UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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OFFICE OF CONGRESSIONAL
AND INTERGOVERNMENTAL RELATIONS

The Honorable Andy Harris, M.D.
Chairman
Subcommittee on Energy and Environment
United States House of Representatives
Washington, DC 20515-6371

Dear Chairman Harris:

Thank you for your letter of February 21, 2012, requesting responses to Questions for the Record following the February 1, 2012, hearing before the Subcommittee on Energy and Environment entitled, "Examining EPA's Approach to Ground Water Research: the Pavillion Analysis."

The responses to your questions are provided as an enclosure to this letter. Again, thank you for your letter. If you have any further questions, please contact me, or you staff may contact Pamela Janifer in EPA's Office of Congressional and Intergovernmental Relations at (202) 564-6969.

Sincerely,

Laura Vaught
Deputy Associate Administrator
for Congressional Affairs

Enclosure

**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.



EPAPAV0069648

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 ftp://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*

*ftp://ftp.epa.gov/r8/pavilliondocs/QA_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 ftp://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 reports[1] 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, $Na_2CO_3$) were the cause, alkalinity would be dominated by carbonate ($CO_3$)(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 tends 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 napthalene 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 norseptic 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.
    a. When were these three experts provided information and how long a period did they have to review the information. Please provide dates.
    b. Please submit a complete list of the data and analysis the three experts were provided.
    c. 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?
    d. Please provide the Committee with the names of the three experts and their qualifications.

**Responses:**

a. 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.
b. The following materials were provided to the peer consultation panel for their review:[2]
    1) Draft EPA Research Brief of the Pavillion investigation
    2) Additional text detailing on sampling procedures and analytical methods
    3) Summary of subsurface sample locations, depth of sample collection, times (phases) of sampling, target analytes, laboratories utilized, and analytical methods
    4) Geochemical results for Pavillion ground water
    5) Geochemical impacts in deep ground-water monitoring wells
    6) Aqueous analysis of light hydrocarbon
    7) Gas and headspace analysis of light hydrocarbon
    8) Isotopic data for dissolved, gas phase, and headspace analysis
    9) Detected dissolved methane concentration in domestic and monitoring wells
    10) QA data table of sample collection containers, preservation, and holding times for ground-water samples
    11) Quality Assurance/Quality Control (QA/QC) requirements for:
        a. analysis of metals and major ions
        b. analysis of dissolved gases, DIC/DOC, VOCs, low molecular weight acids and stable isotopes of water
        c. analysis of semi-volatiles, GRO, and DRO
        d. LC/MS/MS analysis of glycols
        e. analysis of $\delta^{13}C$ of dissolved inorganic carbon
        f. $\delta^{13}C$ and $\delta D$ of light hydrocarbons for aqueous and gas samples
        g. analysis of fixed gases and light hydrocarbons for aqueous and gas samples
        h. 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.



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