of the fracking agents to the site, storage on the site, failure of the well casing at a relatively shallow level underground, and mishandling of the flowback fluids and produce water. As I

state in my written testimony, "... a focus that is solely on the issue presented by the Pavillion study seems like a subterfuge..."

Further, as emphasized in my testimony, the toxicity of fracking mixtures is not being adequately addressed. We are storing up an intentional burden of ignorance that will in the long run significantly detract from the positive aspects for our nation of unconventional gas drilling.

In response to the questions of the Honorable Brad Miller

1. Dr. Goldstein, you said during the hearing a few times that the EPA draft Pavillion study was "appropriately hedged." And the study was "appropriately hedged" because the EPA did not have baseline studies.
 - Whose responsibility should it be to conduct baseline studies? How would baseline studies help the Pavillion residences? Should baseline studies of potentially impacted areas be standard practice of the oil and gas industry?

Response: Baseline studies should be carried out by industry of drinking and recreational water sources that could be contaminated by any aspect of unconventional natural gas drilling. The key question is whether the burden of proof should be on the homeowner or other user of a contaminated water source to demonstrate that water contamination was caused by industry; or on industry to demonstrate that groundwater contamination did not come from its activities. The costs of providing independent baseline measurements are trivial compared either to the profits involved – or compared to industry's costs in defending against the inevitable litigation.

- Also, please comment on whether it is common for scientific studies to "hedge" like EPA did in this study?

Response: Yes, it is appropriate for the interpretation of any study to be "hedged" based upon the strength of the data and the possibility for confounding. As I stated at the Hearing, this study was begun in response to public concern at a specific location. The nature of such field studies is that there always will be some potential for confounding that must be considered. EPA appears to have appropriately taken possible confounders, such as other sources of the contamination, into account both in its carrying out and in its interpretation of the study.

2. Dr. Goldstein, one of the complaints of the industry about the Pavillion study is that EPA should not have included conclusions in the study before it was independently peer reviewed. What do you think about that suggestion? How would this change the scientific integrity of the study?

Response: I do not understand why there is a complaint about EPA including its conclusion in the draft report before peer review. A routine part of the peer review process is for the reviewer to comment on whether the conclusions are justified by the data. Obviously, it is impossible to do so if the peer reviewer does not have access to the conclusions. So I see no grounds for such a complaint.

Appendix II:

ADDITIONAL MATERIAL FOR THE RECORD

SUBMITTED REPORT FOR THE RECORD BY RANKING MEMBER BRAD MILLER

Ranking Member Miller would like to submit for the record the conclusions of the EPA draft "Investigation of Ground Water Contamination near Pavillion, Wyoming." The full report may be found using the following reference and website.

U.S. Environmental Protection Agency, Office of Research and Development and National Risk Management Research Laboratory, "Investigation of Ground Water Contamination near Pavillion, Wyoming," Draft. EPA 600/R-00/000, December 2011.

Pavillion, Region 8, US EPA. <http://www.epa.gov/region8/superfund/wy/pavillion/index.html>. [accessed on February 9, 2012.]

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4.0 Conclusions

The objective of this investigation was to determine the presence of ground water contamination in the Wind River Formation above the Pavillion gas field and to the extent possible, identify the source of contamination. The combined use of shallow and deep monitoring wells allowed differentiation between shallow sources of contamination (pits) and deep sources of contamination (production wells).

Additional investigation is necessary to determine the areal and vertical extent of shallow and deep ground water contamination.

Detection of high concentrations of benzene, xylenes, gasoline range organics, diesel range organics, and total purgeable hydrocarbons in ground water samples from shallow monitoring wells near pits indicates that pits are a source of shallow ground water contamination in the area of investigation. Pits were used for disposal of drilling cuttings, flowback, and produced water. There are at least 33 pits in the area of investigation. When considered separately, pits represent potential source terms for localized ground water plumes of unknown extent. When considered as whole they represent potential broader contamination of shallow ground water. A number of stock and domestic wells in the area of investigation are fairly shallow (e.g., < 30 m) representing potential receptor pathways. EPA is a member of a stakeholder group working with the operator to determine the areal and vertical extent of shallow ground water contamination caused by these pits. The operator of the site is currently engaged in investigating and remediating several pit areas.

Detection of contaminants in ground water from deep sources of contamination (production wells, hydraulic fracturing) was considerably more complex than detection of contaminants from pits necessitating a multiple lines of reasoning approach common to

complex scientific investigations. In this approach, individual data sets and observations are integrated to formulate an explanation consistent with each data set and observation. While each individual data set or observation represents an important line of reasoning, taken as a whole, consistent data sets and observations provide compelling evidence to support an explanation of data. Using this approach, the explanation best fitting the data for the deep monitoring wells is that constituents associated with hydraulic fracturing have been released into the Wind River drinking water aquifer at depths above the current production zone.

Lines of reasoning to support this explanation consist of the following.

1. High pH values

pH values in MW01 and MW02 are highly alkaline (11.2-12.0), above the pH range observed in domestic wells (6.9-10), and above the pH range previously reported for the Wind River Formation with up to 94% of the total alkalinity contributed by hydroxide. The presence of hydroxide alkalinity suggests addition of base as the causative factor for elevated pH in the deep monitoring wells. Reaction path modeling indicates that sodium-sulfate composition ground water typical of deeper portions of the Wind River Formation provides little resistance to elevation of pH with small addition of potassium hydroxide.

With the exception of soda ash, the pH of drilling additives in concentrated aqueous solution was well below that observed in the deep monitoring wells. Dense soda ash was added to the drilling mud which varied between pH 8 - 9.

The possibility of cement/grout intrusion into the screened intervals was considered as a possibility for elevated pH in both monitoring

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wells. However, cement intrusion typically leads to pH values between 10 and 11 – below that observed in deep monitoring wells. Prolonged purging did not show decreasing pH trends. Water chemistry results indicate that ground water from the wells was highly undersaturated with respect to cement phases (e.g., portlandite).

Material Safety Data Sheets indicate that potassium hydroxide was used in a crosslinker (<5%) and in a solvent.

2. Elevated potassium and chloride

The inorganic geochemistry of ground water from the deep monitoring wells is distinctive from that in the domestic wells and expected composition in the Wind River formation. Potassium concentration in MW02 (43.6 mg/L) and MW01 (54.9 mg/L) is between 14.5 and 18.3 times the mean value of levels observed in domestic wells (3 mg/L, 99% of values < 10 mg/L). Chloride enrichment in monitoring well MW02 (456 mg/L) is 18 times the mean chloride concentration (25.6 mg/L) observed in ground water from domestic wells. Chloride concentration in this well is significant because regional anion trends show decreasing chloride concentrations with depth. In addition, the monitoring wells show low calcium, sodium, and sulfate concentrations compared to the general trend observed in domestic well waters.

Potassium levels in concentrated solutions of drilling additives were all less than 2 mg/L. One additive (Aqua Clear used during well development) contained 230 mg/L chloride in a concentrated solution. Information from well completion reports and Material Safety Data Sheets indicate that the formulation of fracture fluid provided for foam jobs typically consisted of 6% potassium chloride.

Potassium metaborate was used in crosslinkers (5-10%, 30-60%). Potassium hydroxide was used in a crosslinker (<5%) and in a solvent. Ammonium chloride was used in crosslinker (1-27%).

Alternative explanations for inorganic geochemical anomalies observed in deep monitoring wells have been provided and considered. These alternate explanations include contamination from drilling fluids and additives, well completion materials, and surface soil, with contamination from all these sources exacerbated by poor well development. Contamination by drilling fluids and additives is inconsistent with analysis of concentrated solutions of bentonite and additives. Well construction materials (screen and sections of casing) consisted of stainless steel and were power-washed on site with detergent-free water prior to use. Sections of tremie pipe used to inject cement above screened intervals were also power washed with detergent-free water prior to use. Stainless-steel screens and sections of casing and tremie pipe remained above ground level (did not touch soil) prior to use. Both deep monitoring wells were purposefully located away from the immediate vicinity of gas production wells, known locations of pits, and areas of domestic waste disposal (abandoned machinery) to minimize the potential of surface soil contamination. Conductor pipe installed over the first 30.5 m (100 ft) of drilling at both deep monitoring wells eliminated the possibility of surface soil entry into the borehole. Turbidity measurements in MW01 during sampling ranged from 7.5 and 7.9 Nephelometric Turbidity Units (NTUs). Turbidity measurements in MW02 during sampling ranged from 24.0 to 28.0 NTUs, slightly above the stated goal of 10.0 NTUs but nevertheless was clear water typical of domestic wells during sampling. A low

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recharge rate in MW02 necessitated a prolonged period of well development which was likely due in part to gas flow (reduced relative permeability to water) into the well during development.

3. Detection of synthetic organic compounds

Isopropanol was detected in MW01 and MW02 at 212 and 581 µg/L, respectively. Diethylene glycol was detected in MW01 and MW02 at 226 and 1570 µg/L, respectively. Triethylene glycol was detected in MW01 and MW02 at 46 and 310 µg/L, respectively. Another synthetic compound, *tert*-butyl alcohol, was detected in MW02 at a concentration of 4470 µg/L. *Tert*-butyl alcohol is a known breakdown product of methyl *tert*-butyl ether (a fuel additive) and *tert*-butyl hydroperoxide (a gel breaker used in hydraulic fracturing). EPA methods were utilized for analysis when applicable for compounds or classes of compounds. Detection of synthetic organic compounds in MW01 and MW02 was made in part through the use of non-commercially available modified EPA analytical methods. For instance, high performance liquid chromatography/mass spectrometry/mass spectrometry was utilized for analysis of diethylene, triethylene and tetraethylene glycols. Ethylene glycol, which was widely used for well stimulation, required additional method modification and was not analyzed during this investigation.

Isopropanol was detected in concentrated solutions of drilling additives at a maximum concentration of 87 µg/L, well below that detected in deep monitoring wells. Glycols were not detected in concentrated solutions of drilling additives.

Material Safety Data Sheets indicate that isopropanol was used in a biocide (20-40%), in

a surfactant (30-60%), in breakers (<1%, 10-30%), and in foaming agents (<3%, 1-5%, 10-30%). Diethylene glycol was used in a foaming agent (5-10%) and in a solvent (0.1-5%). Triethylene glycol was used in a solvent (95-100%). Material Safety Data Sheets do not indicate that *tert*-butyl hydroperoxide was used in the Pavillion gas field. The source of this compound remains unresolved. However, *tert*-butyl alcohol is not expected to occur naturally in ground water. Material Safety Data Sheets do not contain proprietary information and the chemical ingredients of many additives.

Alternative explanations provided to date and considered by EPA for detection of synthetic organic compounds in deep monitoring wells include arguments previously listed and addressed.

4. Detection of petroleum hydrocarbons

Benzene, toluene, ethylbenzene, and xylenes (BTEX) were detected in MW02 at concentrations of 246, 617, 67, and 750 µg/L respectively. Trimethylbenzenes were detected in MW02 at 105 µg/L. Gasoline range organics were detected in MW01 and MW02 at 592 and 3710 µg/L, respectively. Diesel range organics were detected in MW01 and MW02 at 924 and 4050 µg/L respectively. Naphthalene was detected in MW02 at 6 µg/L. EPA methods were utilized for analysis.

BTEX and trimethylbenzenes were not detected in concentrated solutions of drilling additives.

Material Safety Data Sheets indicate that aromatic solvent (typically BTEX mixture) was used in a breaker (<75%). Diesel oil (mixture of saturated and aromatic hydrocarbons including naphthalenes and alkylbenzenes) was used in a guar polymer slurry/liquid gel

DRAFT

concentrate (30-60%) and in a solvent (60-100%). Petroleum raffinates (a mixture of paraffinic, cycloparaffinic, olefinic, and aromatic hydrocarbons) were used in a breaker (<30-60%). Heavy aromatic petroleum naphtha (mixture of paraffinic, cycloparaffinic and aromatic hydrocarbons) was used in surfactants (5-10%, 10-30%, 30-60%) and in a solvent (10-50%). Toluene was used in a flow enhancer (3-7%). Xylenes were used in a flow enhancer (40-70%) and a breaker (confidential percentage). Gasoline range organics correspond to a hydrocarbon range of C6 – C10. It includes a variety of organic compounds ketones, ethers, mineral spirits, stoddard solvents, and naphthas. Detection of gasoline range organics does not infer the use of gasoline for hydraulic fracturing.

Alternative explanations provided to date and considered by EPA for detection of petroleum compounds in deep monitoring wells include arguments previously listed and addressed. An additional alternate explanation for detection of petroleum compounds includes use of lubricants on the drillstem and well casing, use of electrical tape on submersible pumps, and components of submersible pumps. Jet Lube Well Guard hydrocarbon free lubricant specifically designed for monitoring well installation was used for drillstem connections. No lubricants were used to attach sections of casing or sections of tremie pipe during cementation. Clamps, not electrical tape, were used to bind electrical wires for submersible pumps. Water collected for samples during recharge at MW01 and MW02 would have a short contact time with components of submersible pumps. For components of submersible pumps to be a causative factor of high concentrations of petroleum hydrocarbons observed in MW01 and MW02, components of submersible

pumps would have to contain high levels of water extractable petroleum compounds and consist of a matrix allowing rapid mass transfer, neither of which is plausible.

Another alternate explanation is that detection of petroleum hydrocarbons in ground water is expected above a natural gas field. Gas from Fort Union and Wind River Formations is dry and unlikely to yield liquid condensates at ground water pressure and temperature conditions. In addition, a condensate origin for petroleum hydrocarbons in ground water is doubtful because dissolved hydrocarbon gas compositions and concentrations are similar between the two deep monitoring wells and therefore would yield similar liquid condensates, yet the compositions and concentrations of organic compounds detected in these wells are quite different.

5. Breakdown products of organic compounds

Detections of organic chemicals were more numerous and exhibited higher concentrations in the deeper of the two monitoring wells. Natural breakdown products of organic contaminants like BTEX and glycols include acetate and benzoic acid. These breakdown products are more enriched in the shallower of the two monitoring wells, suggesting upward/lateral migration with natural degradation and accumulation of daughter products.

Hydraulic gradients are currently undefined in the area of investigation. However, there are flowing stock wells (e.g., PGDW44 - one of the deepest domestic wells in the area of investigation at 229 m below ground surface) suggesting that upward gradients exist in the area of investigation. In the Agency's report on evaluation of impacts to USDWs by hydraulic fracturing of coalbed methane

DRAFT

reservoirs (EPA, 2004), hypothetical conceptual models were presented on contaminant migration in a USDW during injection of fracturing fluids into a USDW. In these conceptual models, highly concentrated contaminant plumes exist within the zone of injection with dispersed lower concentration areas vertically and laterally distant from injection points. Data from deep monitoring wells suggests that this conceptual model may be appropriate at this site.

6. Sporadic bonding outside production casing directly above intervals of hydraulic fracturing

It is possible that wellbore design and integrity issues were one causative factor in deep ground water contamination at this site (surface casing of production wells not extending below deepest domestic wells, little vertical separation between fractured zones and domestic wells, no cement or sporadic bonding outside production casing).

A review of well completion reports and cement bond/variable density logs in the area around MW01 and MW02 indicates instances of sporadic bonding outside production casing directly above intervals of hydraulic fracturing. For instance, at Pavillion Fee 34-03B, a cement bond/variable density log conducted on 10/22/2004 indicated no cement until 838 m (2750 ft) and sporadic bonding to 1036 m (3400 ft) below ground surface. The well completion report for this production well indicates that hydraulic fracturing was performed at 1039 m (3409 ft) below ground surface on 11/9/2004 prior to cement squeeze jobs at 823 m (2700 ft) and 256 m (840 ft) below ground surface in April 2005. At Tribal Pavillion 41-10 a cement bond/variable density log indicates sporadic bonding directly above the interval of hydraulic fracturing at 493 m (1618 ft) below ground surface. A cement bond/variable density log conducted

on Tribal Pavillion 24-02 after a squeeze job at the base of the surface casing indicates sporadic bonding outside production casing below surface casing to the interval of hydraulic fracturing at 469 m (1538 ft) below ground surface. At Tribal Pavillion 11-11B, a cement bond/variable density log indicates sporadic bonding between 305 to 503 m (1000 to 1650 ft) below ground surface with hydraulic fracturing occurring at 463 m (1516 ft) below ground surface.

7. Hydraulic fracturing into thin discontinuous sandstone units

There is little lateral and vertical continuity to hydraulically fractured tight sandstones and no lithologic barrier (laterally continuous shale units) to stop upward vertical migration of aqueous constituents of hydraulic fracturing in the event of excursion from fractures. Sandstone units are of variable grain size and permeability indicating a potentially tortuous path for upward migration.

In the event of excursion from sandstone units, vertical migration of fluids could also occur via nearby wellbores. For instance, at Pavillion Fee 34-03R, the cement bond/variable density log indicates no cement until 671 m (2200 ft) below ground surface. Hydraulic fracturing occurred above this depth at nearby production wells.

Although some natural migration of gas would be expected above a gas field such as Pavillion, data suggest that enhanced migration of gas has occurred to ground water at depths used for domestic water supply and to domestic wells. Lines of reasoning to support this explanation consist of following.

1. Hydrocarbon and isotopic composition of gas

The similarity of $\delta^{13}\text{C}$ values for methane, ethane, propane, isobutane, and butane

DRAFT

between gas production and monitoring wells and plots of $\delta^{13}\text{C}-\text{CH}_4$ versus $\delta\text{D}-\text{CH}_4$ and $\delta^{13}\text{C}-\text{CH}_4$ versus methane/(ethane + propane) indicate that light hydrocarbons in casing and dissolved gas in deep monitoring wells are similar to produced gas and have undergone little oxidation or biodegradation indicative of advective transport. The absence of ethane and propane in three of four domestic wells having sufficient methane to allow isotopic analysis and a shift of $\delta^{13}\text{C}-\text{CH}_4$ and $\delta\text{D}-\text{CH}_4$ values in a positive direction relative to produced gas suggests the presence of gas of thermogenic origin in domestic wells undergoing biodegradation. This observation is consistent with a pattern of dispersion and degradation with upward migration observed for organic compounds.

2. Elevation of dissolved methane concentrations in proximity to production wells

Levels of dissolved methane in domestic wells generally increase in those wells in proximity to gas production wells. With the exception of 2 domestic wells where methane was detected at less than 22 $\mu\text{g}/\text{L}$, methane was not detected in domestic wells with 2 or less production wells within 600 m.

3. Spatial anomaly near PGDW05

Methane concentrations in ground water appear highest in the area encompassing MW01, PGDW30, and PGDW05. Ground water is saturated with methane at MW01 which is screened at a depth (239 m bgs) typical of deeper domestic wells in the area. Methane was detected in PGDW30 at 808 $\mu\text{g}/\text{L}$ at a depth of only 80 m, the highest level in any domestic well. A blowout occurred during drilling at a depth of only 159 m bgs in December 2005 adjacent to PGDW05.

An alternative explanation of high methane concentrations in this area is that it is close to the top of the dome comprising the Pavillion gas field which may facilitate natural gas migration toward the surface. However, this geologic feature would also facilitate enhanced gas migration. Also, a mud-gas log conducted on 11/16/1980 (prior to intensive gas production well installation) at Tribal Pavillion 14-2 located only 300 m from the location of the uncontrolled release does not indicate a gas show (distinctive peaks on a gas chromatograph) within 300 m of the surface.

4. Shallow surface casing and lack of cement or sporadic bonding outside production casing

With the exception of two production wells, surface casing of gas production wells do not extend below the maximum depth of domestic wells in the area of investigation. Shallow surface casing combined with lack of cement or sporadic bonding of cement outside production casing would facilitate migration of gas toward domestic wells.

The discussion on migration of fluids associated with hydraulic fracturing is relevant for gas migration and is not repeated here for brevity. Of particular concern are wellbores having no or little cement over large vertical instances. For instance, at Pavillion Fee 34-03R, the cement bond/variable density log indicates no cement until 671 m (2200 ft) below ground surface. At Pavillion Fee 34-03B, a cement bond/variable density log conducted on 10/22/2004 indicated no cement until 838 m (2750 ft) below ground surface. Migration of gas via wellbores having no cement or poor cement bonding outside production casing is well documented in the literature.

An alternative explanation of wellbore gas migration provided to EPA and considered is that domestic wells are poorly sealed and thus

DRAFT

constitute a potential gas migration pathway. However, lack of cement and sporadic bonding outside casing in production constitutes a major potential gas migration pathway to the depth of deep monitoring and domestic wells. It is possible that domestic wells could subsequently facilitate gas migration toward the surface.

5. Citizens' complaints

Finally, citizens' complaints of taste and odor problems concurrent or after hydraulic fracturing are internally consistent. Citizens' complaints often serve as the first indication of subsurface contamination and cannot be dismissed without further detailed evaluation, particularly in the absence of routine ground water monitoring prior to and during gas production.

An alternate explanation provided and considered by EPA is that other residents in the Pavillion area have always had gas in their wells. Unfortunately, no baseline data exists to verify past levels of gas flux to the surface or domestic wells.

A lines of reasoning approach utilized at this site best supports an explanation that inorganic and organic constituents associated with hydraulic fracturing have contaminated ground water at and below the depth used for domestic water supply. However, further investigation would be needed to determine if organic compounds associated with hydraulic fracturing have migrated to domestic wells in the area of investigation. A lines of evidence approach also indicates that gas production activities have likely enhanced gas migration at and below depths used for domestic water supply and to domestic wells in the area of investigation.

Hydraulic fracturing in the Pavillion gas field occurred into zones of producible gas located within an Underground Source of Drinking Water (USDW).

Hydraulic fracturing for coal-bed methane recovery is often shallow and occurs directly into USDWs (EPA 2004). TDS less than 10,000 mg/L in produced water is common throughout the Rocky Mountain portion of the United States (USGS 2011; Dahm et al. 2011). Ground water contamination with constituents such as those found at Pavillion is typically infeasible or too expensive to remediate or restore (GAO 1989). Collection of baseline data prior to hydraulic fracturing is necessary to reduce investigative costs and to verify or refute impacts to ground water.

Finally, this investigation supports recommendations made by the U.S. Department of Energy Panel (DOE 2011a, b) on the need for collection of baseline data, greater transparency on chemical composition of hydraulic fracturing fluids, and greater emphasis on well construction and integrity requirements and testing. As stated by the panel, implementation of these recommendations would decrease the likelihood of impact to ground water and increase public confidence in the technology.

SUBMITTED LETTER FOR THE RECORD BY PAVILLION AREA CONCERNED CITIZENS,
THE POWDER RIVER BASIN RESOURCE COUNCIL,
AND THE WESTERN ORGANIZATION OF RESOURCE COUNCILS

The Honorable Brad Miller, Ranking Member
Energy and Environment Subcommittee
House Science, Space, and Technology Committee
United States House of Representatives
Washington, DC 20515

Sent by email

February 13, 2012

Dear Congressman Miller,

On behalf of Pavillion Area Concerned Citizens (PACC) thank you for your efforts in bringing the contamination issues in the Pavillion area of Wyoming to the Energy and Environment Subcommittee of the House Science, Space, and Technology Committee. We appreciate your help to make sure the information about Pavillion is thoroughly reviewed and that concerns from impacted residents are entered into the record. As you know, our members asked to be put on record as fully supporting the EPA Pavillion groundwater contamination investigation and draft report of contamination in the Pavillion area.

Governor Mead has charged the Wyoming Water Development Commission with investigating options for household water replacement in the impacted Pavillion area. Although replacement for our contaminated household water is important, we are still troubled that the state continues to protect Industry. Rather than holding the responsible parties accountable for the contamination they've caused in the Pavillion area, the state is asking impacted residents and the public to pay for replacement water systems. We feel it is of the utmost importance that the polluters, rather than the impacted public, pay for the damage they have caused. It is extremely important that the EPA continue their investigation to fully determine the extent of contamination in our community. We need to understand the source of contamination and we need resolution for not only our household water contamination, but also our stock water contamination, our compromised air quality, diminished property and most importantly the serious health impacts we now have. Why should impacted residents and other citizens pay for the contamination impacts, remediation or water replacement systems?

We want to thank you for bringing our position to the discussion during the February 1, 2012 hearing, and have the following questions about some of the testimony.

As was discussed during the February 1 hearing, Louis and Donna Meeks drilled a water well that blew out from natural gas after it was drilled to 540 feet. Even though the WOGCC has played an instrumental part in the Pavillion area investigation, Mr. Doll seems to be uninformed about the circumstances of the Meeks' water well blowout.

In regards to the Meeks' water well depth, Mr. Doll testified, "I believe that was in that nine hundred to a thousand foot range." In an April 7, 2008 Wyoming State Engineer letter (enclosed), the WOGCC opinion of what happened to the Meeks' water well is as follows.

“The Wyoming Oil and Gas conservation Commission’s opinion of what caused the problems in the first Meeks #2 well was that the “blowout” was the result of the water well driller drilling to 540 feet, finding a good sand, and blowing the hole dry in an attempt to determine water deliverability. Because this is a gas bearing zone, the unloaded hole proceeded to produce gas.”

Mr. Doll was obviously confused about the depth of the water well and we wonder if his opinion of the gas bearing zone is the 540 feet zone stated above or the nine hundred to a thousand feet zone he testified to. We also wonder why the state continues to permit water wells into a “gas bearing zone”. Even on the Meeks’ property, Mr. Meeks has received a permit extension to drill a water well to seven hundred feet (enclosed). The extension makes recommendations to Mr. Meeks outlined in W.S. 41-3-931. Are these recommendations made to everyone applying for a water well permit? How is this permitting process protective of Wyoming citizens, private property and the mineral resource?

When asked about the PACC membership, Mr. Doll said he didn’t know who the members are or how long they’ve lived in the Pavillion area. When asked about PACC chair, John Fenton, Mr. Doll said he believed Fenton had moved to Pavillion after the gas wells were drilled. Mr. Doll is apparently as confused about the residents he claims to represent as he is about the contamination itself. PACC members are long time residents who have farmed and ranched in the Pavillion area for many years. They are not outsiders trying to push an agenda. They are residents who are trying to understand what they are contaminated with, how it is affecting them, who is responsible and how it will be remediated. The membership includes Jeff Locker, who has lived in Wyoming his entire life. He and Rhonda have been on their current farm for over 25 years. Donna and Louis Meeks have lived in Wyoming their entire lives and have been on their farm for 37 years. John Fenton has lived in Fremont County for over 37 years and in the Pavillion area for over 12. John’s wife Catherine has lived on the family place they now farm with her parents Marvin and Evelyn Griffin for 46 years. They moved to their farm before the gas wells were drilled. Shirley Knight was born and raised in Fremont County. She and her husband Harold Knight have lived in the Pavillion area for 35 years. Lucille and George Borushko have lived in the Pavillion area for 15 years. We invite Mr. Doll to tour the Pavillion area where we would be willing to better educate him about our community.

During the February 1 hearing, in subsequent meetings and through public comments, Wyoming’s state representatives continue to say they believe the contamination in the Pavillion area is not from oil and gas operations or fracking. They continue to protect the interests of the oil and gas industry rather than the citizens they say they represent. After years of refusing to investigate the contamination in the Pavillion area, they now attack the EPA investigation and say the state should be in charge. The state agencies have continually told the impacted residents that they do not have the funds or manpower to investigate contamination issues. Where did the Wyoming state agencies suddenly find funding, manpower and expertise to address the extremely complicated issues in the Pavillion area? Why aren’t they demanding the disclosure of all fluids used during drilling, fracking and production of the Pavillion/Muddy Ridge gas field? Finally, why doesn’t the state demand that all samples taken by industry and subsequent test results from the Pavillion area be provided to the state and the public?

After years of looking to the state for answers, we fear that the state of Wyoming's goal is to protect the oil and gas industry. We believe they will do so at the expense of the citizens they are charged to protect and represent, and if left in charge of this investigation, will never conduct an investigation that will determine the true extent and source of the contamination in the Pavillion area. These are among the reasons we support the EPA Pavillion groundwater contamination investigation, the draft report of contamination in the Pavillion area, and all future EPA investigations in the Pavillion area.

The following PACC members thank you on behalf of our organization.

Sincerely,

Eddie Bernice Johnson
Evelyn Luffin
Marvin Kniffin
Lynn C. Woolsey
Donna Meeks
Jeffy Locker
Theresa Luffin
Harold Knight
Shirley Knight
George Borushko
Lucille Borushko

Enclosures: Louis Meeks request for water well permit changes
 Correspondence from Wyoming State Engineer

Cc: Congressman Eddie Bernice Johnson,
 Congresswoman Lynn C. Woolsey
 Congressman Ben Ray Lujan
 Congressman Paul D. Tonko
 Congresswoman Zoe Lofgren
 Congressman Jerry McNerney



State Engineer's Office

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DAVE FREUDENTHAL
GOVERNOR

PATRICK TYRRELL
STATE ENGINEER

April 7, 2008

Louis Meeks
212 Powerline Road
Pavillion, Wyoming 82523

Re: Permit No. U.W. 170310 (Meeks #2 well)

Dear Mr. Meeks:

The State Engineer's Office received your March request to change the estimated depth of the proposed Meeks #2 well from 300 feet, as stated on the *Application for Permit to Appropriate Ground Water*, submitted October 17, 2005 and approved November 3, 2005, to 700 feet.

As you well know, from the problems experienced with drilling the Meeks #1 well, there appears to be shallow gas present in the area in which you wish to drill. The probability that you will encounter a similar gas situation in the deeper well is high. That being said, this agency is guided by the following Wyoming Statute:

W.S. 41-3-931. Application; when granted generally; denial subject to review; defects and corrections generally; cancellation. *An application for a permit for a well in any areas not designated as a critical area shall be granted as a matter of course, if the proposed use is beneficial and, if the state engineer finds that the proposed means of diversion and construction are adequate. If the state engineer finds that to grant the application as a matter of course, would not be in public's water interest, then he may deny the application subject to review at the next meeting of the state board of control. If the state engineer shall find that the proposed means of diversion or construction are inadequate, or if the application is otherwise defective, he may return the application for correction. If such correction is not made within ninety (90) days, the state engineer may cancel the application.*

The Wyoming Oil and Gas Conservation Commission's opinion of what caused the problems in the first Meeks #2 well was that the "blowout" was the result of the water well driller drilling to 540 feet, finding a good sand, and blowing the hole dry in an attempt to determine water deliverability. Because this is a gas bearing zone, the unloaded hole proceeded to produce gas.

When drilling into a gas bearing zone in the Pavillion Field is likely, the Wyoming Oil and Gas Conservation Commission recommends the following:

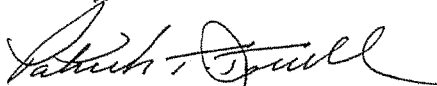
- All water wells deeper than approximately 200 feet should be cased and cemented from total depth to surface.
- Any water well drilled in the Pavillion Field should not be unloaded without first casing and cementing it.

Your request to drill a 700 foot deep water well at this location under Permit No. U.W. 170310 is hereby approved.

Should you wish to avoid the type of problems encountered while drilling the original Meeks #2 well, the State Engineer's Office would suggest that you adhere to the recommendations of the Wyoming Oil and Gas Conservation Commission concerning construction of water wells in this area and proceed with caution.

If you have any questions, please call me at (307) 777-6150.

Sincerely,



Patrick T. Tyrrell, State Engineer

Copies:

Lisa Lindemann, Administrator, Ground Water Division
Loren Smith, Superintendent, Water Division 3
Steve Furtney, Policy Advisor, Governor's Planning Office
Don Likwartz, Supervisor, Wyoming Oil and Gas Conservation Commission
John Corra, Director, Wyoming Department of Environmental Quality
Mark Thiesse, WDEQ West District Supervisor, Groundwater Section
Bureau of Land Management, Lander Field Office
Shoshoni Oil and Gas Commission

PERMIT STATUS U.W 170310

Priority Date OCTOBER 19, 2005

Approval Date NOVEMBER 3, 2005

SEP 29, 2006 - NOTICE OF EXPIRATION OF TIME FOR COMPLETION OF
CONSTRUCTION AND/OR COMPLETION OF BENEFICIAL USE MAILED.

SCANNED AUG 01 2007

October 6, 2006 - Request for extension of time for completion of construction and completion of beneficial use received and granted until December 31, 2007. Applicant notified of extension by letter NOV 17 2006.

11/14/2006
Date of Approval

Lisa Lindemann
Lisa Lindemann, Administrator
Ground Water Division SCANNED AUG 01 2007

SEP 23 '07

September 2, 2007 - Request for extension of time for completion of Construction and completion of Beneficial Use received and extended until December 31, 2009. Applicant notified of extension by letter on JAN 31 2008.

December 4, 2007
Date of Approval

Lisa Lindemann
Lisa Lindemann, Administrator
Ground Water Division

March 24, 2008 - Letter from applicant requesting to amend the total depth of the well from 300 feet to 700 feet was received and granted. See letter filed in Miscellaneous Notice under Permit No. U.W. 170310.

June 2, 2008
Date of Approval

Lisa Lindeman
Lisa Lindeman, Administrator
Ground Water Division



State Engineer's Office

HERSCHLER BUILDING, 4-E CHEYENNE, WYOMING 82002
(307) 777-7354 FAX (307) 777-5451
seoiaq@seo.wyo.gov

DAVE FREUDENTHAL
GOVERNOR

PATRICK TYRRELL
STATE ENGINEER

November 17, 2006

Louis A & Donna J Meeks
212 Powerline Road
Pavillion, Wy 82523

RE: Permit No. U.W. 170310
Meeks #2

Dear Appropriator:

Agreeable to your request of recent date, the time limit for Completion of Construction and Completion of Beneficial Use of Water has been extended until December 31, 2007.

Sincerely,

A handwritten signature in cursive script, reading "Lisa Lindemann".

Lisa Lindemann, Administrator
Ground Water Division

LL/dp



State Engineer's Office

HERSCHLER BUILDING, 4-E CHEYENNE, WYOMING 82002
(307) 777-7354 FAX (307) 777-5451
seoleda@seo.wyo.gov

DAVE FREUDENTHAL
GOVERNOR

PATRICK TYRRELL
STATE ENGINEER

January 31, 2008

Louis Meeks
212 Powerline Rd
Pavillion, WY 82523

RE: Permit No. U.W. 170310
Meeks #2

Dear Appropriator:

Agreeable to your request of recent date, the time limit for Completion of Construction and Completion of Beneficial Use of Water has been extended until December 31, 2009.

Sincerely,

A handwritten signature in cursive script, reading "Lisa Lindemann".

Lisa Lindemann, Administrator
Ground Water Division

LL/dm



State Engineer's Office

HERSCHLER BUILDING, 4-E CHEYENNE, WYOMING 82002
(307) 777-7354 FAX (307) 777-5451
seo@seo.wyo.gov

DAVE FREUDENTHAL
GOVERNOR

PATRICK TYRRELL
STATE ENGINEER

November 3, 2009

Louis A. Meeks
212 W Powerline Rd
Pavillion, WY 82523

RE: Permit No. U.W. 170310
Meeks #2

Dear Mr. Meeks:

Agreeable to your request of recent date, the time limit for Completion of Construction and Completion of Beneficial Use of Water has been extended until December 31, 2011.

Sincerely,

A handwritten signature in cursive script, reading "Lisa Lindemann".

Lisa Lindemann, Administrator
Ground Water Division

LL/dm

Surface Water

Ground Water

Board of Control



State Engineer's Office

HERSCHLER BUILDING, 4-E CHEYENNE, WYOMING 82002
(307) 777-7354 FAX (307) 777-5451
seoletg@seo.wyo.gov

DAVE FREUDENTHAL
GOVERNOR

PATRICK TYRRELL
STATE ENGINEER

June 4, 2008

Louis A. & Donna J. Meeks
212 Powerline Rd.
Pavillion, WY 82523


Re: Permit No. U.W. 170310
Meeks #2

Dear Mr. & Mrs. Meeks:

Per your letter of request received March 24, 2008, the estimated depth of the Meeks #2 Well, has been amended to 700 feet. Enclosed is a copy of the amended permit for your records.

If you have any questions, please contact the Ground Water Division.

Sincerely,


Lisa Lindemann, Administrator
Ground Water Division

LLAsrc

SUBMITTED DOCUMENTS FOR THE RECORD BY MR. RALPH HALL, CHAIRMAN, COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY, U.S. HOUSE OF REPRESENTATIVES



January 5, 2012

Mr. Shawn M. Garvin
Regional Administrator
U.S. Environmental Protection Agency
Region 3
1650 Arch Street
Philadelphia, PA 19103-2029

Dear Shawn:

Thank you for your recent outreach to me and the Department of Environmental Protection (DEP) regarding EPA's renewed interest in events with respect to Dimock. Per our recent conversation I know you have undertaken a door to door survey in the area. Based on my conversation with you it was clear that EPA is really at the very early stages of its learning curve with respect to Dimock and EPA's understanding of the technical facts and DEP's enforcement history with respect to Dimock is rudimentary. As you are well aware, the DEP has a great deal of working knowledge regarding this matter from our experience there over the last several years. As I mentioned to you on the telephone and Scott Perry has mentioned to your staff, we stand ready to share our vast amount of information about Dimock and to assist you in EPA's getting up to speed on both the technical data and the enforcement history.

As I have mentioned to you, there is truly a high degree of "neighbor versus neighbor" emotion there and science and fact have too often been eclipsed by the strong emotions. This has been well documented by numerous sources. The matter is further complicated by the backdrop of a pending plaintiffs' personal injury litigation not to mention the attention of visitors, out of state politicians and celebrities, many of whom are not even from the area, looking for and receiving publicity.

I hope that the EPA will be willing to work together with the Pennsylvania DEP to move your research there forward in a cooperative, logical and scientific manner. We in Pennsylvania would like to see your efforts at EPA with respect to this be based on cooperative, fully science-based and peer reviewed analysis. Also, it is important that EPA govern its efforts in this regard based on science and fact. I have read Wyoming Governor Mead's letter to Administrator Jackson dated December 20, 2011, regarding the technical, scientific and cooperation shortcomings of EPA's activities with respect to that state regarding Pavilion and there is no need here to catalogue those here in this letter. Suffice it to say that we hope that EPA's efforts here not be marked by the same rush to conclusions and other deficiencies here as it was and continues to be with respect to the Pavilion matter. Like Governor Mead, I ask for your commitment to EPA's cooperation with our state experts in your process. I also ask for a full and candid exchange of information as between EPA and the Commonwealth of Pennsylvania. And I ask that your efforts be guided by sound science and the law instead of emotion and publicity.

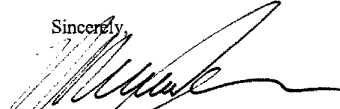
Mr. Shawn M. Garvin

- 2 -

January 5, 2012

I look forward to hearing from you both directly and at the staff level.

Sincerely,



Michael I. Krancer
Secretary

cc: PA Congressional Delegation

RAILROAD COMMISSION OF TEXAS
OFFICE OF GENERAL COUNSEL
HEARINGS SECTION

OIL & GAS DOCKET NO. 7B-0268629

COMMISSION CALLED HEARING TO CONSIDER WHETHER OPERATION OF THE RANGE PRODUCTION COMPANY BUTLER UNIT WELL NO. 1H (RRC ID 253732) AND TEAL UNIT WELL NO. 1H (RRC ID 253729) IN THE NEWARK, EAST (BARNETT SHALE) FIELD, HOOD COUNTY, TEXAS, ARE CAUSING OR CONTRIBUTING TO CONTAMINATION OF CERTAIN DOMESTIC WATER WELLS IN PARKER COUNTY, TEXAS

FINAL ORDER

The Commission finds that, after statutory notice in the above-numbered docket, heard on January 19-20, 2011, the examiners have made and filed a report and proposal for decision, issued on March 11, 2011, containing findings of fact and conclusions of law, which was served on all parties of record, and that this proceeding was duly submitted to the Railroad Commission of Texas at conference held in its offices in Austin, Texas.

The Commission, after review and due consideration of the proposal for decision and the findings of fact and conclusions of law contained therein, and any exceptions and replies thereto, hereby adopts as its own the findings of fact and conclusions of law contained therein, and incorporates said findings of fact and conclusions of law as if fully set out and separately stated herein.

It is accordingly **ORDERED** that production from the Butler Unit Well No. 1H and Teal Unit Well No. 1H, operated by Range Production Company, shall be allowed to continue as Range Production Company has established that the operations of the wells have not caused or contributed, and are not causing or contributing to contamination of any domestic water wells.

Each exception to the examiners' proposal for decision not expressly granted herein is overruled. All requested findings of fact and conclusions of law which are not expressly adopted herein are denied. All pending motions and requests for relief not previously granted or granted herein are denied.

It is further **ORDERED** by the Commission that this order shall not be final and effective until 20 days after a party is notified of the Commission's order. A party is presumed to have been notified of the Commission's order three days after the date on which the notice is actually mailed. If a timely motion for rehearing is filed by any party at interest, this order shall not become final and effective until such motion is overruled, or if such motion is granted, this order shall be subject to further action by the Commission. Pursuant to TEX. GOV'T CODE §2001.146(e), the time allotted for Commission action on a motion for rehearing in this case prior to its being overruled by operation of law, is hereby extended until 90 days from the date the parties are notified of the order.

Done this 22nd of March, 2011.

RAILROAD COMMISSION OF TEXAS


CHAIRMAN ELIZABETH A. JONES


COMMISSIONER MICHAEL L. WILLIAMS


COMMISSIONER DAVID PORTER

ATTEST:



SECRETARY

ELIZABETH A. JONES, *CHAIRMAN*
MICHAEL L. WILLIAMS, *COMMISSIONER*
DAVID PORTER, *COMMISSIONER*



LINDIL C. FOWLER, JR., *GENERAL COUNSEL*
COLIN K. LINEBERRY, *DIRECTOR*
HEARINGS SECTION

RAILROAD COMMISSION OF TEXAS

OFFICE OF GENERAL COUNSEL

OIL AND GAS DOCKET NO. 7B-0268629

COMMISSION CALLED HEARING TO CONSIDER WHETHER OPERATION OF THE RANGE PRODUCTION COMPANY BUTLER UNIT WELL NO. 1H (RRC ID 253732) AND TEAL UNIT WELL NO. 1H (RRC ID 253729) IN THE NEWARK, EAST (BARNETT SHALE) FIELD, HOOD COUNTY, TEXAS, ARE CAUSING OR CONTRIBUTING TO CONTAMINATION OF CERTAIN DOMESTIC WATER WELLS IN PARKER COUNTY, TEXAS

Heard by: Donna K. Chandler, Technical Examiner
Gene Montes, Hearings Examiner

Appearances:

Representing:

David Jackson
Stephen Ravel
John Riley
Andrew Sims
Mike Middlebrook
Norman Warpinski
John McBeath
Mark McCaffrey
Keith Wheeler
Charles Kreidler
Alan Kornacki
Chris Hosek
David Poole

Range Production Company

David Cooney

Railroad Commission staff

Barry Hageman

Enervest Operating Co, LLC

Bill Stevens

Texas Alliance of Energy Producers

Procedural history:

Notice of Hearing:	December 8, 2010
Hearing held:	January 19-20, 2011
Transcript date:	January 24, 2011
Record Closed:	February 17, 2011
PFD issued:	March 7, 2011
Revised PFD issued:	March 11, 2011

REVISED EXAMINERS' REPORT AND PROPOSAL FOR DECISION**STATEMENT OF THE CASE**

This hearing was called by the Railroad Commission of Texas ("RRC") to determine whether the Butler Unit Well No. 1H ("Butler well") or the Teal Unit Well No. 1H ("Teal well"), both horizontal drainhole wells operated by Range Production Company ("Range") and producing from the Newark, East (Barnett Shale) Field, are causing or contributing to the contamination of certain domestic water wells in Parker County. The Notice of Hearing specifically states:

"...the Commission will consider the extent and causation of and responsibility for, any contamination that may have occurred, or which is likely to occur, in domestic water wells in the area of the Range Production Company Butler Unit, Well No. 1H (RRC No. 253732) and the Teal Unit, Well No. 1H (RRC No. 253779), and, more particularly, whether the operation of these wells has caused or contributed, or may cause or contribute, to any such contamination. The Commission may also consider whether there is any alternative cause or contributor to any contamination that may have occurred."

The RRC has had an ongoing investigation into the cause of gas being produced in the domestic water wells since August 2010. In October 2010, the Environmental Protection Agency ("EPA") began its own investigation into the cause of the contamination of the wells, and on December 7, 2010, the EPA issued an Emergency Administrative Order to Range. (See Attachment A, Range Exhibit No. 5). In the order, the EPA concluded that, "[Range] caused or contributed to the endangerment identified herein [inter alia, benzene and methane in two nearby domestic water wells.]" (See Attachment A, Conclusion of Law No. 46). The Order further described to Range "..... the action you must take to ensure the Butler Unit and Teal Unit production facilities pose no imminent and substantial endangerment to public health through methane contamination of an underground source of drinking water."

The Notice of this hearing was sent to Range, the owners of the two domestic water wells at issue and to three EPA officials. The Notice stated "The Commission encourages the participation of EPA in the hearing and presentation by EPA of evidence in its possession supporting the findings of fact and conclusions of law in the Emergency Administrative Order." Range appeared at the RRC hearing and presented evidence in support of its position that the operations of its Teal well and Butler well are not contributing to the production of methane in domestic water wells.

RRC staff appeared at the hearing and cross-examined Range's witnesses. Staff presented an exhibit summarizing the RRC's investigations in this matter, beginning August 6, 2010. (See Attachment B, Staff Exhibit 1).

There was no appearance at the hearing by any representative of the EPA or by owners of the water wells identified as contaminated.

DISCUSSION OF THE EVIDENCE

Background

In August 2010, Mr. Steven Lipsky complained to the Abilene District Office of the RRC that his domestic water well contained natural gas. On August 17, 2010, the RRC collected water samples from the Lipsky well for analysis. On August 26, 2010, the RRC collected gas samples from the Lipsky well for analysis. At approximately the same time, the RRC requested Range to provide a gas analysis from both the bradenhead (the space between the surface casing and the production casing of the well) and from the production tubing of its Butler well.¹ The RRC further requested that Range test the mechanical integrity of the casing of its Butler well. The Butler well is the nearest producing well to the Lipsky well. The path of the Butler well comes within a horizontal distance of approximately 450 feet of the location of the Lipsky water well, but at that point, the Butler wellbore is more than 5,000 feet deeper than the Lipsky water well.

In a memo dated September 22, 2010, the RRC Abilene District Office staff stated "Each of the gas samples taken, the Lipsky water well, the Butler Unit production and the Butler Unit bradenhead gas had distinct characteristics from each of the others." Range conducted the requested production casing integrity test on its Butler No. 1 on October 14, 2010. The test, which was witnessed by RRC personnel, indicated no communication between the surface casing, production casing, or production tubing.

¹ The Butler well is a horizontal drainhole well producing from the Newark, East (Barnett Shale) Field at a depth of approximately 5,700 feet.

On October 26, 2010, the EPA collected the following samples for its investigation:

1. water and gas samples from the Lipsky water well;
2. a water sample from the Rick Hayley domestic water well storage tank;
3. gas and water samples from the tubing of the Butler well; and
4. gas sample from the tubing of the Teal Unit Well No. 1H.²

The horizontal portions of the Teal well and Butler well are approximately 1,000 feet apart and the wells are drilled from the same surface location. The Rick Hayley domestic water well is on property adjacent to the Lipsky property to the north and is a horizontal distance of approximately 300 feet from the path of the Butler well. However, at that point, the Butler well is more than 5,000 feet deeper than the Hayley water well. (See Attachment C, portion of Range Exhibit No. 30).

In a letter dated December 3, 2010, Range notified John Tintera, Executive Director of the RRC, that Range would continue to work with the RRC to demonstrate that both the Teal well and the Butler well were in compliance with all RRC regulations. In the same letter, Range offered to collect soil samples to investigate the possible source of gas production in the Lipsky well, provide gas monitoring equipment and alternative water sources to Mr. Lipsky, and install monitoring wells as directed by the RRC. The letter further indicated that Range's initial analyses indicated that the gas produced in the Lipsky water well had a different constituent analysis than gas from both the Butler well production tubing and from the Butler well bradenhead.

On December 7, 2010, the EPA issued an Emergency Administrative Order ("EAO") to Range. On December 8, 2010, the RRC issued its Notice of Hearing in this docket.

Range Operations

Michael Middlebrook, Vice President of Operations for the Barnett Shale and Northeast Marcellus Shale for Range, testified regarding Range's operations in the area, specifically concerning the Teal and Butler wells. The Teal well was drilled beginning in March 2009 and the Butler well was drilled beginning in June 2009. Both wells were put on production in August 2009. The wells are drilled from the same surface location, which is approximately 2,300 feet southeast of the Lipsky water well.

In August 2010, after Mr. Lipsky's complaint to the RRC about his water well, RRC staff inspected the Teal and Butler wells. Both wells were producing at the time of the inspection. The inspection revealed that the Teal well had no pressure on the bradenhead and the Butler well had 30 psi on the bradenhead. The pressure on the Butler well bled

² The Teal Unit Well No. 1H is another horizontal drainhole well producing from the Newark, East (Barnett Shale) and operated by Range.

down to 0 psi within 10 seconds.³ Pressure on the bradenhead of a well is an indication that formations behind uncemented production casing are seeping fluid into the space behind the production casing. Range was requested to collect and analyze gas samples from the production tubing and from the bradenhead of the Butler well.

The Butler well has surface casing set at 394 feet and cemented to surface. The well has production casing set from its total measured depth of 9,054 feet to surface, including a horizontal lateral approximately 3,300 feet in length. The top of cement behind the production casing is found in the vertical portion of the wellbore at approximately 4,850 feet, as verified by a cement bond log. There is no cement behind the production casing from a depth of 4,850 feet to surface. The gas sample taken from the tubing is therefore gas from the Barnett Shale producing interval. The gas sample taken from the bradenhead is gas from any formation open to the wellbore above 4,850 feet.

Because of the pressure found on the bradenhead of the Butler well, the RRC requested Range to perform a pressure test on the well to confirm the integrity of the production casing. This test was performed on October 14, 2010 and was witnessed by RRC personnel. In order to perform the test, Range placed a packer on the tubing to isolate the tubing from the casing/tubing annulus. The well held 845 psi on the annulus between the tubing and casing for 30 minutes, while the tubing pressure held at 540 psig. The bradenhead pressure was 28 psi during the entire test. These pressures demonstrate that the casing in the well has integrity, i.e. that there are no pathways for gas to migrate from the production tubing to the annulus or from the tubing/casing annular space to the back side of the production casing.

In late October, Range was contacted by the EPA, requesting that EPA be allowed to take gas samples from the Butler well. On October 26, 2010, the EPA collected a gas sample from the tubing of the Butler well. At the same time that the EPA was collecting its single sample, Range collected additional samples of gas from the Butler well tubing, the Butler bradenhead, and the Teal tubing. Because there was no bradenhead pressure on the Teal well, no gas sample could be collected from the bradenhead of that well at that time. Range also collected a sample of the gas that is being reinjected into the casing in both wells for gas lift purposes.

Approximately 30 days after the EPA had collected its sample, Range was notified by phone of the EPA's position that the gas in the Lipsky water well was the same as Range's production gas. Range requested the EPA's gas sampling data, but the EPA did not provide the data.

³ More recently, the bradenhead pressure in the Butler well builds only to about 5 psi and bleeds down to 0 psi immediately.

Geology and hydrogeology

Dr. Charles Kreidler was called by Range to testify regarding geology and aquifers in the area. The Trinity aquifer group (including the Paluxy, Glen Rose and Twin Mountains formations) is part of the Cretaceous system. In this area of Parker County, the Strawn, which is part of the Pennsylvanian system, directly underlies the Trinity. The base of the Cretaceous/top of Pennsylvanian varies from approximately 200 feet below surface (in the area of the Lipsky water well) to approximately 400 feet below surface (in the area of water wells approximately one mile to the east).⁴ The base of the Pennsylvanian/top of Mississippian in the area of the Butler/Teal wells is approximately 5,700 feet. The Barnett Shale is part of the Mississippian system. The Cretaceous dips to the southeast while the Pennsylvanian section dips to the west. An erosional unconformity exists which allows a natural communication between the Cretaceous and the Pennsylvanian. The Pennsylvanian contains hydrocarbons and salt water, while the Cretaceous section contains fresh water. The unconformity is verified by seismic data. In summary, the area from the surface to the base of Cretaceous (ranging from 200 feet to 400 feet below surface) contains fresh water. Immediately below this zone, from the base of the Cretaceous to about 5,700 feet is Pennsylvanian age rock containing natural gas, oil and salt water. Below that, starting at a depth of approximately 5,700 feet, is Mississippian age rock that includes the gas-bearing Barnett Shale formation.

A structure map of the area around the Butler well and Teal well was drawn based on 3-D seismic data. There is no indication of faulting in the vicinity of the wells and therefore no pathway to communicate the Barnett Shale all the way up, over 5,000 feet vertically, to the Cretaceous.

Most of the domestic water wells in the area are completed in the Twin Mountains. Some are completed in the shallower Paluxy. The two are separated by the Glen Rose aquitard, which retards the vertical movement of water between the Twin Mountains and Paluxy. The Twin Mountains is not a highly productive aquifer. As water wells are pumped, the water level in the Twin Mountains falls. Because the Twin Mountains is in communication with the Strawn due to the unconformity, gas and water from the Strawn can move to the Twin Mountains and mix.

Water wells within 3,000 feet of the Butler/Teal surface location were sampled to determine methane concentration. Some homeowners did not allow their wells to be sampled. In the samples, methane concentrations ranged from non-detect to almost 3

⁴ This variance in the base of Cretaceous is due to differences in ground level elevations.

parts per million (ppm).⁵ The Perdue water well had the highest methane concentrations, at 2.8 ppm. The Perdue well is the deepest water well in the area, extending about 100 feet into the Strawn. The Lipsky well had a methane concentration of 2.3 ppm, the second highest concentration found. The concentrations in the various water wells do not demonstrate any type of plume, which would be expected if the gas was from a single source. Instead, the concentrations in the wells vary randomly over the area.

The water well samples also indicate variations in total dissolved solids from about 500 ppm to about 1,800 ppm. The normal range for total dissolved solids in the Trinity aquifer is 500-700 ppm. Chlorides in the water well samples varied from 20 ppm to 535 ppm. The total dissolved solids and chloride concentrations vary randomly over the area, just as the methane concentrations. Range believes that the methane, total dissolved solids and chlorides are all indications of communication between the Twin Mountains aquifer and the higher salinity waters of the underlying Strawn.

The United States Department of Interior ("USDI"), Office of Surface Mining, advises that owners of water wells with methane concentrations less than 10 ppm require no action other than periodic monitoring to make sure concentrations do not change. The USDI further advises that methane will not accumulate in the wellbore of a water well if it is properly vented to the air. The TCEQ requires that all public water supply wells be vented to prevent gas accumulations of any kind in the wellbores.

Microseismic Analysis and Hydraulic Fracturing

Norman Warpinski, the Director of Technology for Pinnacle-Halliburton Service, was called to testify regarding microseismic data and hydraulic fracturing in the Barnett Shale. In order to produce hydrocarbons, tight rocks such as the Barnett Shale, must be hydraulically fractured, thereby creating pathways for hydrocarbons to move to the wellbore. Fracture stimulations are designed to keep the injected fluid within the productive formation. Fracturing is effective in the Barnett Shale because the Barnett Shale is overlain by the Marble Falls and underlain by either the Viola or Ellenburger, all of which are carbonate rocks effective in preventing growth of fractures out of the intended zone.

Microseismic monitoring is used to monitor the results of hydraulic fracturing. During the hydraulic fracturing process, microseisms occur as a result of rock fracturing. These microseisms emit seismic energy which can be detected in geophones which have been placed in nearby wells. By mapping the microseisms, the geometry, dimension and growth behavior of a fracture can be determined.

⁵ Some of the wells that indicated "non-detect" of methane were sampled at the outlet side of the treatment equipment and any gas which had been dissolved in the water would likely have already fallen out of solution.

Microseismic data is available for about 2,400 fracture stimulations in the Barnett Shale. In Parker County alone, data is available for more than 320 fracture stimulations. For the Parker County data, the greatest fracture height seen is about 400 feet, or to a vertical depth no higher than 4,500 feet. The separation between any drinking water source and the highest fracture height is more than 4,000 feet. Dr. Warpinski stated that it would be impossible to create a fracture height of such magnitude.

Range believes that the microseismic data available for wells in Parker County confirm that hydraulic fracturing of Barnett Shale wells is not the cause of natural gas production in the Lipsky well or any other water well in the area.

Geochemical Gas Fingerprinting

Mark McCaffrey, Senior Technical Advisor of Fluid Services for Weatherford Laboratories, was called by Range to testify regarding the various gas analyses. Dr. McCaffrey presented results of geochemical gas fingerprinting which demonstrate that gas from the Lipsky water well does not match gas from the Barnett Shale. Dr. McCaffrey believes that the EPA's geochemical gas fingerprinting study is flawed because the EPA did not attempt to identify other potential sources of gas in the Lipsky well besides the Barnett Shale. Further, the geochemical parameter used in the EPA fingerprinting study was the methane carbon isotope. This parameter does not differentiate between Barnett Shale gas and gas from Pennsylvanian age rock such as the Strawn formation, but simply provides a determination that both gases are thermogenic. Gas found in the shallower Strawn formation would be expected to have similar carbon isotopic composition because the Barnett Shale is the source rock for all gas bearing zones in and above the Barnett Shale. Over geologic time, gas has migrated up from the Barnett Shale into other formations and it is not surprising that the gas samples collected by the EPA have similar methane isotopes and are both thermogenic.

Dr. McCaffrey believes that the appropriate geochemical parameters to use in this case are nitrogen and carbon dioxide (CO_2). These two parameters are more useful when considering that the source of gas in the Lipsky well may be the Pennsylvanian age Strawn formation. Available publications provide data indicating that Pennsylvanian age reservoir gases typically have higher nitrogen and lower CO_2 than Barnett Shale gas.

For its fingerprinting study, Range used solution gas samples and headspace gas samples from 25 water wells within 3,000 feet of the surface location of the Butler and Teal wells. Solution gas is the gas which is dissolved in the water. Headspace gas is the gas above the water level in a well. Additionally, Range had samples from the Butler well tubing (Barnett Shale) gas, Butler well bradenhead gas, Teal well tubing and Teal well bradenhead. Range also had samples of gas being injected into both the Teal and Butler

wells. Elevated nitrogen concentrations were found in the headspace gas of the Lipsky well, indicating that the gas is derived from a Pennsylvanian reservoir, and not the Barnett Shale. The Butler bradenhead gas is approximately 50% nitrogen enriched Pennsylvanian gas and 50% microbial gas. The Teal bradenhead sample was found to be almost entirely microbial. Neither bradenhead gas sample contained Barnett Shale gas. Further, Barnett Shale gas contains no microbial gas, as was found in the two bradenhead samples.

If Barnett Shale gas were migrating upwards and communicating to shallower zones, some component of Barnett Shale gas would have been present in the bradenhead samples of the Teal and Butler wells. Further, the gas found in most of the water well samples has differing degrees of biodegradation, indicating that gas had seeped into the aquifer over geologic time, and not in a single event.

Petroleum Engineering

John McBeath, consulting petroleum engineer, was called by Range to testify regarding the history of gas in water wells and about the mechanical integrity of Range's wells. He also testified as to the extent of Range's investigation into the reason gas is found in the Lipsky well, as requested by the RRC.

Gas production from water wells is not uncommon in this area, and has occurred for many years prior to Barnett Shale gas development. In October 2005, a water well was drilled on the Hurst property, slightly less than 900 feet west of the Lipsky well. The Hurst water well was drilled to a depth of 180 feet and flowed sufficient gas such that the well was flared when initially completed. The gas in the well depleted after a few months and the well is now used as an irrigation supply well. In 2007, a water well was drilled on the Oujesky property to a depth of 220 feet. This well, approximately 750 feet north of the Lipsky well, also flowed gas for a couple of months. The Lake Country Acres public water supply had five wells, the earliest drilled in 1995. These water supply wells are approximately 7,000 feet to the east of the Lipsky well. One of the wells, the No. 4, flowed 122 MCF (thousand cubic feet) of gas per day and was plugged shortly after drilling in 2003. The storage tanks for the remaining four Lake Country Acres water supply are aerated to de-gas the water and signs around the tanks warn of flammable gas.

The Lipsky well was drilled in 2005 to a depth of 200 feet, which Range estimates is within 25 feet of the base of the Cretaceous. According to the Lipsky's deposition, there were no problems with his water well until August 2010 when the output from the well decreased. Lipsky had the pump in the well replaced with a smaller pump in an effort to prevent the water level from falling below the pump. The decreased output from the well continued. Range notes that Mr. Lipsky's home on the property was completed in early 2010, a very large home with extensive landscaping and a swimming pool, likely resulting in an increase in water consumption by Lipsky. Range believes the increased water

consumption by Lipsky, in combination with increased development in the subdivision, may have drawn down water levels in area water wells such that gas could be drawn in from the Strawn formation.

Prior to the drilling of the Teal and Butler wells in 2009, there is significant evidence of shallow gas production within a 2½ mile radius of the wells. The Strawn formation directly underlies the Cretaceous formation, which is the aquifer in the area. Water well records indicate that numerous water wells penetrated the Strawn formation, while numerous others are completed within 25 feet of the top of the Strawn. In addition to gas produced in the numerous water wells, several gas wells were completed in the Center Mills (Strawn) Field approximately one mile to the southeast of the Butler and Teal wells. These wells produced gas in the mid-1980's from the Strawn, with depths ranging from 358 feet to 426 feet. The Lake Country Acres water supply wells are drilled to depths ranging from 385 feet to 420 feet.

Range identified 74 oil/gas wells within 2½ miles of the surface location of the Butler and Teal wells, some of which are abandoned locations which were permitted but never drilled. Range studied the available drilling, completion and plugging records for the wells and found that 11 wells have potential to communicate to freshwater zones due to inadequate surface casing or improper plugging. However, the closest of the 11 wellbores is about one mile away in the area of the Center Mills (Strawn) Field. Range does not believe that any of the 11 wells have any connection to the Lipsky well problem, but Range cannot rule out the possibility that any of the 11 wells may have contributed to gas production in water wells in other areas, such as the Lake Country Acres water supply wells. Eight of the 11 wells are within about ½ miles of the Lake Country Acres water wells.

The surface casing for the Butler well is set at 394 feet and the surface casing for the Teal well is set at 409 feet. The surface casing on the Butler well was tested to 1,500 psi and the surface casing on the Teal was tested to 1,200 psi. The Texas Commission on Environmental Quality ("TCEQ") recommends that the interval from land surface to 20 feet below the base of the Cretaceous be protected, with the Cretaceous estimated to occur at 175 feet. Surface casing on both wells exceed the requirements of the TCEQ. Range's experience in the area is that the Cretaceous generally extends to approximately 320 feet.

The top of cement behind the production casing in the Butler No. 1 is 4,580 feet, based on a cement bond log. The production casing was pressure tested to 845 psig on October 15, 2010. The top of cement behind the production casing in the Teal No. 1 is 4,810 feet, also verified by a cement bond log. The production casing in the Teal No. 1 was pressure tested on December 28, 2010 to 705 psig. The production casings in both wells have mechanical integrity to prevent migration of Barnett Shale gas behind pipe.

Groundwater Investigation

Keith Wheeler was called by Range to testify regarding the groundwater investigation performed by Range per the RRC's December 16, 2010 letter to Range. In late December, ambient air samples were collected from different sources near the area water wells, such as near the wellhead or in the pump house. A headspace gas sample and a water sample was taken from each of the water wells. Additionally, 117 soil gas samples were collected from around the water wells.

The highest measured concentration found in any of the ambient air samples was 6 ppm for ethane, 13.9 ppm for methane, and 61 ppm for propane. The lower explosive limit is 30,000 ppm for ethane, 50,000 ppm for methane, and 21,000 ppm for propane. These ambient air samples indicate insignificant potential for any fire or explosion.

Each of the 25 water samples was field tested at the time of sampling for temperature, specific conductance, dissolved oxygen, pH, oxidation reduction potential and turbidity. Each sample was then sent to a lab for testing of more than 135 constituents. The constituents include 108 volatile organic compounds (VOC). Of this 108, 16 were detected in at least one of the water wells. However, no sample contained a level in excess of the Texas Risk Reduction Program Protective Concentration Level (PCL) established by the TCEQ. The PCL is the value at which the analyte does not present an unacceptable risk to human health. RCRA metals barium, chromium, and lead were detected in at least one water sample, but no sample had a level exceeding the PCL. Dissolved butane, ethane, isobutane, methane or propane was found in at least one water sample. However, there are no established PCL for these dissolved gases because they are not toxic for ingestion of groundwater. Three other analytes (chloride, sulfate and total dissolved solids) were detected in all samples, but there are no established PCL for these analytes. In some wells, the concentrations of these three analytes exceeded the Secondary Maximum Contaminant Levels (SMCL) for drinking water in the State of Texas, as established by TCEQ pursuant to the EPA standards for the Safe Drinking Water Act. However, the presence of these three analytes indicates the aesthetic quality of the water such as odor and taste, and does not indicate risks to human health.

Soil gas samples were collected from 117 locations around the domestic water wells in the area of the Lipsky well. The samples were retrieved from depths between 1 and 3 feet below surface. Each gas sample was tested for presence of methane, ethane, propane and butane. The highest concentration of any of these gases was less than 0.2% of the lower explosive limit for each gas. As in the other analyses, the concentrations were randomly distributed over the area, with no indication of any single source.

EXAMINERS' OPINION

The examiners find that Range's evidence clearly demonstrates that its drilling and operations of the Teal and Butler wells have not contributed to contamination of any domestic water wells. The examiners further find that the most likely source of gas in the Lipsky well and other domestic water wells in the area is the shallow Strawn formation.

Most of the domestic water wells in this area are completed in the Twin Mountains formation within the Cretaceous. The Cretaceous and the underlying Pennsylvanian are in direct communication as a result of an erosional unconformity between the two systems of rock. The Strawn is the shallowest formation within the Pennsylvanian. The Strawn is found at a depth of about 200 feet below surface in the area of the Lipsky water well and at a depth of approximately 400 feet below surface in the Lake Country Acres water supply wells about one mile to the west. Water wells records show that some water wells in the area were actually drilled into the Strawn formation. Additionally, there was gas production in the mid-1980's from the shallow Strawn formation in the Center Mills (Strawn) Field, with gas production from depths of less than 400 feet below surface.

Domestic water wells in the area of the Lipsky water well have contained methane gas for many years. The nearby Hurst water well produced sufficient gas to flare when it was initially completed in 2005. The Oujesky well also produced gas for a couple of months just after completion in 2007. One water well in the Lake Country Acres water supply produced 122 MCF of gas per day upon completion, so much gas that it had to be abandoned as a water supply well. All of these wells were drilled prior to the drilling of both the Butler and Teal wells by Range in 2009.

The EPA's investigation compared gas produced from the tubing of the Butler well (Barnett Shale gas) to gas found in the Lipsky water well. The methane carbon isotope fingerprint analysis of the gases were found to be very similar and both gases were determined to be thermogenic. Range demonstrated that use of the methane carbon isotope in the EPA analysis was inappropriate because the Barnett Shale is the source rock for all gas bearing zones above the Barnett Shale, including the much shallower Strawn formation. All gas produced from the same source rock would be expected to have a similar methane carbon isotope. The EPA did not attempt to identify any other potential source of the gas produced from the Lipsky well. Range further showed the appropriate geochemical parameters to use for fingerprinting in this case are nitrogen and carbon dioxide. Published literature confirms that Pennsylvanian age gases, including the Strawn, have higher nitrogen and lower carbon dioxide than Barnett Shale gas.

For its gas fingerprinting analysis, Range collected samples of headspace gas and solution gas from 25 water wells within 3,000 feet of the surface location of the Butler/Teal wells. Range also collected samples from the tubing of the Butler well, tubing of the Teal

well, bradenhead of the Butler well, bradenhead of the Teal well, and injection gas used in both the Teal and Butler wells. The fingerprinting analyses performed by Range demonstrates that gas found in the Lipsky water well and other water wells had elevated nitrogen concentrations, indicating Pennsylvanian gas, not Barnett Shale gas. Additionally, gas produced from the Barnett Shale in the Butler and Teal wells contained no microbial gas, but the bradenhead samples from each well did contain microbial gas. These differentials confirm that the Barnett Shale is not in communication with any other zone, including the much shallower Strawn.

In addition to the fingerprinting analysis, additional testing for the presence of 135 constituents was performed on water samples from the 25 water wells. The constituents include 108 volatile organic compounds. No sample contained a level in excess of the Texas Risk Reduction Program Protective Concentration Level (PCL) established by the TCEQ. The PCL is the value at which the analyte does not present an unacceptable risk to human health. The water samples were also tested for eight RCRA metals. Three of these metals, barium, chromium, and lead, were detected in at least one water sample, but no sample had a level exceeding the PCL. Dissolved butane, ethane, isobutane, methane or propane was found in at least one water sample, but these gases are not toxic for ingestion of groundwater and there are no established PCL for these gases. Three other analytes (chloride, sulfate and total dissolved solids) were detected in all samples and some exceeded the SMCL. However, the presence of these three analytes affects only the aesthetic quality of the water such as odor and taste, and are not indications of risks to human health.

Ambient air samples were collected from various areas around the wellbores and pump houses of the water wells. These ambient air samples were tested for ethane, methane and propane. All samples were far below the lower explosive limit for the three gases, meaning there is insignificant potential for explosion for fire. Additionally, 117 soil gas samples were tested for presence of methane, ethane, propane and butane. The highest concentration of any of these gases was less than 0.2% of the lower explosive limit for each gas.

Range also presented extensive microseismic data to demonstrate that hydraulic fracturing has not caused communication between the Barnett Shale and Cretaceous aquifers in the area. Microseismic data is available for 320 fracture stimulations for wells in Parker County. For these 320 stimulations, the greatest fracture height is about 400 feet. Given that the separation between the Barnett Shale and the aquifer is about 5,000 feet, it is evident that hydraulic fracturing of the Barnett Shale has not caused any communication with the aquifer.

The Butler and Teal wells have mechanical integrity which will prevent any migration of gas out of the Barnett Shale. The surface casing in each well is set below the base of the Cretaceous and is cemented to surface. The surface casings and production casings of both wells were tested when set during the drilling process. Further, Range performed a mechanical integrity test on the Butler well at the request of the RRC to demonstrate that the low bradenhead pressure on the well was not related to any type of casing problem. The cement behind the production casing is verified by a cement bond log in both wells.

Based on the evidence, the examiners conclude that gas produced in the Lipsky water well and other area water wells is from the Strawn formation which is in direct communication with the Cretaceous aquifer in which the water wells are completed. Some of the water wells even penetrated the Strawn formation. There is no evidence to indicate that either the Teal well or the Butler well is the source of gas production in area water wells. When the appropriate parameters are used in a fingerprinting study, it is clear that the gas produced from the water wells is from Pennsylvanian rock (Strawn) which is significantly different in composition than Barnett Shale gas.

FINDINGS OF FACT

1. Notice of this hearing was given on December 8, 2010 to all parties entitled to notice, including Range Production Company, the owners of the two domestic water wells at issue, and three officials of the Environmental Protection Agency.
2. The hearing was called by the Railroad Commission of Texas to consider the extent and causation of and responsibility for, any contamination that may have occurred, or which is likely to occur, in domestic water wells in the area of the Range Production Company Butler Unit, Well No. 1H (RRC No. 253732) and the Teal Unit, Well No. 1H (RRC No. 253779), and, more particularly, whether the operation of these wells has caused or contributed, or may cause or contribute, to any such contamination. The call of the hearing was also to consider whether there is any alternative cause or contributor to any contamination that may have occurred.
3. Range Production Company presented evidence in support of its position that neither its Butler Unit Well No. 1 or its Teal Unit Well No. 1 has caused or contributed to contamination of any domestic water wells in the area. The EPA did not appear at the hearing. Neither owner of the two domestic water wells appeared at the hearing.

4. The Teal Unit Well No. 1H was drilled beginning in March 2009 and the Butler Unit Well No. 1H was drilled beginning in June 2009. The wells are horizontal drainhole wells completed in the Newark, East (Barnett Shale) Field.
5. The Butler Unit Well No. 1H and the Teal Unit Well No. 1H were drilled from the same surface location, which is approximately 2,300 feet southeast of the domestic water well on Steven Lipsky's property in Parker County.
6. Both the Butler Unit Well No. 1H and the Teal Unit Well No. 1H have sufficient surface casing to protect usable quality water as recommended by the Texas Commission on Environmental Quality.
 - a. The Texas Commission on Environmental Quality recommends that the interval from land surface to 20 feet below the base of the Cretaceous be protected, with the Cretaceous estimated to occur at 175 feet.
 - b. The surface casing for the Butler Unit Well No. 1H is set at 394 feet and cemented to surface.
 - c. The surface casing for the Teal Unit Well No. 1H is set at 409 feet and cemented to surface.
7. Both the Teal Unit Well No. 1H and the Butler Unit Well No. 1H have production casing cemented in a manner to prevent migration of fluids behind pipe.
 - a. The top of cement behind the production casing in the Butler Unit Well No. 1H is 4,580 feet, based on a cement bond log. The production casing was pressure tested to 845 psig on October 15, 2010.
 - b. The top of cement behind the production casing in the Teal Unit Well No. 1H is 4,810 feet, based on a cement bond log. The production casing in the Teal No. 1H was pressure tested on December 28, 2010 to 705 psig.
8. The Lipsky water well was drilled in 2005 to a depth of 200 feet. The horizontal drainhole of the Butler Unit Well No. 1H comes within a horizontal distance of approximately 450 feet of the Lipsky well, but is more than 5,000 feet deeper than the Lipsky water well.

9. Mr. Lipsky's first complaint to the District Office of the Railroad Commission in Abilene regarding natural gas in his water well was in August 2010. The Railroad Commission collected a water sample from the Lipsky well on August 17, 2010 and collected a gas sample from the well on August 26, 2010.
10. The Rick Hayley domestic water well is on property adjacent to the Lipsky property to the north. The horizontal drainhole of the Butler Unit Well No. 1H comes within a horizontal distance of approximately 300 feet of the Hayley well, but is more than 5,000 feet deeper than the Hayley water well.
11. On October 26, 2010, the EPA collected water and gas samples from the Lipsky water well, a water sample from the Rick Hayley domestic water well storage tank, gas and water samples from the tubing of the Butler Unit Well No. 1 and a gas sample from the tubing of the Teal Unit Well No. 1H.
12. On December 7, 2010, the EPA issued an Emergency Administrative Order to Range Resources Company. Range was advised of the EPA's determination that Range's oil and gas production operations related to the Butler Unit Well No. 1H and the Teal Unit Well No. 1H "...were directly related to imminent and substantial endangerment to a public drinking water aquifer."
13. In the subject area of Parker County, the Pennsylvanian age Strawn directly underlies the Trinity aquifer group which is composed of the Paluxy, Glen Rose and Twin Mountains. The Trinity is Cretaceous age.
14. The depth of the base of the Cretaceous/top of Pennsylvanian occurs at depths ranging from approximately 200 feet to approximately 400 feet in this area. An erosional unconformity exists which allows communication between the Cretaceous and the Pennsylvanian.
15. The Barnett Shale occurs at a depth of approximately 5,700 feet in the area of the Butler Unit Well No. 1H and Teal Unit Well No. 1H.
16. The Barnett Shale is Mississippian age rock, but is the source rock for all gas-bearing formations in the Fort Worth Basin including the subject area.
17. Gas production in water wells in Parker and Hood Counties has occurred since at least 2003, several years before the drilling and production of both the Teal Unit Well No. 1H and the Butler Unit Well No. 1H.

- a. A domestic water well on the Hurst property, approximately 900 feet west of the Lipsky water well, was completed in October 2005 and flowed gas sufficient to flare for a few months. The well is 180 feet deep.
 - b. In 2007, a domestic water well on the Oujesky property approximately 750 feet to the north of the Lipsky property, flowed gas upon completion which continued for a couple of months. The well is 220 feet deep.
 - c. Well No. 4 of the Lake Country Acres water supply flowed 122 MCF per day upon completion in 2003 and was plugged. This well is approximately 7,000 feet to the east of the Lipsky water well and was drilled to a total depth of approximately 400 feet.
18. Production from the Strawn formation occurred in the mid-1980's from the Center Mills (Strawn) Field approximately one mile to the southeast of the surface location of the Butler/Teal wells. The Strawn in this field was productive from depths as shallow as 358 feet.
19. Lipsky first reported gas production from his water well after construction of a home, extensive landscaping and pool construction on his property in 2010.
20. Samples from 25 water wells within 3,000 feet of the Butler/Teal surface location were analyzed for 135 constituents, including 108 volatile organic compounds, eight RCRA metals, and dissolved gases. None of the samples had levels of any of the constituents which exceed the Texas Risk Reduction Program Protective Concentration Level established by the TCEQ standards.
21. Ambient air samples taken from various areas around the 25 water wells contained concentrations of methane, ethane and propane far below the lower explosive limit for the gases. The highest concentration of any of the gases was 0.29% of the lower explosive limit.
22. Soil gas samples from 117 sites were tested for methane, ethane, propane and butane, and the concentrations of these gases were far below the lower explosive limits for each gas. The highest concentration of any of the gases was 0.176% of the lower explosive limit.
23. Because the Barnett Shale is the source rock for shallower gas-bearing formations, the methane carbon isotope fingerprint for Barnett Shale gas is expected to be similar to Strawn gas, as determined by the EPA's analysis.

24. The appropriate geochemical parameters for fingerprinting to distinguish Strawn gas of Pennsylvanian age from Barnett Shale gas of Mississippian age, are nitrogen and carbon dioxide, not methane carbon isotope. Gas from Pennsylvanian age rock, including the Strawn, has higher nitrogen concentration and lower carbon dioxide concentration than Barnett Shale gas.
25. Gas found in the 25 water wells, including the Lipsky and Hayley water wells, does not match the nitrogen fingerprint of Barnett Shale gas. The gas found in the water wells matches Pennsylvanian gas.
26. Bradenhead gas samples from both the Teal Unit Well No. 1H and the Butler Unit Well No. 1H do not match Barnett Shale gas, confirming that gas is not migrating up the wellbores and that the Barnett Shale producing interval in the wells is properly isolated.
27. Hydraulic fracturing of the Barnett Shale in the Teal Unit Well No. 1H and the Butler Unit Well No. 1H did not result in communication of the Barnett Shale with shallow aquifers from which water wells in the area produce.
 - a. Based on available 3D seismic, there is no evidence of faulting in the area of the Butler/Teal wells.
 - b. Microseismic data available for more than 320 fracture stimulations in Parker County indicate a maximum fracture height of approximately 400 feet, meaning that almost one mile of rock exists between the highest fracture and the shallow aquifer.

CONCLUSIONS OF LAW


1. Proper notice was issued in accordance with applicable statutory and regulatory requirements.
2. All things have occurred to give the Railroad Commission jurisdiction to consider this matter.
3. Specifically, the Commission has jurisdiction over the issues in this proceeding pursuant to Title 3, Oil and Gas, Subtitles A, B, and C of the Texas Natural Resources Code, Chapter 26, 27 and 29 of the Texas Water Code, and Tex. Gov't Code Ann. §§ 2001 et seq. (2010).
4. No person conducting activities subject to regulation of the Commission may cause or allow pollution of surface or subsurface water in the state. 16 *Tex. Admin. Code Ann.* § 3.8(b).


5. Pursuant to 16 *Tex. Admin. Code* § 1.47, in response to a written complaint or on the Commission's own motion, the Commission may issue a notice commanding a person or agency subject to the Commission's jurisdiction to appear at a public hearing and show cause why the person or agency should not be compelled to do the act required or refrain from doing an act.
6. The Railroad Commission has acted appropriately in its investigation of, and actions with regard to, the Lipsky complaint.
7. The Environmental Protection Agency (EPA) through the following individuals, were provided notice of this hearing: Dr. Alfredo Almendariz, Regional Administrator, Tucker Henson, Office of Regional Counsel, John Blevins, Office of Compliance Assurance and Enforcement *Tex. Gov't Code Ann.* § 2001.051 et seq. and 16 *Tex. Admin. Code* § 1.45.
8. Steven Lipsky and Rick Hayley were provided notice of this hearing pursuant to *Tex. Gov't Code Ann.* § 2001.051 et seq. and 16 *Tex. Admin. Code* § 1.45.
9. The EPA, Mr. Lipsky and Mr. Hayley did not to appear or participate in the evidentiary hearing.
10. Range has met its burden of proof as to the matters considered in this proceeding and has established that none of its activities in the subject wells are in violation of Statewide Rule 8.
11. The Protective Concentration Levels (PCL) are the default cleanup standards in the Texas Risk Reduction Program, found at 30 *Tex. Admin. Code* § 350 et seq. and the water well sampling results established that PCLs were not exceeded for any of the wells sampled.

EXAMINERS' RECOMMENDATION

Based on the evidence presented and summarized in the above findings of fact and conclusions of law, the examiners recommend that a Final Order be issued which finds that the operations of the Teal Unit Well No. 1H and the Butler Unit Well No. 1H by Range Resources Company have not contributed and are not contributing to contamination of any domestic water wells.

Respectfully submitted,


Gene Montes
Hearings Examiner


Donna K. Chandler
Technical Examiner

SUBMITTED DOCUMENTS FOR THE RECORD BY MR. PAUL D. TONKO, MEMBER, COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY, U.S. HOUSE OF REPRESENTATIVES

April 8, 2008

Mr. Don Aragon
Executive Director
Wind River Environmental Quality Commission
P.O. Box 217
Fort Washakie, WY 82514

Subject: Review of EnCana Oil & Gas (USA) Inc. Public Participation Plan
Voluntary Remediation Program – Pavillion Natural Gas Field, Fremont County, WY
Tribal Pavillion 14-11, Tribal Pavillion 42-11, Tribal Pavillion 24-3

Dear Mr. Aragon:

At the request of the Wyoming Department of Environmental Quality (WDEQ), EnCana Oil and Gas (USA) Inc. (EnCana) has prepared this Public Participation Plan (PPP) for your review and comment. The PPP describes how interested parties may obtain information related to the subject Voluntary Remediation Program (VRP) sites. In addition, interested parties may participate in the process of addressing the subject sites.

Once you have had an opportunity to review the contents of this PPP, please submit any comments or questions you may have to the WDEQ office in Lander to the attention of Ms. Kathy Brown. The address for their office is:

Wyoming Department of Environmental Quality
Lander Field Office
510 Meadowview Drive
Lander, Wyoming 82520

If you have any questions, please feel free to contact Ms. Kathy Brown at (307) 335-6949.

Sincerely,

Michael Larson
Environmental Team Lead
EnCana Oil & Gas (USA) Inc.

Cc: K. Brown, WDEQ
S. Regan, EnCana
C. Thunem, EnCana

**Public Participation Plan
EnCana Oil & Gas (USA) Inc.
Pavillion, Wyoming**

**Voluntary Remediation Program
Natural Gas Well Locations**

**Tribal Pavillion 14-11
Trial Pavillion 42-11
Tribal Pavillion 24-3**

Prepared by: EnCana Oil & Gas (USA) Inc.

Prepared for: Wyoming Department of Environmental Quality and Interested Parties

Date: April 8, 2008

Contents

- 1.0 Introduction
- 2.0 Site and Project History
 - 2.1 History of VRP Sites
 - 2.2 Regulatory Background
 - 2.3 Site Investigation Activities
 - 2.3.1 Tribal Pavillion 14-11
 - 2.3.2 Tribal Pavillion 42-11
 - 2.3.3 Tribal Pavillion 24-3
- 3.0 Initial Site Characterization Results
- 4.0 Planned Activities and Projects Schedule
- 5.0 Community Participation

List of Attachments

- Attachment 1 Public Participation Contact List
- Attachment 2 Public Participation Mailing List

1.0 INTRODUCTION

EnCana Oil & Gas (USA) Inc. (EnCana), is submitting this Public Participation Plan (PPP) to the Wyoming Department of Environmental Quality (WDEQ) pursuant to Voluntary Remediation Plan (VRP) Rules and Regulations – Title 35, Chapter 11, Article 16 of the Wyoming Environmental Quality Act, W.S. § 35-11-1601 et seq. (Act). The primary objective for developing this document is to allow the public the ability to participate in the VRP activities associated with three of EnCana's natural gas production locations that are enlisted in WDEQ's VRP program. These locations include: Tribal Pavillion 14-11, Tribal Pavillion 42-11, and Tribal Pavillion 24-3.

The PPP has been developed to provide background information on the VRP sites and to describe the recommended approach for communicating VRP-related activities to interested parties. The PPP provides a:

- Framework for community participation including voicing concerns, interests, and expectations for the VRP sites;
- Mechanism for dissemination of site information and for receiving public feedback; and
- Means for obtaining information related to planned site assessment and remediation activities.

2.0 SITE AND PROJECT HISTORY

2.1 History of VRP Sites

The Pavillion Natural Gas Field is located east and north of Pavillion, WY, approximately 15 miles west of Riverton, WY. The Pavillion area is characterized by a shallow water table aquifer with groundwater flow direction generally toward Five Mile Creek which runs west to east bisecting the Pavillion Field. Geologic features include thin unconsolidated alluvial and colluvial deposits of Quaternary age underlain by the weathered Wind River bedrock formation.

Figure 1 provides a map showing the location of the three VRP sites, including the surface ownership, adjacent neighbors, and nearby roads. Agricultural land use consists primarily of alfalfa and grazing land. EnCana has operated the three natural gas well locations since acquiring the facilities from Tom Brown, Inc. in 2004. Shell Oil, or other predecessors, drilled and operated these natural gas well locations with the following spud dates:

TP 14-11	November 9, 1955
TP 42-11	August 6, 1973
TP 24-3	October 27, 1965

Since EnCana's predecessors operated these well locations for many years prior to EnCana's acquisition, this period of operations history is not known; however, it is

believed that unlined pits were used for temporary storage of drilling fluids, produced water, and condensate. Currently, the three locations are actively producing natural gas.

2.2 Regulatory Background

EnCana is participating in the VRP program, administered by the WDEQ, at these three locations because hydrocarbon impacts were discovered in groundwater. EnCana address hydrocarbon impacted soils in accordance with the Wyoming Oil and Gas Conservation Commission (WYOGCC) cleanup guidelines.

The current status of EnCana's VRP sites is summarized below:

1. VRP applications for the three locations were submitted and approved by WDEQ on September 7, 2005.
2. EnCana has completed the public notice and comment period which ended on February 10, 2008.
3. Initial site characterization activities were performed in 2007.
4. Preliminary Remediation Agreement (PRA) between EnCana and the WDEQ was submitted to WDEQ on February 25, 2008 and became effective on March 7, 2008.

Anticipated VRP-related activities for each of the three VRP locations include:

1. Conduct continued site characterization activities;
2. Complete a report on site characterization results;
3. Evaluate remediation alternatives;
4. Complete remedy agreements;
5. Implement remedies;
6. Confirm that cleanup objectives have been met; and
7. Obtain certificate of completions.

This PPP includes:

1. A schedule for anticipated VRP-related activities for each site.
2. A commitment to provide the public with all soil and groundwater data.
3. A location in Fremont County where documents will be made accessible to the public.
4. A description of how the data will be made available in electronic form to the public.
5. Contact information.

2.3 Site Investigation Activities

The initial site investigation reports for each site have been submitted to WDEQ for review. These reports were entitled "Report of Groundwater Hydrocarbon Impacts and Pavillion Pit Remediation" dated September 10, 2007 with a follow-up report dated October 12, 2007. The following provides brief descriptions for each VRP location.

2.3.1 Tribal Pavillion 14-11 (API Number 049-013-06355)

The Tribal Pavillion 14-11 is located in the SW1/4 SW1/4 of Section 11, Township 3N, Range 2E. The elevation of the drill pad is approximately 5360 ft. The nearest perennial stream is Fivemile Creek runs northwest to southeast at a distance of approximately one mile north of the TP 14-11. The residence of Mr. and Mrs. John Middelstadt is a few hundred yards to the west of the facility. Figure 1 shows the TP 14-11 site and surrounding features.

Site investigation activities conducted to date at the TP 14-11 have included drilling over thirty (30) pushprobe boreholes on a grid pattern to a depth of bedrock or below the water table. The estimated depth of groundwater on site is approximately 12 ft below ground surface. The range in total hydrocarbons detected in site soils during field monitoring was from 0 – 2000+ ppm. Discrete samples were also collected and submitted to Energy Laboratories for concentrations of hydrocarbons, metals, and salinity.

As part of the site investigation, five groundwater monitoring wells were also installed at this location due to the elevated levels of hydrocarbons in the soil – groundwater interface. The monitoring wells were installed near the west, north, east, and south borders as well as directly in the center of the location.

2.3.2 Tribal Pavillion 42-11 (API Number 49-013-20442)

The Tribal Pavillion 42-11 is located in the SE1/4 NE 1/4 of Section 11, Township 3N, Range 2E. The elevation of the drill pad is approximately 5340 ft. The nearest perennial stream is Fivemile Creek runs northwest to southeast at a distance of approximately 0.25 mile northeast of the TP 42-11. The nearest residence of Mr. and Mrs. Jeffrey Locker is located approximately 0.5 mile east of the facility. Figure 1 shows the TP 42-11 site and surrounding features.

Site investigation activities conducted to date for the TP 42-11 have included drilling over twenty pushprobe boreholes on a grid pattern to a depth of bedrock or below the water table. The estimated depth of groundwater on site ranges from 13 – 14 ft. below ground surface. The range in total hydrocarbons detected during field monitoring was from 0 – 2000+ ppm. Discrete samples were also collected and submitted to Energy Laboratories for concentrations of hydrocarbons, metals, and salinity.

As part of the site investigation, three groundwater monitoring wells were installed at this location due to the elevated levels of hydrocarbons exhibited near the soil – groundwater interface. The monitoring wells were installed near the west, center, and east portions of the area where hydrocarbons were detected.

2.3.3 Tribal Pavillion 24-3 (API Number 49-013-06387)

The Tribal Pavillion 24-3 is located in the SE1/4 SW 1/4 of Section 3, Township 3N, Range 2E. The elevation of the drill pad is approximately 5380 ft. The nearest perennial stream is Fivemile Creek runs northwest to southeast at a distance of approximately 0.3 mile northeast of the TP 24-3. The nearest residence of Ms. Zoeann Randall is located approximately 0.5 mile southeast of the facility. Figure 1 shows the TP 24-3 site and surrounding features.

Site investigation activities conducted to date for the TP 24-3 have included drilling 12 pushprobe boreholes on a grid pattern to a depth of up to 10 – 12 ft below ground surface. The depth of groundwater at this location is estimated to be about 10 ft. below ground surface. The range in total hydrocarbons detected during field monitoring was from 0 – 2000+ ppm. Discrete samples were also collected and submitted to Energy Laboratories for concentrations of hydrocarbons, metals, and salinity.

Three groundwater monitoring wells were also installed at this location due to the elevated levels of hydrocarbons exhibited near the soil – groundwater interface. The monitoring wells were installed near the west, center, and east portions of the area where hydrocarbons were detected.

3.0 INITIAL SITE CHARACTERIZATION RESULTS

EnCana has submitted the initial Site Investigation Reports for the three VRP sites to WDEQ. Additional site investigation requirements will be based upon the WDEQ's review of the initial reports. Although the cause of the hydrocarbon impacts is believed to be similar for each of the three sites, the extent of impacts varies from site-to-site. Initial groundwater characterization results have shown localized hydrocarbon impacts in the vicinity of where the unlined pits were once located.

Site characterization results based on of existing data have shown the following:

- Hydrocarbon impacted soil in known source areas will be cleaned up to meet either WYOGCC cleanup criteria or VRP cleanup levels;
- Soil type (mainly loamy sands) and groundwater depth have been confirmed at each site by using pushprobe boreholes;
- There are no known hydrocarbon impacts to the only VRP site with an adjacent private water well (Tribal Pavillion 14-11); and
- Ecological receptors will be evaluated through the Ecological Risk Assessment per VRP Fact Sheets #14 and #19.

4.0 PLANNED ACTIVITIES AND PROJECT SCHEDULE

The following presents a summary of project work completed and the proposed schedule for 2008 and early 2009. The project schedule applies to all three VRP sites. Changes in schedule are likely and may occur due to certain factors that influence completion of each VRP-related item. These changes will be communicated to WDEQ immediately and to the public through a quarterly newsletter beginning on July 1, 2008. The quarterly newsletter will also provide VRP site-by-site progress updates to all interested parties.

Item	Estimate of Completion Date
Conducted Public Participation Meeting -Pavillion Community Center	September 12, 2006
Initiated Site Assessment Work	February, 2007
Met with WDEQ several times to discuss VRP program *	Fall, 2007
Met with landowners and WDEQ to discuss groundwater results	December, 2007
Conducted Public Notice Period	December, 2007 – February, 2008
Submitted Preliminary Remediation Plan *	February 25, 2008
Submitted Public Participation Plan *	February 29, 2008
Completed Phase I Site Investigation Reports *	March 7, 2008
Public Review Period for Public Participation Plan	April 14 – May 14, 2008
WDEQ requests Additional Site Characterization Activities	Spring, 2008
Perform Additional Site Characterization Activities *	June 1 – August 1, 2008
Perform Field Activities to Address Impacted Soils *	June 1 – August 31, 2008
Prepare Phase II Site Investigation Report *	September 15, 2008
Submit Site Remedy Evaluation*	November 1, 2008
WDEQ Completes Draft Remedy Agreement	November 21, 2008
Conduct Public Notification Process of Remedy Agreement	November 21 – January 1, 2009
Final Remedy Agreement *	January 1, 2009
Implement Remedy Alternative	March - May, 2009

* Denotes activity for review and approval by WDEQ

** The public will have access to all data, correspondence, and documentation

The underlying goal of the VRP is to reach a remedy agreement between WDEQ and EnCana. This agreement establishes the agreed upon remedial option for each site with components including:

- Remedial action work plan
- Remedial action schedule
- Provisions for modifying the remedy agreement
- Any other provisions or terms necessary to support the remedy implementation

The process for developing final reports includes:

- Submittal of draft document for WDEQ review
- Modifying document based on WDEQ comments
- Finalization of the document

Wyoming Statute 35-11-1604(d) requires public notice prior to the WDEQ and EnCana entering into a remedy agreement. This process allows public review and comment on the proposed remedy agreement.

5.0 COMMUNITY PARTICIPATION

EnCana has adhered to all of the VRP requirements for public notification. At least twenty individuals or groups notified WDEQ that they wished to be involved in the Public Participation Process. EnCana will continue to keep the public informed to meet or exceed the recommended VRP public awareness approach.

EnCana is committed to keep all interested public informed on all aspects of the VRP sites activities and progress. To keep the public up-to-date on progress, a quarterly newsletter will be mailed to all parties on the interested party list maintained by EnCana and WDEQ. In addition, an easily located file of all data, correspondence, and documentation will be maintained at the following locations:

- Riverton Library – 1330 West Park, Riverton, WY. 82501
- Central Wyoming Community College Library – 2660 Peck Avenue, Riverton, WY. 82501

Hard copies of reports can be made available to interested parties on a special request basis.

Attachment 1 provides the WDEQ and EnCana representatives contact list. Attachment 2 provides a list of all individuals and organizations that are currently on the Interested Parties Mailing List. The mailing list may be modified at any time by contacting Ms. April Woodward of EnCana at 307-857-4600.



Tom Doll <tom.doll@wyo.gov>

Pavillion Meeting Notes 20 April 2011

Tom Doll <tom.doll@wyo.gov>

Tue, May 10, 2011 at 2:00 PM

To: Alan Hofer <ahofer12@wyo.com>, Alan Ver Ploeg <verploeg@uwyo.edu>, Alana Cannon <alana.cannon@wy.usda.gov>, Andrea Taylor <andrea.taylor@encana.com>, Ann Stoeger <ann.stoeger@wy.usda.gov>, Armando Ramirez <ar0619@owc.edu>, Bob King <bobking06@qwestoffice.net>, Brandon Kintzler <brandon.kintzler@encana.com>, Cathy Purves <cpurves@tu.org>, Corky Vickers <corky.vickers@encana.com>, David Haire <dhaire@bresnan.net>, David Stewart <david.stewart@encana.com>, Deb Harris <dham2@wyo.gov>, Deb Thomas <dthomas@nemontel.net>, Deisa Allen <dallen@sublettecd.com>, Doyle Ward <tamraward@bresnan.net>, Dustin Krajewski <dustin.krajewski@aecom.com>, Fernando Roman <fernandor@wyoming.com>, George Moser <gmoser@seo.wyo.gov>, Gregory Oberley <oberley.gregory@epa.gov>, Jeff Locker <flocker@wyoming.com>, Jesse LeClair <jessieleclair@hotmail.com>, Jimmy Goolsby <jimmy@goobsbyfinley.com>, John Corra <john.corra@wyo.gov>, John Fenton <jfenton_indianridge@wyoming.com>, John Passehl <jpassehl@wyo.gov>, John Schmidt <john.schmidt@encana.com>, Jolene Catron <jolene@windriveralliance.org>, Jon Kaminsky <jkaminsky@blm.gov>, Joy Bannon <joybannon@wyomingwildlife.org>, Karl Osvald <karl_osvald@blm.gov>, Kassel Weeks <zugu-out@hotmail.com>, Kathy Brown <kbrown2@wyo.gov>, Keith Guille <keith.guille@wyo.gov>, "KEVIN FREDERICK, P.G." <kfred@wyo.gov>, Kimberly Shelley <kimberly.shelley@fremontcountygovernment.org>, Kirsten Derr <kirsten.derr@encana.com>, Lisa Campbell <lisa.campbell@fremontcountygovernment.org>, Lisa Lindemann <llinde@seo.wyo.gov>, Louis Dickinson <lousdrilling@hotmail.com>, Louis Meeks <ldmeeks@wyoming.com>, Mark Pepper <markp@warws.com>, Melissa Fox <mpf0503@owc.edu>, Nathan Wiser <nathan.wiser@epa.gov>, Paul Ulrich <paul.ulrich@encana.com>, Rob Parker <parker.robert@epa.gov>, Ron Mellor <mellor.ron@epa.gov>, Ross Jorgensen <rossj@warws.com>, Ryan McConnaughey <ryan.mcconnaughey@mail.house.gov>, Sandy Tinsley <sandy_tinsley@enr.senate.gov>, Scott Quillinan <scottyq@uwyo.edu>, Steve Babits <sbabits@wyoming.com>, Susan Hill <oriolehill@deepool.com>, Tara Berg <tara.berg@fremontcountygovernment.org>, Tom Doll <tom.doll@wyo.gov>, Tom Kropatsch <tom.kropatsch@wyo.gov>, gary.strong@wyo.gov

Participants:

Here are my notes from the April 20, 2011 Pavillion Working Groups meeting held at CWC in Riverton. Please email me with any corrections or additions. I also attached a file with a well schematic and a schematic of the cementing process. That second attachment is from the API Hydraulic Fracturing Operations-Well Construction and Integrity Guidelines, API Document HF1, First Edition, October 2009. That document is available at <http://www.gwpc.org/e-library/documents/general/API%20Hydraulic%20Fracturing%20Guidance%20Document.pdf> if you want to learn more.

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2 attachments

Notes_Pavillion Working Groups Meeting_CWC Riverton_20April2011.pdf
70K

O&GWellSchematic+Cementing.pdf
70K

Notes from the Pavillion Working Groups Meeting held April 20, 2011 at Central Wyoming College in Riverton

9:00 am to 11:45 am Pits Working Group

1. Irrigation – Greg Oberley reported EPA GIS review for irrigation is a work-in-progress
2. Records Search for Potential Additional Sources within 1500 foot radius – Greg reported the search is a work-in-progress and that access for ground truth inspection may be an issue. Greg is interested in reviewing air photos for 1975 and 1985 as Kirsten Derr-EnCana reported all pits were replaced with tanks in the 1995-1997 timeframe.
3. Other potential sources – Greg Oberley-EPA said a records search into septic systems, dumps, oil and chemical storage sites is a work-in-progress. Kathy Brown-DEQ reported that a DEQ database search did not identify any potential sources but she will need to do a paper records search to confirm. John Fenton said he needed more time to research county records and work with County Planning to identify potential sources.
 - a. Action item: Tom Kropatsch-OGCC to coordinate a conference call to discuss sources.
4. Areas of Public Concern – Report on Ground Truth onsite visits April 13-14, 2011 by Rob Parker-EPA, Tom Kropatsch-OGCC, Kathy Brown-DEQ, John Fenton, Andrea Taylor-EnCana
Thanks to them for their time and effort to visit these sites over the two-day period.
 - a. Reviewed spreadsheet handout that listed the 32 sites that were visited.
 1. Reviewed and discussed the ranking, actions required and the anecdotal comments made for each site.
 - b. Discussion included a request for disclosure of landowner name for each site which Working Group members declined to include.
 - c. GPS location which was taken at each site will be added to the spreadsheet.
 - d. Action items:
 1. Additional records search is required for all 32 sites.
 2. Cuttings pits – analytical data availability? To be researched by Kathy Brown-DEQ and David Stewart-EnCana.
 3. Meeting in Lander to be scheduled to review federal and tribal well records for information for those sites that have mid to mid-high ranking – Jon Kaminsky-BLM to coordinate, OGCC and DEQ to attend but other visitors will limited due to file area space and records confidentiality.

12:45 pm to 2:00 pm Well Integrity Working Group

1. Records Review – Gary Strong, OGCC, discussed his review of 169 wells drilled in the Pavillion area, 80 of which are wells of interest. He has 10 of these 80 left to review in detail and will continue that effort.
 - a. Review for well integrity concentrates on the surface and production casing cementing jobs
 - i. 46 wells of the total 169 wells were plugged.

- ii. Of the 123 remaining wells, 33 well records do not indicate or there is no clear evidence in the OGCC records that cement was circulated to surface on the surface casing or the production casing cement job.
- iii. Of the 33 wells, 11 are non-federal wells and 22 are federal or tribal wells
 - 1. Action – recommend that 29 producing wells have a bradenhead pressure test taken, that the 3 shut-in wells have a mechanical integrity pressure test, and 1 well be reviewed for a re-plugged. Gary Strong-OGCC identified the wells on a spreadsheet.
 - 2. Action - recommend well files be reviewed for completion fluids used for well stimulation. Gary Strong-OGCC stated that pre-1986 46 wells were drilled with invert based mud and post-1986 123 wells were drilled with water based mud. He said that additional records research is needed to identify the select number of pre-1986 stimulations that may have used diesel based fluids and identify which wells used water based stimulation fluids. Discussion included this as an action for the team federal and tribal well records review in Lander with BLM.
- 2. The OGCC webpage is <http://wogcc.state.wy.us> and well information can be found by API number (a unique identifier for each well); by ¼ - ¼ Section, Township and Range; by Operator Name. Search Completions and Sundries. Action – Tom Doll to provide a gas well diagram.
- 3. Pathway Review – Water Supply wells: George Moser-SEO stated his research identified 33 water supply wells with valid SEO permits, 21 of which had a Statement of Completion report but the majority do not note cement use.
 - i. SEO Standards 1974 required a water supply well to have the top 10 feet at surface sealed.
 - ii. SEO Standards 2010 require the sealing of the top of the well to prevent contamination.

2:00 pm to 2:15 pm Update on WWDC Water Supply Study. John Wagner-DEQ stated that an intense review of available hydrogeology and water quality information has been undertaken by the WWDC contractor. A preliminary result is the use of groundwater in the core area has been ruled out. The contractor is reviewing the following water source solutions:

- 1. Town of Pavillion supply and additional system requirements.
- 2. Separate well or well field from outside the core area.
- 3. Treated well in the core area.
- 4. Treated surface water source.
- 5. Individual treatments for private wells.
- 6. Individual cisterns for hauled-in water from an outside source.

Scoping meetings are anticipated in the spring to summer timeframe with the final report December 2011.

2:15 pm to 2:30 pm EPA April, 2011 Sampling Update from Greg Oberley-EPA:

1. Two deep monitoring wells were sampled in October, 2010.
2. EPA is going back to old data to apply Quality Assurance (QA) to the highest level EPA standard, Level 1.
3. Sampling in April, 2011 and the October, 2010 sampling includes the EPA protocol on sampling and a QA auditor was onsite when samples were taken.
4. The purpose of the sampling in April, 2011 was to provide a vertical profile of water quality to assist in demonstrating if contamination of concern is from shallow versus deep sources.
 - a. Two deep (800 foot and 1,000 foot) monitoring wells were drilled in 2010. EPA used a handheld gas detector during the drilling of the wells. Those wells were sampled in October, 2010 and in April, 2011.
 - b. 12 additional water supply wells at various depths from 50 feet to 750 feet were sampled in April, 2011. Low flow samples were taken at existing infrastructure.
 - c. No sampling was done at the monitoring well at the Voluntary Remediation Program site.
 - d. Suite of chemicals to be identified from sample lab analyses included added analytes from prior testing lists and included glycol method and carbon isotope testing.
 - e. The QA Protocol is to be posted on the EPA Region 8 webpage along with the listing of wells sampled.
 - i. Test results may be late summer at the earliest due to the QA process which is extremely rigorous.
5. Discussion of the testing included the following
 - a. Elimination of bacteria sampling in April 2011 versus prior testing.
 - b. Water supply well information - EPA is struggling to get the data.
6. EPA Region 8 hired a geophysicist to look at the well log data from 1000 feet back to surface.

Meeting was adjourned at 2:30 pm. Action – Working Groups to set the next meeting date and place. Thanks to Kathy Brown-DEQ for coordinating the meeting site.

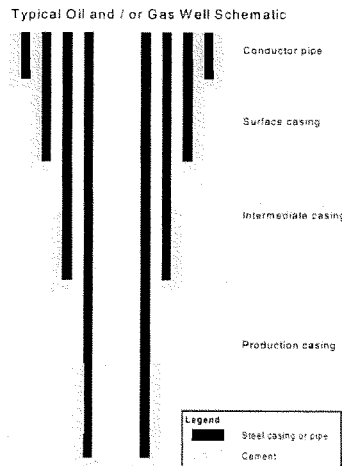


Figure 1—Typical Well Schematic

Casing used in oil and gas wells that will be hydraulically fractured should meet API standards, including API Spec 5CT. API casing specifications and recommended practices cover the design, manufacturing, testing, and transportation. Casing manufactured to API specifications must meet strict requirements for compression, tension, collapse, and burst resistance, quality, and consistency. The casing used in a well should be designed to withstand the anticipated hydraulic fracturing pressure, production pressures, corrosive conditions, and other factors. If used or reconditioned casing is installed in a well that will be hydraulically fractured, it should be tested to ensure that it meets API performance requirements for new built casing.

Casing and coupling threads should meet API standards and specifications to ensure performance, quality, and consistency, including API Spec 5B. If proprietary casing and coupling threads from a specialized supplier are used, these threads must also pass rigorous testing done by the supplier and should adhere to applicable subsets of the API qualification tests.

5 Cementing the Casing

5.1 General

After the casing has been run into the drilled hole, it must be cemented in place. This is a critical part of well construction and is a fully designed and engineered process. The purpose of cementing the casing is to provide zonal isolation between different formations, including full isolation of the groundwater and to provide structural support of the well. Cement is fundamental in maintaining integrity throughout the life of the well and part of corrosion protection for casing.

Cementing is accomplished by pumping the cement (commonly known as slurry) down the inside of the casing, and circulating it back up the outside of the casing. Top and bottom rubber wiper plugs should be used to minimize mixing of cement with drilling fluid while it is being pumped. A downhole schematic of a cement job in progress is illustrated in Figure 2.

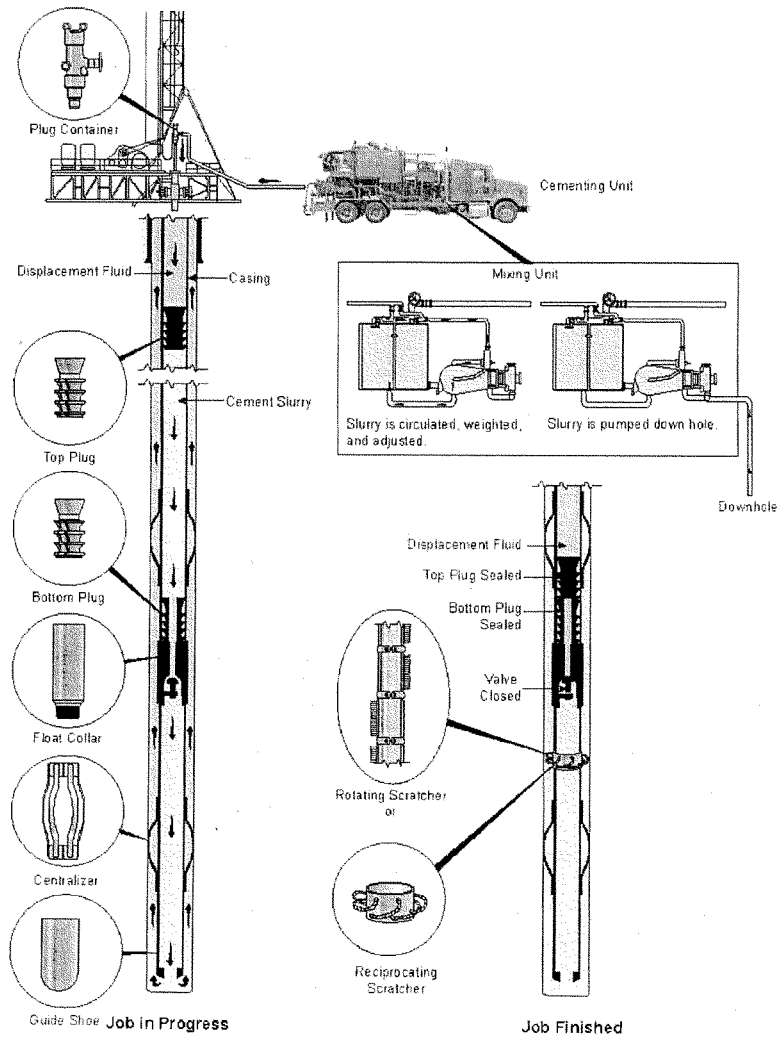


Figure 2—Cementing the Casing

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Jessieclair	CWC	jessieclair@hotmail.com
Deis Thomas	PRBC, PACC	dthomas@nemotel.net

Wells w/ Required or
Suggested Testing.

4/19/2011

ApI Number	Well No.	Unit Lease Density changed 6/1/1986, 1/1/2005	Range	Township	Sec	Qtr	Qtr	Recommendation for further action 4/19/11, MIT if table Bradenhead if Producing	Co. that Drilled the well	Oversight agency
1320026	12-1	TRIBAL PAVILLION SW NE	1	1	2			Bradenhead test	TBI	BLM/ Tribal
1321997	12-1	TRIBAL PAVILLION NE SW	1	1	12			Bradenhead test	TBI	BLM/ Tribal
1322625	10-026	TRIBAL PAVILLION NW SE	2	3	12			Bradenhead test	Encana	BLM/ Tribal
1322070	13-2	TRIBAL PAVILLION NW SW	2	3	2			Bradenhead test	TBI	BLM/ Tribal
1321126	14-2	TRIBAL PAVILLION SW SW	2	3	2			Bradenhead	Shell	BLM/ Tribal
1322067	14-038	PAVILLION FEE SW SE	1	3	2			Bradenhead up grad	TBI	WOGCC
1306367	14-3	IND 14-10-126-1358	SE SW	1	3	2		Bradenhead test	Shell	BLM/ Tribal
1300666	4-6	Barbership Fee	SE NE	4	3	2		MIT, up grad	Palmer	WOGCC
1300675	47X6	USA TRIBAL 258	NE NE	2	2	2		Bradenhead	Shell	BLM/ Tribal
1321131	21-9	IND 14-20-0258-2001	NE NW	8	3	2		Replay 8 Ann. Refr. risers	Shell	BLM/ Tribal
1321991	31-10	PAVILLION FEE NW NE	10	3	2			Bradenhead	TBI	WOGCC
1321994	42-10	TRIBAL PAVILLION SE NE	10	3	2			Bradenhead test	TBI	BLM/ Tribal
1322724	21-038	TRIBAL PAVILLION SW NE	10	3	2			Bradenhead	TBI	BLM/ Tribal
1321998	20-10	TRIBAL PAVILLION SE NW	10	3	2			Bradenhead Pressure	TBI	BLM/ Tribal
1321978	22-10	USA TRIBAL 258	SE NW	10	3	2		Bradenhead	Shell	BLM/ Tribal
1321141	10-10	TRIBAL PAVILLION SW NW	10	3	2			Bradenhead Pressure	TBI	BLM/ Tribal
1321867	10-10	TRIBAL PAVILLION NW SE	10	3	2			Bradenhead test	TBI	BLM/ Tribal
132416	21-100	TRIBAL PAVILLION NE SW	10	3	2			Bradenhead test	TBI	BLM/ Tribal
132417	22-108	TRIBAL PAVILLION NE SW	10	3	2			Bradenhead test	TBI	BLM/ Tribal
1321862	22-10	TRIBAL PAVILLION NE SW	10	3	2			MIT	TBI	BLM/ Tribal
132243	13-10	PAVILLION FEE NW SW	10	3	2			Bradenhead test	TBI	WOGCC
1322046	14-10	TRIBAL PAVILLION SW SW	10	3	2			Bradenhead test	TBI	BLM/ Tribal
1321866	41-11	PAVILLION FEE NE NE	11	3	2			Bradenhead test	TBI	WOGCC
1320442	42X-11	W.H. PAUL PATENT	SE NE	11	3	2		Bradenhead test	Shell	WOGCC
1320878	22-12	14-20-0258-1310	SE NW	12	3	2		Bradenhead	Shell	BLM/ Tribal
1322255	12-12	TRIBAL PAVILLION SW NW	12	3	2			Bradenhead test	Encana	BLM/ Tribal
1322824	33-12	PAVILLION FEE NW SE	12	3	2			Bradenhead Test	Encana	WOGCC
1322214	13-12W	PAVILLION FEE NW SW	12	3	2			Bradenhead Test	TBI	WOGCC
1322060	13-12	PAVILLION FEE NW SW	12	3	2			Bradenhead	TBI	WOGCC
1322057	21-13	PAVILLION FEE NE NW	13	3	2			Bradenhead test	TBI	WOGCC
1321695	41-15	TRIBAL-PAV	NE NE	15	3	2		Bradenhead Test	TBI	BLM/ Tribal
1320889	21-15	USA TRIBAL 258	NE NW	15	3	2		Bradenhead Test	Shell	BLM/ Tribal
1320764	44-15	DOLES UNIT	SE SE	15	3	2		MIT	Shell	WOGCC

The above wells were selected because they indicated a possible annular space between surface casing and top of prod. casing cement.

Doll, Tom

From: Doll, Tom
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Cc: Guille, Keith
Subject: RE: Next Meeting for Pavilion Working Groups
Attachments: Pavillion Meeting Agenda April 20 2011.docx

The agenda is attached. I will facilitate as John Corra will not be able to attend. See you April 20 at the Central Wyoming College, Riverton, in the Fremont Room (SC103) in the Student Center. We will start at 9:00 am.

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<http://wogcc.state.wy.us>

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From: Corra, John
Sent: Tuesday, April 05, 2011 1:12 PM
To: Doll, Tom; Steve Babits (sbabits@wyoming.com); Brown, Kathy; Jolene Catron (jolene@windriveralliance.org); Jimmy Goolsby (jimmy@goolsbyfinley.com); David Haire (dhaire@bresnan.net); Deb Thomas (dthomas@nemontel.net); Harris, Deborah; Alan Hofer (ahofer12@wyo.com); Ross Jorgensen (rossj@warws.com); Bob King (bobking06@qwestoffice.net); Dustin Krajewski (dustin.krajewski@aec.com); Kropatsch, Tom; Lisa Lindemann (llinde@seo.wyo.gov); Wagner, John; Jeff Locker (rlocker@wyoming.com); Ron Mellor (mellor.ron@epa.gov); George Moser (gmoser@seo.wyo.gov); Gregory Oberley (oberley.gregory@epa.gov); Rob Parker (parker.robert@epa.gov); Passehl, John; Mark Pepper (markp@warws.com); Alan Ver Ploeg (verploeg@uwyo.edu); Scott Quillinan (scottyq@uwyo.edu); David Stewart (david.stewart@encana.com); Andrea Taylor (andrea.taylor@encana.com); paul.ulrich@encana.com (paul.ulrich@encana.com); Corky Vickers (corky.vickers@encana.com); Doyle Ward (tamraward@bresnan.net); Nathan Wiser (wiser.nathan@epa.gov); Kirsten Derr (kirsten.derr@encana.com); Jon Kaminsky (jkaminsk@blm.gov); John Fenton (fenton_indianridge@wyoming.com); Louis Dickinson (lousdrilling@hotmail.com); Louis Meeks (ldmeeks@wyoming.com); Kassel Weeks (zugu-out@hotmail.com); Frederick, Kevin
Cc: Guille, Keith
Subject: Next Meeting for Pavilion Working Groups

At our last meeting it was agreed that the week of April 18 would be a good week to schedule our next meeting. I will not be there due to a prior commitment and John Wagner will represent me. Tom will be there to lead the discussions. Tom may also want to adjust the agenda and if so will communicate separately. A press release will be sent out today or tomorrow.

Here are the meeting details (thanks to Kathy Brown for arranging!):

Date: Wednesday, April 20, 2011

Time: 9 AM to 4 PM. Depending on progress, the meeting could end earlier.

Location: Central Wyoming College, Riverton, WY. Fremont Room (SC103) in the Student Center

Lunch: There is a food court at the site and it will be open. You must use either cash or check, no credit cards are accepted. The actual lunch break time and duration can be decided at the meeting.

Draft Agenda:

- Review of Assignments from the last meeting
- Pits Working Group discussion and progress report
- Well Integrity Group discussion and progress report
- Updates on monitor wells, water supply study (if available)
- Public comments

Special Note to Group Leads: I encourage you to prepare a more detailed agenda for your portion of the meeting.

For all who are on the working groups, please inform your group leads, Tom and me of what items you want to cover at the meeting.

Public Area of Concern	Location	Priority	Action	Comments
1	Tribal 21-9	High	Review former pit location, PA info	Drilled 1980, PA 1992. PA marker is loose. Well produced large amounts of water, reportedly overflowing the 400 yd3. Topsoil stockpile may still exist. Potential pits not previously investigated.
2	W E Lloyd #1	Mid-High	Records search for former pit location, potential field investigation	PA well on same pad as new well 34X-03. Site review indicates pit may be on north side of location. High water was present went 34X-03 drilled - rat hole/mouse hole reportedly filled with water. Surrounding area was historically irrigated. Landowner plans to restart irrigation. <i>on the surface</i>
3	Tribal 33X-10	Mid	Review pit closure and previous investigation data, potential additional field investigation	Drilled 1963-1965, plugged 1984? Encana investigated pit and excavated approx 400 yd3. During excavation the 4 sides of pit were reportedly identified. Landowner concerned that full extent of pit was not identified and contaminated soil remains in place. Located in field that is irrigated, reported visibly stunted plant growth.
4	Tribal Pavillion 15-21X	Mid-High	Review well records	Drilled 1998-1999, recompleted 2000. Water based muds with lined drill pit? Drilled as a deeper well then completed shallower. Pit location south of well based on vegetation, subsiding soil. Concern is pit was open for several years and received various materials, close to irrigation ditch. <i>Encana surface - not within WSW</i>
5	Pavillion 11-10	Mid	Review records to determine if another well was ever drilled	Current location is for well 11-10. To the east is a concrete pad of type used to support rig during 1960's drilling program. Doesn't appear to be a well, if well was ever drilled concern is that a pit exists somewhere in field. Based on WOGCC well records there is some mention in file for 33X-10 of well named 11-10 to be drilled in NWNW Sec 10, well was moved to NWSE Sec 10 and renamed 33X-10. Original location may have been the concrete pad east of the current well 11-10. Location for well was surveyed in 1963. <i>irrigated field may have been built but never drilled</i>
6	Tribal 41-9	Mid-High	Review previous investigation report, potential additional field investigation	Drilled 1979, concern is that previous pit investigation/excavation didn't remove all contaminated soil. Excavated approx. 1280 yd3. Pit had some water present during excavation, water may have had an odor - no apparent hydrocarbon sheen on water. Pit is close to irrigation ditch, groundwater not apparently shallow enough to infiltrate into ditch. During excavation the irrigation company requested Encana stay a certain distance from the irrigation ditch to not compromise ditch walls. Tank present on south side of pit also restricted access to excavate too far south. <i>when ditch was dug GW rises - Midvale may know date when constructed</i>
7	Pavillion 31-10	Low	Review disposal records for cuttings, types of pad liners/stabilizers	Liner material visible on location, concern is that cuttings were buried onsite, well is on irrigated land. Liner/geotextile was used to stabilize the location to keep vehicles from sinking into soft soil under location. <i>on the surface</i> <i>Geotex used to stab</i>
8	Tribal 43-10	Mid	Review well records, any potential cuttings analytical	Drill cuttings buried onsite, toe of slope was subsequently cut back, exposing the cuttings pit in the road cut on north side of location. Erosion of cuttings onto road and field below.
9	Tribal Pavillion 41-15	Low	Review well records for cuttings disposal	Drilled in 1994, landowner moved in after well was drilled and would like information on potential cuttings pit onsite. Production has always been into tanks.

Add landowner? No
Add GP location

Pavillion Areas of Public Concern

Site Visit Notes

April 13-14, 2011

Page 2 of 3

10	Tribal Pavillion 43-10B	Low	Review well records to determine location of cuttings pit and analytical available	Cuttings pit onsite, when well was drilled there was apparently a shallow GW table. Well is on top of ridge, would appear that GW may be perched aquifer.
11	Tribal Pavillion 33-10B	Low	Review well records	Cuttings buried onsite SW of well against ridge. Concern is that precip. Runs down hill across buried pit and eventually onto irrigated land. Also landowner water well nearby.
12	33X-10, The Bowl	Mid	Records review for waste handling during drilling, potential field investigation	33X-10 drilled 1963-1965, portion of cuttings from well were reportedly transported to the Bowl location and disposed. Landowner concerns of hydrocarbon odors and wet, boggy conditions, stained soil. Landowner feeds cattle in area. <i>Never used by Encana</i>
13	Tribal 12-13	Mid	Review well records, research pit location, potential field investigation	<i>Joe Dennis</i> Drilled 1978, PA in 2001. Not previously investigated, PA marker is most likely under new shed. Pit location is assumed to be NW of shed in area used for implement storage. Location is next to irrigation ditch. Mr. Locker previously plowed up potential pit location several years ago.
14	Tribal 33-10, 33-10W	Low	Review well records for Lozier cuttings disposal	Concern was cuttings buried onsite. Encana records show cuttings transported offsite to Lozier site.
15	Tribal Pavillion 23-10C	Low	Review cuttings records, potential drill cuttings sampling	Cuttings buried onsite, landown concerned of salt concentrations in cuttings. Closed loop, non-irrigated, pit location up against ridge. Concern of water runoff from ridge across pit location.
16	Tribal Pavillion 23-10B	Low	Review cuttings records, potential drill cuttings sampling	Cuttings buried onsite, landown concerned of salt concentrations in cuttings. Closed loop, non-irrigated, pit location up against ridge. Concern of water runoff from ridge across pit location.
17	Pavillion Fee 41-10B	Remove from List	N/A	Location identified by Mr. Meeks as a depression that was a historic oil and gas pit. Information from former landowner is that location is a water retention pond constructed by former landowner Mr. Williams to stop the irrigation water runoff from rotting Mr. Meeks hay stored downgradient.
18	Tribal Pavillion 14-1	Mid	Review previous investigation report	In irrigated land south of compressor. Encana previously investigated pit on location, excavated soil (need total volume), GW never encountered.
19	Coolidge 1-4	Low	Review well info	Never a production pit at location, always had tanks. Pit would have been cuttings only. No apparent pit location at site. Well drilled in 1982 by Amoco?
20	Doles Unit 44-15	Mid	Review pit investigation report, potential additional field investigation	Encana previously investigated, clean up goal 5500 ppmTPH, 486 ppm highest detected.
21	Tribal 41-1	Remove from List	N/A	Landowner concerned about site during initial EPA tour, walked site and didn't see any evidence of historic pit locations.

Pavillion Areas of Public Concern
Site Visit Notes
April 13-14, 2011

Page 3 of 3

22	Tribal Unit 1	Remove from List	N/A	Review pit investigation report, potential additional field investigation	Concern was potential pit and proximity of irrigation tile drain. Walked site and couldn't find any evidence of location.
23	Tribal Pavillion 21-15	Mid		Review pit investigation report, potential additional field investigation	Previously investigated pit - clean up goal ²⁵⁰ 400 ppm TPH highest detected was 400 ppm
24	Tribal 21X-14	Mid		Review pit investigation report, potential additional field investigation	Multiple potential pit locations investigated by Encana, no contamination detected, 4000 ppm clean up goal
25	Tribal Pavillion 31X-14	Mid		Review pit investigation report, potential additional field investigation	Drilled 1973, pit previously investigated, 1000 ppm clean up goal, 260 yd3 soil excavated. Post excavation samples all non-detect.
26	Tribal Pavillion 11-14	Mid		Review pit investigation report, potential additional field investigation	Previously investigated, clean up goal set at 4000 ppm TPH, highest detected was 16 ppm TPH, no excavation necessary.
27	Ora Wells 14-12	Mid-High		Review pit investigation report, potential additional field investigation	Discovery well, former landowner was one of first complaints of pit and water well contamination. Clean up goal 1000 ppm, soil excavated but 1800 ppm remained, WOGCC instructed Encana to remove additional soil. Need follow up report. Excavation difficult due to safety concerns with lines out of separator.
28	Tribal Pavillion 22-12	High		Encana to tabulate analytical data and review with Mr. Locker	Concern from landowner that pit was completely investigated, also concern due to proximity to water well and detection found in water well during first round of sampling.
29	Buddy Ridge Pavillion Fee 33X-11	Remove from List	N/A	Records review for cuttings	team to discuss removal of area from list - outside study area
30	Pavillion Fee 31-9	Mid-Low		Review cuttings records	Cuttings burial pit, review for potential cuttings analytical. Continue to monitor MW-5 which was installed for VRP 42-11 and is adjacent to cuttings pit - no detection to date at water well
31	Pavillion Fee 13-03W	Low		Review cuttings records	Drilled closed loop, cuttings buried onsite, concern is of shallow water table. Potential cuttings sampling.
32		Remove from List	N/A		closed loop no pit cuttings hauled away recent well

VRP 14-11
412-11
24-3

AGENDA

Pavillion Working Groups Meeting

April 20, 2011 Riverton, Wyoming

Potential Attendees: DEQ: J Corra, J Wagner, K Frederick, J Passehl, D Harris, J O'Conner, K Brown, C Anderson
 EPA: M Hestmark, G Oberley, R Parker, N Wiser, R Mellor
 Encana: P Ulrich, D Stewart, K Derr, C Vickers
 OGCC: T Doll, T Kropatch, G Strong,
 Wind River Environmental Quality Commission: D Aragon, D Goggles, D Haire, S Babits
 WGS: A Ver Ploeg, S Quillinan
 BLM: J Kaminsky
 SEO: L Lindemann, G Moser
 WARWS: M Pepper, R Jorgensen

9:00 AM – 11:30 AM: Pits

- Review irrigation information – maps, dates, ditches (G Oberley, EPA)
- Findings from records search – additionally identified locations within 1500' radius with pits (T Kropatsch OGCC, J Kaminsky BLM, D Stewart Encana)
- Other potential sources in 1500' radius – septic, dumps, storage tanks, etc. (S Quillinan WGS, K Brown DEQ, J Fenton, P Ulrich Encana)
- Report on Ground Truth CIA's – (R Parker EPA, T Kropatsch OGCC, J Fenton, K Brown DEQ, A Taylor Encana)
- Work plan development for investigation of any additional potential sources

Noon – 2:30 PM: Well Integrity

- Records Review: Sec. 1-4, 9-13 and 15 T3N,R2E, John K, G. Strong, Corky V. Ron M, G. Moser, Lisa L
 Water well TDs and construction including surface seals. Location in relation to surface features.
 Gas Well Construction
- Casing cement data, volumes, types
 CBL data, TOC notations
 Shallow gas, noted in literature
- Chemicals Review:
- Drilling fluids,
 Invert- most pre 1986 wells
 Water based- all post 1986 wells

- Completion fluids,
 - Diesel- pre 1986 or older ? possibly just selected wells.
 - Water based- post 1986 or older
- Populate a GIS database: Greg Oberley
- Pathway Review: Look at gas wells, H₂O wells and interconnections.
- Well Testing –
 - Select wells for integrity or annular testing
 - Bradenhead: Producing wells
 - MIT: Shut-in or idle wells
- Select for onsite review .
 - Water Wells
 - Gas wells
 - P and A'd wells

2:30 PM – 3:00 PM:

- Update on WWDC water supply study

3:00 PM – 3:30 PM:

- Public comment

PITS WORK GROUP

Map the irrigated areas, when irrigation started, including ditches (Greg Oberley)

Records Search (including landfill records) for wells that have cuttings, and production pits within circles.

- Tom K, OGCC, John K., BLM, David, EnCana

Look for other potential sources inside 1500' radius circles (Septic Systems, other historical items, dumps, storage tanks, equipment maintenance areas – WGS can help.

- Scott Quillinan, Kathy Brown, John Fenton & Paul Ulrich

Ground truth community identified Sites:

- Rob Parker, EPA, Tom K. OGCC, J Fenton, Kathy Brown, Andrea Taylor, EnCana

DRILL HOLE GROUP

1. Universe to look at: Sec. 1-4, 9-13 and 15 T3N,R2E
2. Records Review: John K, G. Strong, Corky V. Ron M, G. Moser, Lisa L
3. Chemicals Review: Wait until next meeting.
4. Populate a GIS database: Greg Oberley
5. Pathway Review: Look at gas wells, H2o wells and interconnections.
6. Well Testing – Wait

Doll, Tom

From: Kropatsch, Tom
Sent: Wednesday, March 09, 2011 11:04 AM
To: Doll, Tom; Strong, Gary; Nelson, Janie
Subject: FW: Narrative associated with Community Identified Areas
Attachments: Letter from John Fenton discussing community identified areas.pdf

Attached are the comments that John Fenton provided to the EPA for the "Community Identified Areas" (pits) at Pavillion. The pit workgroup members tasked with ground truthing these locations will tentatively complete the task on April 5-6.

Tom Kropatsch
 Natural Resource Analyst
 Wyoming Oil and Gas Conservation Commission
 (307) 234-7147
tkropa@wyo.gov

-----Original Message-----

From: Parker.Robert@epamail.epa.gov [<mailto:Parker.Robert@epamail.epa.gov>]
Sent: Wednesday, March 09, 2011 9:22 AM
To: Brown, Kathy; Kropatsch, Tom; Andrea Taylor; fenton.indianridge@wyoming.com
Subject: Fw: Narrative associated with Community Identified Areas

All -

I apologize for this second email. The email address I had entered for John Fenton was incorrect.

Rob Parker
 Site Assessment Manager, Environmental Engineer U.S. Environmental Protection Agency, Region 8
 Address: 1595 Wynkoop St, 8EPR-SA, Denver, Colorado 80202-1129
 Email: parker.robert@epa.gov | Direct Phone: (303) 312-6664

----- Forwarded by Robert Parker/R8/USEPA/US on 03/09/2011 09:16 AM -----

From: Robert Parker/R8/USEPA/US
To: "Brown, Kathy" <kbrown2@wyo.gov>, TKropa@wyo.gov, Andrea Taylor (andrea.taylor@encana.com)
 <andrea.taylor@encana.com>, John Fenton
 <fenton.indianridge@wyoming.com>
Date: 03/09/2011 09:13 AM
Subject: Narrative associated with Community Identified Areas

Kathy, Tom, Andrea, and John,

I have attached to this email a scanned copy of the comments provided to EPA from John discussing the individual areas identified by the community. I will be sure to send out the

map that was compiled showing the approximate locations of these areas. I will send the map using www.transferbigfiles.com (as it is a 15 MB file that some email systems might not receive), so look for an email from that website with a link to download the map. Please let me know if you do not receive this email in the next day or so, and I will try another method of delivery.

I intend to bring GPS equipment to more accurately document the location information for all of these areas for mapping purposes.

(See attached file: Letter from John Fenton discussing community identified areas.pdf)

I understand that a number of us were looking at meeting in Pavillion the week of April 4th. I am hopefully optimistic, but I suspect that it might take a couple of days to visit all 32 sites, so if we are still looking at the first week of April, I'd propose to schedule this work around April 5th and 6th. Does that pose any issues for you all?

Thanks,

Rob Parker

Site Assessment Manager, Environmental Engineer U.S. Environmental Protection Agency, Region 8

Address: 1595 Wynkoop St, 8EPR-SA, Denver, Colorado 80202-1129

Email: parker.robert@epa.gov | Direct Phone: (303) 312-6664

