

**Summary Minutes of the
U.S. Environmental Protection Agency
Science Advisory Board Hydraulic Fracturing Research Advisory Panel
Public Teleconference, March 7 and March 10, 2016**

Date and Time: Monday, March 7, 2016, 11:00 a.m. – 6:05 p.m. ET.; and Thursday, March 10, 2016, 12:00 p.m. – 6:45 p.m. ET

Location: Teleconference Only.

Purpose: The purpose of the March 7 and March 10, 2016 teleconferences was to hear public comments and discuss the Panel's comments on the Science Advisory Board Panel's February 16, 2016 draft report¹ regarding SAB's review of the EPA's draft *Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft – June 2015)*.

Participants:

SAB Hydraulic Fracturing Research Advisory Panel (See Roster, Attachment A):

Dr. David A. Dzombak, Chair	Dr. Bruce D. Honeyman
Dr. Stephen W. Almond	Mr. Walter R. Hufford
Dr. E. Scott Bair	Dr. Richard F. Jack
Dr. Peter Bloomfield	Dr. Dawn S. Kaback
Dr. Steven R. Bohlen	Dr. Abby A. Li
Dr. Elizabeth W. Boyer	Mr. Dean Malouta
Dr. Susan L. Brantley	Dr. Cass T. Miller
Dr. James V. Bruckner	Dr. Laura J. Pyrak-Nolte
Dr. Thomas L. Davis	Dr. Stephen J. Randtke
Dr. Joseph J. DeGeorge	Dr. Joseph N. Ryan
Dr. Joel Ducoste	Dr. James E. Saiers
Dr. Shari Dunn-Norman	Dr. Eric P. Smith
Dr. Katherine Bennett Ensor	Dr. Azra N. Tutuncu
Dr. Elaine M. Faustman	Dr. Paul K. Westerhoff
Mr. John V. Fontana	Dr. Thomas M. Young
Dr. Daniel J. Goode	

Drs. Steven Bohlen, Susan Brantley, James Bruckner, Joel Ducoste, Dawn Kaback, and Joseph Ryan could not participate during the March 7 and March 10, 2016 public teleconferences.

EPA SAB Staff:

Mr. Edward Hanlon, Designated Federal Officer, SAB Staff Office

Other Attendees: A list of persons present on the teleconference line or live webcast, who requested information on accessing the teleconference line, or who noted via email that they participated on the teleconference, is provided in Attachment B.

Materials Available: The agenda and other teleconference materials are available on the SAB website (www.epa.gov/sab) at the following SAB Hydraulic Fracturing Research Advisory Panel

March 7, 2016 teleconference page:

<https://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/d451dd9ce7752a9285257f17006edb7e!OpenDocument&Date=2016-03-07>

Teleconference Summary

The public teleconference was announced in the Federal Register² and was conducted according to the teleconference agenda.³ A summary of the public teleconference follows.

March 7, 2016

Opening Statements

Mr. Edward Hanlon, the Designated Federal Officer (DFO), opened the public teleconference, and made a brief opening statement noting that the SAB Hydraulic Fracturing Research Advisory Panel operates in accordance with the Federal Advisory Committee Act (FACA). He noted the teleconference was open to the public and that teleconference materials were posted on the SAB website. He noted that the purpose of the Panel teleconference was for the Panel to review and discuss the Science Advisory Board Panel's February 16, 2016 draft report¹ regarding SAB's review of the EPA's draft *Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources*, which was released in June 2015. Mr. Hanlon noted that most of the Panel members were serving as Special Government Employees, with one Panel member already being a regular government employee employed at the U.S. Geological Survey. He noted that Panel members were appointed to provide individual expertise and advice, not to represent any organization. He stated that 433 sets of unique written public comments were received by the EPA Docket as of March 7, 2016 for the Panel's consideration, and that 45 members of the public had requested to present oral comments during the teleconference. He stated that the SAB Staff Office identified no financial conflicts of interest or appearance of a lack of impartiality for any Panel members for this review. He also noted that minutes of the teleconference were being taken to summarize discussions and action items in accordance with the requirements of FACA.

Dr. David Dzombak, Chair of the Panel, then welcomed everyone. Dr. Dzombak noted that the objectives for this teleconference were to hear public comments and discuss the Panel's comments on its second draft SAB Report. He noted that the Panel's draft report and other teleconference materials were available on the Panel's March 7, 2016 website for consideration by the Panel and the public, and that the outcome that the Panel was seeking was a consensus SAB report of advice to the EPA Administrator. He also noted that a discussion on next steps would be provided at the end of the teleconference. He stated there were eight charge questions to which the Panel was responding and that these were developed by the EPA's Office of Research and Development (ORD) with review by the SAB Panel. He noted that the Panel worked to identify points of agreement and consensus advice on these charge questions at the Panel's October 28-30, 2015 meeting, and during the Panel's December 3, 2015, and February 1-2, 2016 teleconferences.

Dr. Dzombak noted that the Panel's first draft report was released on January 7, 2016 onto the SAB Panel's February 1, 2016 website for consideration by the Panel and the public. He stated that after holding the Panel's February 1 and February 2, 2016 teleconferences, a second draft Panel report was released on February 16, 2016 and posted on the SAB Panel's March 7, 2016 teleconference website. He also noted that there were 45 requests from members of the public to

present oral public comments during the teleconference, and that members of the public who registered to present oral comments were asked to keep their comments to three minutes or less.

Summary of Written Public Comments

Dr. Dzombak noted that since the Panel's February 1-2, 2016 public teleconference, approximately 65 additional public comments were received and posted to the EPA Docket for the EPA's Draft Hydraulic Fracturing Assessment Report and the Panel's January 7, 2016 and February 16, 2016 draft SAB Reports. He stated that to assist the Panel in its consideration of public comments as it continues to refine its responses to charge questions, SAB Panel members Dr. Elizabeth Boyer, Dr. Susan Brantley, and Mr. Walt Hufford prepared a table of public comments that was posted onto the Panel's teleconference website. He stated that as of March 7, 2016, 433 sets of unique written public comments were received and posted to the EPA's Docket for consideration by the Panel. He noted that since the Panel's February 1-2, 2016 public teleconference, approximately 65 additional unique written public comments were received and posted to the Docket. He noted that instructions on how to access these public comments in the EPA's Docket were posted on the SAB Panel's teleconference website.

Mr. Walt Hufford provided an update to the Panel on the additional public comments received and posted to the EPA's Docket for consideration by the Panel. Mr. Hufford noted that the 433 unique comments that were posted to the EPA's Docket represented comments from approximately 107,600 members of the public. Many of the comments received were identical or nearly identical and were from organized mass mailings. Such comments were considered as one unique comment. Mr. Hufford noted that approximately 4,000 pages of text and documents within these comments have been submitted to the Docket, and that since the Panel's February 1-2 teleconference, 75 additional (65 unique) written public comments have been submitted to the Docket.

Mr. Hufford noted that the table that he, Dr. Boyer and Dr. Brantley provided on the March 7 Panel teleconference website for review was similar to the earlier versions of this table posted on the Panel's earlier teleconference and meeting websites. He noted that the table identified the Docket number, link to the comment, commenter name, commenter affiliation, and state in which the commenter resided, and provided notes regarding the comment and check-boxes related to the report content. He stated that a goal of this effort was to map the content of the comment to the specific charge questions and draft Assessment Report chapters. Mr. Hufford also noted that the table identified comments that provided new scientific resources, such as journal articles or links to data resources.

Mr. Hufford stated that most of the 75 recently-posted public comments voiced support for the EPA draft Assessment Report as written. He noted that the scope of these 75 recent public comments included the following:

- (1) Support of or opposition to the EPA's draft Assessment Report and the original conclusions of the report;
- (2) Details on case studies and state experiences;
- (3) Citations or references to new research, studies, and data;
- (4) Support of or opposition to SAB Panel's draft recommendations to EPA related to including further details about proposed case studies and state experiences in Dimock, Pennsylvania; Pavillion, Wyoming; and Parker County, Texas;
- (5) Personal accounts of impacts of the hydraulic fracturing water cycle (HFWC); and

(6) Commentary on the EPA SAB Panel's draft review comments.

Dr. Dzombak noted there are many interested residents of Pennsylvania who provided public comments and stated that these comments raised the Panel's awareness of various topics. A Panel member noted that Ms. Bridget Scanlon provided a public comment that referred to the Ohio Department of Natural Resources, and stated that this public comment contained information that the Panel had previously requested regarding changes to standards in the State of Ohio and editorial comments. The Panel member suggested that the references noted in this public comment could potentially be included as references within the updated draft SAB Panel Report.

Another Panel member suggested that the updated draft SAB Panel Report note that the EPA should be encouraged to review public comments that have been submitted and posted to the Docket. Dr. Dzombak agreed with this suggestion.

Public Comments

Dr. Dzombak noted that it was important for the Panel to consider public comments, and that Panel members would have an opportunity to direct clarifying questions to the public commenters. He noted that 45 members of the public were registered to present oral comments during the teleconference. He stated that while the SAB was not obligated to respond to public comments received in its deliberations for the review, Panel members should keep these public comments in mind and consider points made in public comments as they deliberated during this SAB review.

Mr. Jeff Zimmerman, representing Damascus Citizens for Sustainability, NYH2O, and Citizens for Water, presented his oral statement. Mr. Zimmerman noted that he had two issues to address: one that has not yet been addressed by the SAB Panel or by the EPA, and one that has received only minor consideration by the EPA. He noted the first issue was that gas companies developed settlement agreements with individuals, and stated that such agreements typically involved the placement of water supplies at individual homes. He stated that there are over 400 families in Pennsylvania who had entered into such agreements, and that there are approximately 6,600 impacts to these families. He stated that six percent of Pennsylvania wells are impacted, and that many wells in the nation were impacted. He noted his second issue was that the EPA draft Assessment Report did not quantify orphan wells. He stated that the Interstate Oil and Gas Compact Commission (IOGCC) estimated that there are a million orphan gas wells across the United States, and 45,000 orphan wells in Pennsylvania. He stated that there are an estimated 180,000 unplugged wells in Pennsylvania that provide a conduit for contamination. He noted that if one applied that percentage to IOGCC figures, there are over 750,000 wells that have not been identified or plugged throughout the United States. He stated that these wells are typically in sandstone, and requested that the areas comprising these orphan, unplugged wells be considered in the draft Assessment Report.

Mr. John Fenton presented his oral statement. Mr. Fenton noted that the Wyoming Department of Environmental Quality (DEQ) study on the Pavillion Wyoming website is on hold and stated that this study should be completed and released. He stated that the Wyoming DEQ study was funded by oil and gas companies, and that the State of Wyoming lobbied against the EPA's original study on Pavillion. He stated that his neighbor expressed concern that the oil and gas industry paid for this study, and noted that Wyoming DEQ stated that if someone gave Wyoming DEQ \$800,000, Wyoming DEQ would conduct a study for them. He stated that if the oil and gas

industry wanted to prove the EPA's finding that the EPA did not find evidence that hydraulic fracturing activities have led to widespread, systemic impacts on drinking water resources in the United States, then the oil and gas industry should release people who signed non-disclosure agreements with the oil and gas industry so that these people could inform the public about what is occurring on their properties. He stated that he and his neighbors are sick and are dying.

Mr. Walter Brasch had registered to speak but was not available to present his oral statement on the public teleconference line.

Ms. Lena Moffitt, representing Beyond Dirty Fuels, presented her oral statement. Ms. Moffitt noted that millions of people in the United States live near oil and gas facilities and that the EPA needs to correctly assess this topic. She stated that members of the public have been painfully impacted by hydraulic fracturing activities. She noted that members of the public have had their water shut off, that oil and gas has travelled into their homes, and that members of the public needed to get water from supermarkets, use water buffalos, or get their own water supplies. She noted that many members of the public only read executive summaries of reports, and that this was problematic. She stated that the draft SAB report described problems with major findings of the EPA's draft Assessment Report. She noted that the EPA did not support its major findings within the body of the draft Assessment Report and that the draft Assessment Report's Executive Summary appeared inconsistent with the findings provided within the body of the draft Assessment Report, and stated that the SAB should note this concern within the SAB's report. She noted that the stated findings within the draft Assessment Report's Executive Summary are alarming.

Mr. Hugh MacMillan, representing Food and Water Watch, presented his oral statement, reading from a statement⁴ that was posted onto the SAB teleconference website. Mr. MacMillan stated that Mr. Hufford's respectful dissenting opinion notes that the EPA's draft Assessment Report could have articulated the agency's statistical assessment more clearly. Mr. MacMillan noted that while almost everyone agrees with this statement, Mr. MacMillan understood that Mr. Hufford did not believe that the EPA needed to improve its articulation of its statistical assessment since Mr. Hufford agreed that the EPA did not find evidence of widespread, systemic impacts and that the EPA's holistic conclusion is fine as stated without the need for clarification. Mr. MacMillan stated that the EPA should clarify the quantitative basis and scale of its claims that there are no widespread, systemic impact from hydraulic fracturing to drinking water resources. He noted the EPA should clarify whether this claim applied nationwide on a yearly basis, or on a county-by-county basis after five or seven years of widespread and intensive drilling and hydraulic fracturing. He stated that the EPA should not use a determination of widespread, systemic impact as a threshold that would trigger concern. He noted that the EPA had recently considered impacts to be widespread when the rate of impacts reach 20 percent occurrence under various sampling schemes. He stated that in Flint, Michigan, the contaminated drinking water is widespread and systemic and occurred as a result of criminal activity. Mr. MacMillan noted that his holistic view of the EPA's conclusion on widespread, systemic impacts from hydraulic fracturing to drinking water resources was that ten wells per square mile, for many thousands of square miles, results in widespread hydraulic fracturing that brings dangerous and disruptive climate change impacts and food and water insecurity. He stated that his written comments provide additional, more specific comments on the text of the SAB Panel's second draft report.

Mr. Craig Stevens presented his oral statement. Mr. Stevens noted that he is a landowner in Pennsylvania, and that there is an ongoing federal lawsuit in Pennsylvania related to hydraulic

fracturing that should be highlighted. He noted that the Pennsylvania Department of Environmental Protection continues to ban drilling in a nine square mile area of Pennsylvania, and that Cabot Corporation has not brought water supplies back to background levels in the area of this drilling ban. He noted that he travelled to Florida to educate the public in 2014 and 2015 on hydraulic fracturing. He stated that 34 Florida counties instituted resolutions that banned hydraulic fracturing activity, and that the American Federation of Labor and Congress of Industrial Organizations (AFL/CIO) in Florida stated that hydraulic fracturing should not occur. He asked that politics be taken out of the discussion on hydraulic fracturing, and stated that the public wanted the truth on risks to water from hydraulic fracturing.

Ms. Katie Brown, representing Energy In Depth, presented her oral statement. Ms. Brown noted that various entities and organizations have found that there are no widespread, systemic impact from hydraulic fracturing to drinking water resources. She noted that these organizations included the University of Cincinnati, the Groundwater Protection Council, the U.S. Department of Energy (DOE), the Texas Commission on Environmental Quality (CEQ) and the Wyoming DEQ have noted that it is unlikely that hydraulic fracturing fluids had intercepted water supplies. Ms. Brown asked the SAB to consider the EPA's well integrity review which indicated that hydraulic fracturing did not impact drinking water resources. She noted that the EPA's draft Assessment Report provides the broadest study to date on hydraulic fracturing, and that there is nothing in the draft SAB Panel report recommendations that stated that the EPA's conclusions on widespread, systemic impacts from hydraulic fracturing to drinking water resources is incorrect. Ms. Brown stated that the SAB should maintain its role of finding scientific fact.

Mr. Geoffrey Thyne presented his oral statement. Mr. Thyne noted that he approached the EPA in 2011 with isotopic data that he was asked to review regarding hydraulic fracturing wells that are completed in the Barnett Shale. He noted that the gas in the wells he assessed is ignitable, and that the EPA investigated this emergency situation. He noted that the Texas Water Commission found that the gas in the wells he assessed had generated from shallow zones and not from the Barnett Shale. He noted that while gas previously found in the area of the wells he assessed matched shallow formations rather than the Barnett Shale, local wells continued to produce gas that can be ignited. He stated that geological literature indicates that faults are documented to produce gas, and that forensic investigations based on a CO₂ method (published by Peter Faulk) and several academic groups agree with this finding. He stated that he published a 2014 report that concluded the source of the gas in these wells was indeterminate.

Mr. James O'Reilly had registered to speak but was not available to present his oral statement on the public teleconference line.

Ms. Tara Meixsell presented her oral statement. Ms. Meixsell stated that she lives on a small farm in Colorado where a large amount of hydraulic fracturing has occurred. She noted that many people are available who can discuss hydraulic fracturing impacts. She stated that a neighbor had her well explode in a manner similar to a geyser eruption when hydraulic fracturing occurred in the area. She stated that her neighbor was told to leave her windows open to keep gas from accumulating in her house. She noted that her neighbor had a brain tumor and cancer, and that these health effects were caused from exposure to tetrabromoethane (TBE), a chemical used in hydraulic fracturing. She stated that this neighbor settled with companies that conduct hydraulic fracturing. She noted that lawyers told her neighbor to move away from the problems they were experiencing. Ms. Meixsell stated that her neighbors have been ill with chronic

wasting-away effects, and that industry informed people living on industry land to stay in their homes and to not drink water from the homes. She noted that Mr. Wes Wilson of the EPA stated that an investigation should occur into the well incident that she described. She requested help for her and her neighbors.

Mr. Ray Kemble presented his oral statement. Mr. Kemble stated that he is an ex-gas worker, and noted that the Pennsylvania Department of Environmental Protection (DEP) tested his well in 2010. He stated that arsenic, ethylene, uranium, silicon, methane, and strontium was indicated in his well water. He stated that the Pennsylvania DEP banned drilling in a nine square mile area of Pennsylvania, and that the company where this ban occurred stated that the company contaminated water wells. He noted that the EPA tested well water in the area near his home in 2010. He noted that the EPA stated that there are no problems with water wells in Dimock, Pennsylvania; Pavillion, Wyoming; and Parker County, Texas. He asked why the EPA's Region 3 office stated that there was contamination in water wells near hydraulic fracturing sites. He stated that the EPA should reopen the investigations at Dimock, Pennsylvania; Pavillion, Wyoming; and Parker County, Texas, and that the results of these investigations should be made public and put on the front page of newspapers.

Ms. Tracee Bentley, representing the American Petroleum Institute's Colorado Petroleum Council, presented her oral statement. Ms. Bentley stated that concerns raised regarding hydraulic fracturing sampling results are being ignored in the EPA's draft Assessment Report. She stated that this sampling information is readily available, and that industry has made several efforts to provide this information to the EPA. She stated that the scope of the EPA's Assessment Report should be limited to the scope intended by the U.S. Congress, and be scientific and fact-based. She noted that the State of Colorado began testing water wells and hydraulically fractured wells near coal bed methane wells in 1999. She noted that a database exists that contains over 5,000 datasets on over 2,000 hydraulically fractured wells. She noted that the EPA's Assessment Report should recognize state agency data that are available through agencies such as the U.S. Bureau of Land Management. She noted that the State of Colorado adopted a groundwater monitoring program that should be reviewed and considered within the EPA's Assessment Report, and stated that groundwater monitoring should be subject to rigorous quality assurance/quality control protocols. She noted that the EPA should select peer reviewers who are currently working in the practice and operation of hydraulic fracturing, and that the criteria for selecting the peer reviewers should have been released before the study design was finalized. She noted that she offered this information to the SAB Panel so that it could make informed decisions on hydraulic fracturing and impacts to water quality.

Mr. Jackie Stewart, representing Energy In Depth, Ohio, presented his oral statement, reading from a statement⁵ that was posted onto the SAB teleconference website. Mr. Stewart stated that the EPA's conclusion that there are no widespread systemic impacts to groundwater resources from hydraulic fracturing is sound and was in line with a large number of studies that have arrived at the same conclusion. He stated that one such study was recently completed by the University of Cincinnati (UC) that found no instances of groundwater contamination from hydraulic fracturing in Ohio. He noted that the UC study used isotope analyses, was conducted over 28 months, analyzed 194 samples from private drinking water wells in five Ohio counties, and included baseline water sampling that occurred before shale development began. He noted that the UC study also assessed methane concentrations. He noted that Dr. Amy Townsend-Small's recent announcement of the findings of the UC study included that all water samples fell within the clean water range, there was no significant increase in dissolved methane

concentration after hydraulic fracturing occurred, and that sample results that were high in dissolved methane did not have a natural gas source.

Ms. Marigrace Butela had registered to speak but was not available to present her oral statement on the public teleconference line.

Ms. Stephanie Catarino Wissman, representing Associated Petroleum Industries of PA, presented her oral statement. Ms. Catarino Wissman noted that evidence, sound science, data and facts support the EPA's statement that hydraulic fracturing does not cause widespread, systemic impacts to groundwater resources. She noted that the terms 'widespread' and 'systemic' are not vague, and that experiences in Pennsylvania have proven that safe, responsible hydraulic fracturing using horizontal wells has worked well. She noted that the State of Pennsylvania has among the most stringent regulatory structures in place for hydraulic fracturing, and has standards for well construction and casing to prevent pollution of groundwater. She noted these State of Pennsylvania requirements exceeded the State Review of Oil, Natural Gas, Environmental Regulations, Inc. (STRONGER) organization guidelines for disclosure. She stated that in 2012, the EPA's sampling results in Dimock, Pennsylvania indicated that arsenic and magnesium was naturally occurring. She stated that scientific support for the EPA's conclusion that hydraulic fracturing does not cause widespread, systemic impacts to groundwater resources is credible and clear.

Ms. Kim Feil presented her oral statement. Ms. Feil noted she lives in Arlington, Texas, and that her home is not supplied by well water. She stated that hydraulic fracturing has contributed total dissolved solids (TDS) to receiving waters near her home. She noted that Trihalomethane (THM) levels in drinking water from Lake Arlington have tripled, and that Fort Worth's drinking water supplies have higher THM levels than Arlington. She stated that water well companies would not discuss issues associated with hydraulic fracturing since hydraulic fracturing drilling companies are the largest customers of water well companies. She stated that the Texas Railroad Commission has requested that members of the public report water testing data related to hydraulic fracturing activities, and that naturally occurring radioactive materials (NORM) was not on the list of contaminants to be analyzed. She requested that the EPA reach out to Mr. Jamie Johnson who has a video of water well contamination associated with hydraulic fracturing.

Mr. Richard Guldi presented his oral statement. Mr. Guldi stated that he is appalled that the hydraulic fracturing industry has poisoned water, and that the EPA concludes that there are no widespread systemic impacts to groundwater resources from hydraulic fracturing. He noted that while water in Boston and the District of Columbia may not be contaminated, members of the public in eight states and in Alberta Canada have lawsuits regarding water and hydraulic fracturing activities. He stated that 38 dairy farms were closed in Bradford County, Pennsylvania, and that calves at these farms were still-born. He also noted that Mr. Steven Lipsky's water catches on fire, and the Texas Water Commission told members of the public who lived near Mr. Lipsky to keep their home windows open. He stated that the Schlumberger Company noted that five percent of hydraulic fracturing wells leak within five years, and that 15 percent of these wells leak within 15 years. He noted that the reason these wells leaked was because the well cement cracks, and stated that casing cement that is one inch thick will crack if the well depth is over 1000 feet.

Mr. Steven Lipsky presented his oral statement. Mr. Lipsky noted that he lived in Parker County, Texas, and that four tests have been completed on his water well. He noted that the average

concentration of methane in his well water is 60 milligrams per liter (mg/l). He stated that water can ignite at 29 mg/l, as indicated in a Duke University study of his water. He noted that Duke University's study of his water stated that a closed system was necessary for the water testing. He noted that the Texas Water Commission did not use an acceptable analytical laboratory to analyze his water, and that the Texas Water Commission put him and his family at risk due to the incorrect testing results that it conducted on his water. He noted that research indicates that his water came from the Barnett Shale. He stated that the EPA will not reply to his requests, and he requested that the SAB Panel do what it could to prevent these problems from occurring elsewhere. He asked the Panel to not think that the public is making up the problems that they have noted for consideration by the Panel.

Mr. Victor Furman had registered to speak but was not available to present his oral statement on the public teleconference line.

Ms. Mary Winfree presented her oral statement, reading from a statement⁶ that was posted onto the SAB teleconference website. Ms. Winfree noted that she has various sources of information that could be used to provide necessary baseline data to assess human exposure to petroleum. She stated that this information included yearly water quality and well monitoring data collected at and surrounding military bases under the U.S. Air Force (USAF) Public Health and Environmental Engineering programs. She stated that the USAF's Flight Medicine and Public Health Groups and bioenvironmental engineers conduct annual measurements of personnel including monitoring of blood enzymes and kidney, liver, and other organ function, and that this personnel monitoring data are available upon request. She stated that hydraulic fracturing wells may have methane in them, and that methane in drinking water supplies has caught on fire in New York, Oklahoma and Pennsylvania. She also stated that West Virginia springs have methane in them. She requested that good science drive the development of the EPA's Assessment Report.

Ms. Mary Kelleher presented her oral statement. Ms. Kelleher stated that she lived in Fort Worth, Texas, and has 40 head of cattle on her farm. She noted that a state agency devastated her quality of life. She noted that a 30-inch natural gas pipeline is buried on waste material and constructed in a floodplain area within 100 feet of her home. She noted that parts of her property valued at thousands of dollars was destroyed from this pipeline. She noted that the pipeline was constructed near her water well, and that her livestock was showing health effects. She stated that the EPA's mission is to protect human health and the environment, and that she was satisfied with the outcome of working with the EPA in the past. She noted that she is somewhat surprised with the casual way that the EPA has been addressing hydraulic fracturing, and stated that a large amount of money is involved in addressing this topic. She noted that the EPA's draft Assessment Report states that under specific instances hydraulic fracturing contaminates water, and that if the EPA failed to enforce [regulations] with the hydraulic fracturing industry, human health and the environment would be impacted.

Ms. Margaret Leslie Jolly had registered to speak but was not available to present her oral statement on the public teleconference line.

Ms. Rhonda Roff presented her oral statement. Ms. Roff stated that there are significant negative climate change and sea level rise impacts on drinking water supplies in sub-tropical Florida. She noted that Florida has a fragile hydrogeology, and that Florida completely depends on groundwater for drinking water. She stated that most of Florida depended on the sole-source

Floridian Aquifer, and that the limestone geology in Florida does not allow hydraulic fracturing to occur. She noted that the Florida State Legislature refused to consider a bill that would allow hydraulic fracturing only after a Florida Department of Environmental Protection study on the topic is completed. She noted that groundwater contamination and sinkholes would result if hydraulic fracturing occurred in Florida. She stated that many of Florida's drinking water wells are rural and have limited treatment. She noted that municipal public water supply wells cannot treat all chemicals used during hydraulic fracturing, and that municipal wells in Florida are impacted by sea level rise.

Mr. John Dwyer presented his oral statement. Mr. Dwyer noted he is a resident of Naples, Florida, which is situated above karst geology. He noted that the five miles of carbonate rock below Naples are totally porous and, as described by a professor in southern Florida, resembled poorly-made Swiss cheese containing many interconnected caves. Mr. Dwyer noted that whatever is put into the ground in Florida enters underground rivers, and that it is incorrect to believe that anything released into ground will stay in a contained pool below the ground. He also stated that it is incorrect to state that science indicates that there have been thousands of sinkholes in Florida. He noted that a sudden lowering of surface aquifers creates sinkholes, and that water flows through the aquifers via transmissivity and is not static. He stated that Florida's underground water flows to a distance 100 miles west of the Florida coast where there is a cliff on the bottom of the Gulf of Mexico that is 4,000 feet in elevation and runs along the entire length of Florida into Alabama.

Mrs. John Dwyer had registered to speak but was not available to present her oral statement on the public teleconference line.

Mr. Rick Roles presented his oral statement. Mr. Roles noted that he lived in Colorado where hydraulic fracturing has been occurring for years. He noted that members of the public are ignoring science and tests on water resources. He stated that chloride is present in his wells, and that he has had problems on his property associated with hydraulic fracturing since 2010. He noted that Susan Nagle of the University of Missouri tested water on his farm and found moderate to high concentrations of endocrine disrupting compounds associated with hydraulic fracturing in water on his property. He stated that his property's water has affected his livestock, and asked when the EPA would address this issue. He asked whether the EPA would wait to address this issue until a time when all water is contaminated and everyone is wearing respirators. He stated that there is unlimited evidence of water contamination from hydraulic fracturing activities that has been covered up by industry, and offered that this information is not available in order to provide profits to industry. He stated that water contamination from hydraulic fracturing activities is occurring in Pennsylvania, Ohio, Wyoming, Texas, California and other states.

Mr. William Fleckenstein had registered to speak but was not available to present his oral statement on the public teleconference line. The presentation that Mr. Fleckenstein had planned to make is provided in a statement⁷ that is posted onto the SAB teleconference website.

Ms. Colleen Faber presented her oral statement. Ms. Faber noted she is a private landowner in northeast Wyoming. She stated that she is a professional soil scientist and a farmer, and has an active oil and gas well on her property. She noted she also has multiple wells on her property to water her cattle, and that she has a private well that provided water for her livestock, garden and trees. She stated that there have been no impacts to her water supply for 11.5 years, and that

there are at least three active oil and gas wells within a mile of her water well. She noted that her water supply is active on a year-round basis, and flows into a large reservoir that is a critical wildlife area. She noted there has been no interruption of water volume to her water supply, and no indication or evidence of problems to water supplies near her home due to hydraulic fracturing. She stated that a second water well on her property is used in summer hot months during low supply times and that there are no water quality issues associated with this well. She stated that she is very secure that oil and gas well operators are doing good work, and that current regulations are adequately protective of water wells.

Ms. Susan Dowling Reuterskiold presented her oral statement. Ms. Reuterskiold stated that she supported hydraulic fracturing and has always heard that mineral rights trump water rights. She requested that no more studies occur, and that the EPA approve and finalize its latest draft Assessment Report.

Mr. Rick Hall presented his oral statement. Mr. Hall stated that he owns a 100 acre farm in north-central Pennsylvania, and that his farm is served by well water that he uses for drinking and recreation. He stated that his farm is leased to an oil and gas company, who conducted three-dimensional seismic, hydraulic fracturing drilling, well pad installation, and site restoration activities on his farm. He stated that the oil and gas company tested his water before hydraulic fracturing occurred, and also interviewed members of the public who lived in the area. He noted that pipelines are installed throughout his property, and that of the eight wells in total that have been installed on his property, seven were hydraulically fractured. He noted that the oil and gas company who installed wells and pipelines on his property did a professional job and gave 20 cords of wood to his parents. He stated that since 2012, two wellpads have been constructed in vicinity of his farm, and that one wellpad is 2,800 feet away from his wellwater. He stated that the Pennsylvania DEP did substantial inspections associated with the installation of these hydraulically fractured wells, and noted that after these wells were constructed, the Pennsylvania DEP inspected one well 28 times and the other well 33 times. He noted that after many inspections of hydraulically-fractured wells on his property and on nearby properties, no environmental impacts have been observed or have occurred as a result of the installation of these wells.

Ms. Bonita Bandaries, representing Stone Lakes Homeowners Association, Shreveport, Louisiana, presented her oral statement. Ms. Bandaries stated that she has lived in Louisiana her entire lifetime where she has hunted and fished. She noted she supported the EPA's five year study that assessed hydraulic fracturing activities, and asked that the hydraulic fracturing industry be allowed to continue to work and operate. She noted that the EPA's Assessment Report should lay environmental concerns to rest. She stated that her community has leased lands to oil companies and is awaiting the installation of wells. She noted that that she is not aware of any impacts associated with oil and gas or hydraulic fracturing that have contaminated her community's water supplies.

Mr. Jack Kruell presented his oral statement. Mr. Kruell noted that he lived in southwest Pennsylvania, and that he converted his landfill gas to electricity. He noted that the gas and methane that was collected for this conversion was hazardous based on his understanding of materials and constituents that the oil and gas industry put into the landfill. He stated that there are 55 gases listed in an emissions report associated with the landfill, and that over 800 chemicals used by the oil and gas industry during extraction were placed into 154 landfills. He noted that he wanted to use compressor stations that had engines that emitted 1,950 lbs/hr. of

gas. He stated that the only gases that were tested include sulfur, ammonia, and a few other gases. He stated that the landfills are burning off toxins and generating profit. He noted that the state of Pennsylvania has one of the highest radon gas concentrations in the United States, and that Mr. Quigley of the Pennsylvania DEP noted that radon gas should be tested in his landfill gas. He stated that a 12/16/15 report by the Delaware River Network described the level of competency of the Pennsylvania DEP.

Mr. Michael Teague, representing the State of Oklahoma, presented his oral statement. Mr. Teague noted that he is Secretary of Energy and Environment for the State of Oklahoma and oversees regulators. He noted that the EPA visited Oklahoma as it developed the Assessment Report, and stated that he agreed with the statement in the draft SAB Panel Report that the EPA's approach is comprehensive and appropriate. He noted that he agreed with the EPA's conclusion that there are no widespread systemic impacts to groundwater resources from hydraulic fracturing. He stated that he appreciated that the EPA's draft Assessment is clear on what it is and is not, and that the draft Assessment stated that it is not a health risk assessment. He requested that the draft Assessment Report stay founded in science, and agreed that the Report could conclude that industry and regulators can continue to work together on HFWC activities. He noted that while water availability is within the purview of the states, advice is welcome on that topic.

Mr. Matthew Lock presented his oral statement. Mr. Lock noted he has over 25 years of experience as a professional geologist in Pennsylvania, and that he spent most of his career addressing impacted groundwater. He noted that over the past five years there has been a significant amount of focus on the potential for hydraulic fracturing to have impacts on domestic water supplies. He stated that he reviewed data from hydraulically fractured wells in Pennsylvania and Ohio, and noted that these observations, while smaller in scope than the EPA's Assessment Report, confirmed that there are no widespread systemic impacts to groundwater resources from hydraulic fracturing. He stated that while hydraulic fracturing has challenges, these challenges are not insurmountable. He stated that hydraulic fracturing can evolve.

Ms. Lily Baldwin, representing Chevron Energy Technology Company, presented her oral statement. Ms. Baldwin noted she is a senior environmental engineer who graduated from the University of California, Berkeley and Stanford, and has worked at Chevron for nine years. She noted she had previously worked at the DOE's Lawrence Livermore Laboratory where she worked on environmental impact assessments. She stated that before working at Lawrence Livermore Laboratory, she was a consultant. She stated that she supported the SAB draft report's recommendations that the EPA's draft Assessment Report should recognize improvements that the oil and gas industry has made regarding hydraulic fracturing activity. She noted that the draft Assessment Report should recognize the industry trend to use non-potable water sources during hydraulic fracturing. She stated that the oil and gas industry continues to improve hydraulic fracturing chemistry and treatment technology, and noted that an *Environmental Science & Technology* (ES&T) letter stated that the hydraulic fracturing industry has reduced the level of contamination and is continuously improving. She stated that continuous improvement of hydraulic fracturing industry practices has also been indicated in American Petroleum Institute (API) publications, and that these practices were developed by multiple stakeholders.

Ms. Rebecca Johnson presented her oral statement. Ms. Johnson noted that she is a Colorado native and graduated from Colorado State University with a degree in chemical engineering. She stated that she lived in the town of Bertha in northern Colorado. She stated that she is a

completion scientist and has worked in the oil and gas industry for several years. She stated that she agreed with the EPA's statement that there are no widespread systemic impacts to groundwater resources from hydraulic fracturing. She stated that there is a large public misunderstanding regarding the hydraulic fracturing industry and that it is helpful to see that the EPA's Assessment Report published facts regarding the industry. She noted that the well cementing, well integrity, and design processes of hydraulic fracturing were regulated, and that the hydraulic fracturing industry is highly regulated through permitting. She stated that the industry provided data to the FracFocus database. She noted that her county in Colorado is comprised of 2.75 million acres and is mostly devoted to raising livestock and farming. She stated that twenty percent of the 3,000 farms in the area produce an income of over \$100,000/year. She stated that there are over 20,000 wells in the county, and that if there were problems with these wells she would know of those problems.

Mr. Zacariah Hildenbrand presented his oral statement. Mr. Hildenbrand stated that he is employed at an environmental company and at the University of Texas-Arlington, and that he is exploring environmental implications of hydraulic fracturing drilling operations in Texas and Pennsylvania. He stated that discussion on this topic should focus on unconventional oil and gas operations, and noted that hydraulic fracturing centered on well stimulation which is only one part of unconventional oil and gas drilling operations. He stated that the environmental implications of drilling, well cementing, processing of fluid waste, and production and use of chemicals such as naturally occurring radioactive materials (NORM) and chlorinated species during the different phases of unconventional oil and gas drilling operations need to be studied. He noted that there are many cases that indicated that hydraulic fracturing stimulation had contaminated water wells. He stated that the EPA's Assessment Report should distinguish between hydraulic fracturing and the other components of hydraulic fracturing operations. He also stated that it is imperative that the EPA's Assessment Report discuss how hydraulic fracturing activities have caused widespread impacts to groundwater resources, and that that it is inappropriate for the EPA's Assessment Report to state that there have been only a handful of studies that have indicated problems from hydraulic fracturing. He noted that peer-reviewed literature indicates there is a large amount of contamination associated with hydraulic fracturing activities, and that Susquehanna County, Pennsylvania and other Pennsylvania counties have problems with contaminated groundwater resources from hydraulic fracturing. He observed that industry cannot be indicated as a source of hydrocarbon contamination that is detected in water since hydraulic fracturing chemicals are not disclosed.

Ms. Juliette Nguyen had registered to speak but was not available to present her oral statement on the public teleconference line.

Mr. David McBride, representing Anadarko Petroleum, presented his oral statement. Mr. McBride stated that he believed that the EPA conducted a thorough review in its draft Assessment Report, and noted that the draft Assessment Report and evaluation extended well beyond hydraulic fracturing through its investigation of HFWC activities. He noted that it is not a surprise that the draft Assessment Report concludes that there are no widespread systemic impacts to groundwater resources from hydraulic fracturing, and asked the SAB to support this major finding of the EPA. He noted that current state and federal regulations applicable to hydraulic fracturing operations are comprehensive and ensure that hydraulic fracturing liquids are properly handled, and stated that Anadarko Petroleum works well with state regulatory authorities. He stated that if there were widespread systemic impacts to groundwater resources

from hydraulic fracturing, those impacts would have been widely documented and would have been indicated already.

Mr. Danny Dixon had registered to speak but was not available to present his oral statement on the public teleconference line.

Ms. Yvonne Watson presented her oral statement, reading from a statement⁸ that was posted onto the SAB teleconference website. Ms. Watson noted that a fundamental threat posed by hydraulic fracturing is that until recently, regulatory agencies in the State of California did not monitor where or how often hydraulic fracturing is occurring. She stated that while hydraulic fracturing activities are regulated, there are no reports on regulated hydraulic fracturing activities and that therefore it is not possible to determine the effects of such activities. She noted that she was informed by Dr. Tom Williams, a retired oil and gas expert, that there is no direct information from hydraulic fracturing operators/contractors to correlate cause and effects of well stimulation on drinking water resources. She stated that voluntary disclosure of HFWC information such as through the FracFocus database is not adequate and that regulatory agencies have not yet caught up with the public's concerns regarding this topic. She noted that the Los Angeles Water District noted there are three types of hydraulic fracturing: (a) conventional hydraulic fracturing; (b) unconventional hydraulic fracturing; and (c) high-rate gravel packing. She noted that high-rate gravel packing involves two distinct injection stages performed in a single step, and stated that if high-rate gravel packing occurred on a large scale, that it should be included and evaluated within the EPA's Assessment Report.

Mr. Matthew Schwartz, representing South Florida Wildlands Association, had registered to speak but was not available to present his oral statement on the public teleconference line.

Ms. Jane Varcoe, representing Waymart Borough Council, Pennsylvania, and Waymart Area Historical Society, had registered to speak but was not available to present her oral statement on the public teleconference line.

Mr. Matt Connolly presented his oral statement. Mr. Connolly noted that the first hydraulic fracturing operations occurred in 1947 and that since that time, hydraulic fracturing operations have had a failure rate of less than one percent. He stated that hydraulic fracturing is comparable to laparoscopic vs. invasive surgery, and noted that the myths associated with hydraulic fracturing should be dispelled because hydraulic fracturing is the way to extract a tremendous source of natural gas. He noted that hydraulic fracturing wells that reach a 9,000 foot depth would have no issues and would be a safe and secure operation provided that the well's cement seal was structurally sound.

Mr. Mike Ming, representing General Electric Oil and Gas Technology Center, presented his oral statement. Mr. Ming stated that he was speaking on behalf of the General Electric Company, and that he agreed with the need for sound science in the development of the EPA's Assessment Report. He stated that he agreed with the EPA's Assessment Report conclusion that there are no widespread systemic impacts to groundwater resources from hydraulic fracturing. He noted that a Greene County, Pennsylvania laboratory study indicated that hydraulic fracturing occurs below drinking water aquifers and that no releases to such aquifers have occurred. He stated that the microseismic fracture height growth that occurs during hydraulic fracturing is consistent with the Greene County study findings. He noted that most companies that conduct hydraulic fracturing activities require predrilling analysis to help assess impacts to nearby wells. He stated that

hydraulic fracturing is essential to energy independence in the United States, and that if the United States did not have hydraulic fracturing there would be less energy security. He stated that there is no scientifically credible basis to conclude that hydraulic fracturing causes risks to water supplies.

Dr. Dzombak reiterated the names of registered speakers who did not respond when their name was called to provide their oral public comments, and no additional registered public commenters voiced their request to make an oral statement.

Dr. Dzombak asked if any Panel members had clarifying questions for the public commenters who presented oral comments during the teleconference. One Panel member asked Mr. Guldi whether the Schlumberger Company report that Mr. Guldi referred to in his oral comments was documented and available. Mr. Guldi stated that he would provide a reference to that report in his written comments, and send those comments to the Designated Federal Officer. Mr. Guldi stated that a recent publication notes that hydraulic fracturing technology fails at a rate of 12%.

Panel Discussion on March 2, 2016 ‘Suggested Topics for Discussion’ Document

Dr. Dzombak noted that based on preliminary comments received from Panel members on the Panel’s February 16, 2016 second draft SAB Panel Report, he prepared a March 2, 2016 ‘Suggested Topics for Discussion’⁹ document that was posted on the teleconference website on March 2, 2016. He stated that there are 31 topics identified in his ‘Suggested Topics for Discussion’ document, and that he would use these suggested topics as a guide for the Panel’s discussion on the February 16, 2016 second draft SAB Panel Report. He noted that these ‘Suggested Topics for Discussion’ were identified in comments received from members of the Panel to the February 16, 2016 second draft SAB Panel Report.

Dr. Dzombak noted that the usual SAB process for this stage of Panel deliberations was that the chair of the Panel would seek consensus where possible on points made in draft SAB Panel report. He stated that where there are differences of opinion between Panel members on any topic, the SAB report might note ‘most members concluded that ...’ or ‘one (or several) Panel members concluded that ...’ He also noted that sometimes there are instances when a Panel member strongly disagreed with the majority of the Panel’s findings. He stated that in such instances, the Panel member may author a minority view that would be included as an Appendix to the consensus SAB report. He noted that such a minority statement would clearly indicate authorship, and the majority SAB report would reference the minority viewpoint. He stated that such a dissenting statement was provided by Panel member Mr. Walt Hufford on some specific topics. Dr. Dzombak stated that after discussing all topics, and after Panel consensus is reached on how to proceed on these topics, he would summarize his plan for moving forward and ask Panel members if there was any disagreement on moving forward based on the discussion during the teleconference.

Dr. Dzombak noted that in the initial part of his suggested topics for discussion document, a draft of a dissenting opinion document prepared by Mr. Hufford was included. Dr. Dzombak noted that Mr. Hufford’s document contained dissenting views on four conclusions identified by the Panel in the Panel’s February 16, 2016 second draft SAB Report, and three recommendations for modification of statements in the Panel’s second draft SAB Report. Dr. Dzombak noted that he planned to discuss separately each of the seven topics identified in Mr. Hufford’s dissenting opinion document, and stated that the Panel’s discussion of each of Mr. Hufford’s seven topics

may lead to changes in the second draft SAB Panel report and/or to changes in Mr. Hufford's draft dissenting opinion document. Dr. Dzombak noted that Mr. Hufford welcomed Panel discussion and input on each of the points Mr. Hufford raised in his draft dissenting opinion document, and that Mr. Hufford would decide whether to make changes to his draft dissenting opinion document. Dr. Dzombak noted that after Panel discussions concluded on the topics for discussion, Dr. Dzombak would ask whether additional Panel members wished to join Mr. Hufford in his dissenting opinion document. Dr. Dzombak noted that any dissenting opinion would be included as an Appendix to the SAB Panel report, and that this Appendix would clearly indicate authorship and state which Panel members supported that opinion. Dr. Dzombak stated that the majority report would reference the minority dissenting viewpoint.

Mr. Hufford noted that during the Panel's October 28-30, 2015 meeting, he stated his reservations on the SAB Panel's wording regarding the EPA's conclusion that there are no widespread systemic impacts to drinking water resources from hydraulic fracturing. Mr. Hufford stated that since the Panel's October meeting, he had contemplated how to articulate his position that the EPA's conclusion is correct. He stated that there is an enormous amount of information regarding the potential impact to water resources from hydraulic fracturing activities that is contained in a variety of documents and references. He noted that these documents, references and sources of information included the EPA's draft Assessment, the 4,000 pages of public comments submitted for consideration by the Panel, reports prepared by the U.S. Government Accountability Office, United States Geological Survey (USGS), U.S. Department of Energy (DOE, in its 2014 report on Greene County, Pennsylvania), and by the University of California, Berkeley (in 2015), and other available reports regarding hydraulic fracturing and the hydraulic fracturing water cycle. Mr. Hufford stated that his firm position is that the EPA was asked whether there are no widespread systemic impacts to groundwater resources from hydraulic fracturing, and that the EPA's conclusion on this question is correct.

Dr. Dzombak noted that Panel member discussion would start on Topic 1 (Dissenting Opinion by Mr. Hufford) found on page 2 of Dr. Dzombak's March 2, 2016 'Suggested Topics' document.

Topic #1, sub-topic #1, Dissenting Opinion from Walt Hufford, of the March 2, 2016 'Suggested Topics' document: EPA's finding of "no widespread, systemic impacts on drinking water resources within the United States"

Mr. Hufford noted his concern with statements in the Panel's February 16, 2016 second draft SAB Panel Report regarding the conclusion in the EPA draft Assessment Report that the EPA did not find evidence that hydraulic fracturing mechanisms have led to widespread, systemic impacts on drinking water resources in the United States. He stated his opposition to the Panel's position, as stated in the second draft SAB Panel Report, that the EPA statement does not clearly describe the system(s) of interest (e.g., groundwater, surface water) nor the definitions of "systemic" and "widespread," and that the EPA's conclusion and the EPA's definitions of "systemic" and "widespread" required clarification and additional explanation. Mr. Hufford stated his view that the EPA's conclusion that it did not find evidence that hydraulic fracturing mechanisms have led to widespread, systemic impacts on drinking water resources in the United States is accurate, clear, concise, unambiguous, and supportable with the facts that the EPA has reviewed. Mr. Hufford noted that the EPA's statement provides a holistic conclusion regarding the industry's processes for water used during HFWC activities. Mr. Hufford stated that while the EPA could have articulated its statistical assessment more clearly, there are no facts or

evidence demonstrating that there is a systemic or widespread impact from hydraulic fracturing to existing drinking water resources.

Mr. Hufford stated that if a systemic or widespread impact from hydraulic fracturing to existing drinking water resources had been identified, the EPA and the state regulatory agencies would have quickly responded to such findings. He noted that the EPA estimates that approximately 30,000 hydraulic fracturing wells are drilled each year in the United States, and that only a very small percentage of those wells have had an operational issue that may have impacted drinking water resources. He further stated that among this small percentage, the identified impacts to drinking water resources have primarily been associated with surface spills, well construction, and well cementing and not with hydraulic fracturing. He stated that localized impacts from HFWC activities should not be discounted nor marginalized, and that the EPA's Assessment Report should further clarify the descriptions of actual impact from a HFWC-related spill, including whether impacts from such spills or releases were permanent or temporary.

Dr. Dzombak asked Panel members for their reactions, and suggested that the Panel not focus on trying to revise specific wording in Mr. Hufford's opinion document, which expresses his personal views. A Panel member stated that Mr. Hufford noted that issues associated with surface spills, cementing, and other issues are not linked to hydraulic fracturing, and asked Mr. Hufford to state his definition of the term "hydraulic fracturing" and discuss whether he intends that this term only apply to the short-term act of fracturing the subsurface. Mr. Hufford responded that there is indeed a need to distinguish between hydraulic fracturing and the HFWC. Mr. Hufford noted that hydraulic fracturing does not refer to the 30-year life of a well nor to the drilling of a well. He stated that hydraulic fracturing referred to operations that stimulated and fractured the well, which generally occurs during a one week period when actual hydraulic fracturing occurred. Mr. Hufford stated that hydraulic fracturing and HFWC activities have not resulted in widespread, systemic impacts to drinking water resources.

Three Panel members (Drs. Dunn-Norman and Steve Almond, and Mr. John Fontana) supported Mr. Hufford's statement that the conclusion by the EPA in the June 2015 draft Assessment report that the EPA did not find evidence that hydraulic fracturing mechanisms have led to widespread, systemic impacts on drinking water resources in the United States is accurate, clear, concise, unambiguous, and supportable with the facts EPA has reviewed. One Panel member noted that if there were problems associated with hydraulic fracturing these problems would be well known given the many years that hydraulic fracturing has been occurring in the United States. The Panel member noted that the available data did not indicate that large numbers of people were affected from HFWC activities, that effects were indicated from HFWC activities, or that there was a failure of the entire HFWC system that would indicate a systemic problem.

A Panel member noted that based on his substantial hydraulic fracturing experience across the world, a limited amount of releases have been indicated from HFWC activities, and thus there is no widespread, systemic issue from hydraulic fracturing. Another Panel member noted that based on his experiences with hydraulic fracturing on many projects, there are many examples where hydraulic fracturing has been conducted safely and has been embraced by the community. The Panel member stated that several members of the public have spoken passionately about what has occurred in some areas, such as in Dimock, Pennsylvania; Pavillion, Wyoming; and Parker County, Texas. The Panel member stated it would be helpful if the Assessment Report provided information about hydraulic fracturing problems at these three locations, described whether the problems are due to human error, and present the focused concerns of members of the public

regarding these particular areas.

The Panel discussed whether to reiterate a statement in its draft report that the EPA's statement on widespread, systemic impacts required clarification and additional explanation in order to put the three well-known areas in Dimock, Pennsylvania; Pavillion, Wyoming; and Parker County, Texas into perspective relative to the total number of hydraulically-fractured wells in the United States. Several Panel members stated they disagreed with adding this language, and the Panel agreed not to include this statement in the SAB Report in the discussion of the three particular areas noted.

A Panel member noted that the EPA's statement that the EPA did not find evidence that hydraulic fracturing mechanisms have led to widespread, systemic impacts on drinking water resources in the United States only appeared in the Executive Summary of the EPA draft Assessment Report, and was not included or discussed anywhere else in the draft Assessment Report. Several Panel members recommended that the SAB draft report should include and broaden text from the January 7 SAB draft report stating that this EPA statement does not reflect data limitations and uncertainties from individual chapters. A Panel member did not agree that this text should be included and broadened in the SAB draft report. The Panel member stated that including such text would give too much credence to uncertainties that the EPA has identified, that it is not clear that the EPA considered all information that was available, and that the EPA may be able to support its statement.

Another Panel member stated that the SAB draft report should recommend that the EPA's statement that the EPA did not find evidence that hydraulic fracturing mechanisms have led to widespread, systemic impacts on drinking water resources in the United States should be deleted from the EPA Assessment Report if the SAB Panel concludes that this EPA statement does not reflect the major findings of the EPA's Assessment report. The Panel member suggested that if the SAB Panel made this conclusion, the SAB Panel should recommend that the EPA conduct a risk assessment that links to incidents described by the EPA in the Assessment Report. Several Panel members stated that instead of recommending that the EPA delete their statement, the draft SAB report should maintain the recommendation that the EPA clarify its conclusion that there is no evidence that hydraulic fracturing mechanisms have led to widespread, systemic impacts on drinking water resources in the United States.

Several Panel members expressed concern that in addition to defining "systemic" and "widespread," the EPA should also carefully define the term "impact." Several Panel members noted there is confusion between HFWC and the single process of breaking rock that some people refer to as hydraulic fracturing. A Panel member requested that the EPA clarify its definition of hydraulic fracturing in the Assessment Report and clarify the focus of the Assessment Report regarding HFWC and hydraulic fracturing. Several Panel members suggested that the focus of the Assessment Report should be on activities that occur during all stages of the HFWC and not solely focus on activities that occur during the one week period of the well development when actual hydraulic fracturing occurs.

A Panel member asked whether hydraulic fracturing conducted in the 1970s was different than current hydraulic fracturing activity. A Panel member responded that while the time to reach closure pressure has changed, and volumes of liquids put into the ground are different, the hydraulic fracturing process is fundamentally the same between the 1970s and present day.

Upon completion of this discussion, the Panel agreed to revise the statements within the draft SAB Report regarding widespread, systemic impacts within the SAB Report's cover letter and Executive Summary to note that four members of the SAB Panel have concluded that the EPA's statement on widespread, systemic impacts is clear, concise and accurate. The Panel also agreed to note that this EPA statement does not clearly describe the scale of impacts (i.e., local or regional), nor the definition of "impact".

Topic #1, sub-topic #2, Dissenting Opinion from Walt Hufford, of the March 2, 2016 'Suggested Topics' document: Prospective case studies

Mr. Hufford stated that the SAB Report should not state that the lack of EPA's completion of prospective case studies was a major finding or a major limitation of the draft Assessment Report. Mr. Hufford stated that the EPA and industry made considerable efforts to conduct these prospective studies but that they could not be conducted and incorporated into the draft Assessment Report. Mr. Hufford noted that there are numerous reports from stakeholders in academia, regulatory agencies, industry and other experts documenting the lack of widespread, systemic impacts on water resources by the oil and natural gas industry. Mr. Hufford noted that the Panel should consider that in the six years since the EPA developed its research Study Plan for hydraulic fracturing research, a wealth of information on HFWC activities has been generated from various companies including Mr. Hufford's company. He noted that to include a statement in the draft SAB report that not executing the prospective case studies is a major finding would inappropriately imply that the results of the extensive studies completed by others are not adequate or accurate, and advance a position that the agency's work and subsequent conclusions are therefore qualified by not implementing the originally planned prospective studies.

Several Panel members stated that the EPA not only did not conduct the prospective case study research, but did not even mention the originally planned prospective case studies in the Assessment Report. These Panel members stated that the EPA should mention the planned prospective studies in the Assessment Report, and discuss in the Assessment Report why such studies were not conducted. Several Panel members stated that while the lack of prospective studies is not a major finding of the EPA's Assessment Report, the lack of such studies is a data limitation of the EPA's Assessment Report, and that prospective studies would have considered effects of flowback water releases to the environment.

A Panel member noted that the SAB review of the EPA draft research Study Plan in 2011 recommended that the EPA collect baseline water quality data before hydraulic fracturing occurred in order to document changes to water quality. Dr. Dzombak stated that the SAB Panel that reviewed the Hydraulic Fracturing Research Study Plan stated in its SAB advisory report that prospective studies are important, and noted that the collection of research-grade information demands a significant amount of work. Dr. Dzombak noted that many public commenters have expressed dismay at the EPA's lack of inclusion of the prospective studies.

Several Panel members noted that based on available data, if the EPA conducted a few prospective studies randomly in any location, there is a good chance that no impacts to drinking water resources would be indicated. A Panel member stated that the prospective study approach is problematic since it is not clear which chemicals would be used and assessed during the prospective studies.

A Panel member stated that the only other available study that assessed water quality impacts

before hydraulic fracturing activity is a study conducted by the University of Cincinnati, Ohio. The Panel member noted that hydraulic fracturing prospective studies would help assess potential impacts and help convince members of the public on the potential impacts of hydraulic fracturing to drinking water resources. A few other Panel members stated that several studies by the oil and gas industry and public comment #EPA-HQ-OA-2015-0245-0427 that was posted to the EPA's Docket on the EPA draft Assessment Report provided data regarding environmental conditions before and after oil and gas activities, and that the EPA could ask for and consider these data. Several Panel members suggested that the SAB should recommend that the EPA consider other available studies providing information on conditions before and after hydraulic fracturing activities. A Panel member stated that the EPA should conduct the prospective studies as a future long-term research project.

Upon discussion, the Panel agreed to revise the draft SAB Report to remove the word "major" from the statement that the lack of prospective studies is a major limitation of the draft Assessment Report. The Panel agreed that the draft SAB report should recommend that the EPA Assessment Report should summarize the prospective study activities that the EPA had planned to conduct, the goals and benefits for conducting these studies, and the reasons for not conducting these studies. The Panel also agreed to recommend that the EPA evaluate lessons learned from its attempts to develop the prospective case studies and the implementation challenges encountered, including how these lessons could inform design of future prospective case studies. The Panel also agreed that the Assessment Report should identify ongoing and future needs for research, assessments, and field studies including prospective studies and other research that EPA had planned but did not conduct as described in the EPA Hydraulic Fracturing Research Study Plan.

In addition, the Panel agreed that the EPA should investigate prospective studies that may have been conducted by other organizations for site-specific hydraulic fracturing operations, and to describe such studies in the Assessment Report. The Panel further agreed that the draft SAB report should note that one Panel member did not find the lack of prospective case studies to be a limitation to the draft Assessment Report, based on the perspective that investigations conducted by universities, consulting firms, and other external stakeholders could be used in lieu of the agency conducting such studies.

A Panel member stated that she would work with the Designated Federal Officer after the teleconference to help incorporate the above-noted changes into the draft SAB Report. Mr. Hufford stated that he would remove his dissenting opinion for this topic with incorporation of the above-noted changes.

Topic #1, sub-topic #3, Dissenting Opinion from Walt Hufford, of March 2, 2016 "Suggested Topics" document: Major Finding associated with chemical mixing stage in the HFWC

Mr. Hufford expressed his view that the SAB Report should not state that there are three "major findings" associated with uncertainties in hydraulic fracturing chemicals and spills that should be presented in the chemical mixing discussions of the EPA Assessment Report. Mr. Hufford noted that since initiation of the EPA assessment, industry has significantly progressed in transparently disclosing products used during the hydraulic fracturing process. Mr. Hufford also noted that approximately 90% of the constituents used during hydraulic fracturing are itemized in the FracFocus data system, and that regulatory agencies using the FracFocus data system could

require more detailed information from industries on their hydraulic fracturing activities, including proprietary information, for regulatory use.

A Panel member agreed with Mr. Hufford that the EPA Assessment Report should provide updated, current information, including information on the frequency or severity of spills, especially spills that are released from containment facilities. The Panel member stated that the degree of uncertainty regarding the ability to conclude what is known about the impacts of spills was not brought forth by the EPA as a major finding.

A Panel member agreed with the EPA's statement that there is a significant amount of uncertainty regarding chemicals used during hydraulic fracturing. The Panel member stated that the draft Assessment Report is woefully inadequate in its description of spills from hydraulic fracturing operations, and noted that since the EPA did not collect sufficient data regarding the frequency and type of spills that have occurred from hydraulic fracturing operations, the EPA could not adequately assess the frequency, severity and type of such spills. The Panel member noted that while the word 'significant' could be removed from the EPA's statement, these uncertainties are still important to consider. The Panel member expressed concern that if hydraulic fracturing chemicals cannot be analyzed, they cannot be detected. The Panel member also asked whether such chemicals are present on hydraulic fracturing sites for only one or two weeks during certain hydraulic fracturing activities. The Panel member noted that data on spills from hydraulic fracturing operations is likely to be available at state offices but in a form that is not electronically and readily accessible. Several Panel members suggested that the EPA's use of updated information on hydraulic fracturing chemicals from the FracFocus 3 database may help reduce these uncertainties.

Another Panel member stated that public comment #EPA-HQ-OA-2015-0245-0434 that was posted to the EPA's Docket on the EPA's Draft Hydraulic Fracturing Assessment Report described how the persistent lack of data precluded the EPA from making conclusions on potential impacts from hydraulic fracturing on drinking water resources within the Assessment Report. The Panel member noted that uncertainties are rampant throughout the draft Assessment Report, and that many sections of the draft Assessment Report stated that hydraulic fracturing data are uncertain. The Panel member stated that the draft SAB report language that there are three "major findings" associated with uncertainties in hydraulic fracturing chemicals and spills should not be revised. The Panel member also stated that the current draft SAB report already stated that the Assessment Report should include more recent data. Dr. Dzombak noted that the EPA stated in an earlier Panel meeting that the EPA necessarily had to put a boundary date on its collection of data in order to produce the Assessment, and that the industry existed in a dynamic, evolving environment.

A few Panel members did not agree with the EPA's statement that there is a significant amount of uncertainty regarding chemicals used during hydraulic fracturing, and stated the draft SAB report language that there are three major findings associated with uncertainties in hydraulic fracturing chemicals and spills should be revised since these three major findings overstate a problem that might not be there. These Panel members suggested that the EPA improve its presentation of available data in the Assessment Report. A Panel member stated that it is not clear that the EPA considered all information that was available and that therefore it is unclear whether there is a significant amount of uncertainty regarding chemicals used during hydraulic fracturing.

A Panel member observed that the draft Assessment Report inconsistently states the number of proprietary hydraulic fracturing chemicals currently in use, and that it is therefore uncertain what information is currently available. The Panel member noted that while the draft Assessment Report stated in many places that 70% of entries into the FracFocus database identified chemicals as proprietary, Chapter 5 of the draft Assessment Report stated that 10% of entries into the FracFocus database identified chemicals as proprietary.

A Panel member suggested that it would be helpful if the EPA documented safety and containment improvements in the hydraulic fracturing industry. Another Panel member noted that the Emergency Planning and Community Right-to-Know Act (EPCRA) has chemical storage reporting requirements and that information on stored chemicals has been compiled and submitted by the industry under EPCRA and is available to the public.

Upon completion of this discussion, the Panel agreed to revise the draft SAB Report to state that there are two uncertainties associated with spills of hydraulic fracturing chemicals: (1) which hydraulic fracturing chemicals have been used widely and at any specific site; and (2) the frequency, severity, and type of hydraulic fracturing-related spills and their associated impacts. The Panel also agreed to recommend that Chapter 5 of the Assessment Report should include more recent data that are available, and that the EPA should conduct a more comprehensive and thorough analysis on the available data on hydraulic fracturing chemicals and spills.

Several Panel members agreed to work with the Designated Federal Officer after the teleconference to incorporate the above-noted changes into the draft SAB Report. Mr. Hufford stated that he would remove his dissenting opinion for this topic with incorporation of the above-noted changes.

Topic #1, sub-topic #4, Dissenting Opinion from Walt Hufford, of the March 2, 2016 'Suggested Topics' document: Data limitations and uncertainties

Mr. Hufford noted that there is no support for the statements in the draft SAB Report that there are data gaps and uncertainties associated with the EPA's draft Assessment Report. Mr. Hufford asserted that large amounts of data are available from the states and recommended that the EPA should discuss the technological challenges in using the various database systems that states have developed for their unique regulatory requirements. He noted that many of these database systems are not electronic or in digital format. He also noted that while the EPA found it difficult to gather data from these databases, difficulty in accessing this data should not be a basis for stating that there are data limitations and uncertainties. Mr. Hufford recommended that the SAB should request that the EPA provide recommendations on how the various regulatory agencies could improve the database management systems to allow for greater transparency and use by external stakeholders.

Mr. Hufford noted that states differ in their approaches towards database management, and recommended that the EPA highlight the improvements that several states have already made to update their database systems to provide for electronic submittals. He noted that he agreed with several other Panel members that the EPA should have reviewed other available toxicological data in developing the Assessment Report. Mr. Hufford said he was frustrated that the EPA did not take the time to review available state data that are often available only in paper form, and did not describe the availability of these data within the Assessment Report.

Several Panel members stated that that the Assessment Report should note that the EPA may not be able to access some information that is required to be reported to states, and that it was difficult for the EPA to access available information that states are collecting from industries. Several Panel members recommended that the EPA describe the data that are available from each state, where the data are located, and the formats for these available data (e.g., electronic vs. paper). One Panel member stated that the Pennsylvania DEP is not yet able to provide readily accessible data, and stated this problem remains a major challenge for the states. Several Panel members recommended that the EPA should revise the Assessment Report to describe the information the EPA relied upon to develop its analyses and make its conclusions, and clarify whether that information is available at a local or state level. Several Panel members also recommended that the EPA should discuss more clearly how uncertainties described within the Assessment Report affect conclusions that the EPA formed in the Assessment Report.

Upon completion of this discussion, the Panel agreed to revise the draft SAB Report discussion on the EPA's findings of gaps and uncertainties to more clearly describe Panel concerns regarding the EPA's limited descriptions of the publicly available data that the EPA relied upon to develop conclusions within the draft Assessment Report. The Panel decided that the revised text in the SAB Report should recommend that the EPA describe the various available databases that contain data on HFWC processes and activities and the challenges of accessing that data, and that the EPA should make recommendations on how these databases could be improved to facilitate more efficient investigation and utilization of these databases and provide for greater transparency.

Mr. Hufford stated that he would remove his dissenting opinion for Topic 4 with incorporation of the above-noted changes.

Topic #1, sub-topic #5, Dissenting Opinion from Walt Hufford, of the March 2, 2016 'Suggested Topics' document: Recommendation #1 regarding Proposed Major Finding – Role of regulatory agencies in the HFWC process

Mr. Hufford recommended that within the Assessment Report, the EPA should provide a comprehensive review of regulatory processes that affect HFWC activities, describe how these regulations have evolved in recent years to address the expansion of oil and natural gas operations, discuss the application of hydraulic fracturing in developing these resources, and describe how best management practices relevant to the HFWC have been implemented. Mr. Hufford noted that such a discussion would provide the reader with substantive information on the current regulatory framework which aims to minimize potential impacts. Mr. Hufford also stated that the EPA should also discuss the work by organizations such as the Interstate Oil and Gas Compact Commission, State Review of Oil, Natural Gas, and Environmental Regulations (STRONGER) and the Groundwater Protection Council (GWPC) on this topic.

Dr. Dzombak and several Panel members stated that the draft SAB report and cover letter already provided recommendations regarding expanded discussion in the Assessment Report of regulatory processes that affect HFWC activities. The Panel agreed to develop a new thematic area within the Executive Summary of the SAB Report to describe concisely the Panel's recommendations associated with the evolving regulatory processes that affect HFWC activities. A Panel member noted that addition of this new thematic area would necessitate some changes to the best management practices thematic area discussion in the draft SAB Report which includes discussion of evolving regulatory processes. . Another Panel member noted that there is a link

between best management practices and the applicable regulatory framework that should be recognized in the draft SAB Report. Several Panel members and Mr. Hufford suggested bringing forth language regarding regulatory practices from the body of the draft SAB report and from Mr. Hufford's dissenting opinion into this new regulatory processes thematic topic area. Several members suggested that the SAB should recommend that the EPA focus this discussion on regulations that minimize the potential impacts to drinking water resources associated with hydraulic fracturing, and the Panel agreed to incorporate this suggestion.

Several Panel members agreed to work with the Designated Federal Officer after the teleconference to incorporate the above-noted changes into the draft SAB Report. Upon discussion, Mr. Hufford stated that he would remove his first recommendation for modification of statements within the second draft SAB Report from his dissenting opinion, with incorporation of the above-noted changes.

Topic #1, sub-topic #6, Dissenting Opinion from Walt Hufford, of the March 2, 2016 'Suggested Topics' document: Recommendation #2 regarding Proposed Major Finding –Potable water well construction and maintenance, and education of the public on water well results

Mr. Hufford recommended that the EPA should expand the Assessment Report to educate external stakeholders on private potable well issues including well maintenance and monitoring, interpretation of laboratory results, and descriptions of "background" conditions. Mr. Hufford noted that during the Panel's public participation process, several public commenters stated that they did not understand laboratory results for their water samples, did not understand how certain constituents such as metals, organics, inorganics, and gases could be in their water supply, and are concerned about using their water. Mr. Hufford referred to the photographs in his written comments, and noted people should be educated and informed on how to protect their water supplies. Mr. Hufford noted his written comments provided references to excellent resources on this topic.

A Panel member stated that a paragraph on water quality data could be included in the draft SAB Report's Executive Summary to concisely discuss various topics raised by Mr. Hufford. Several Panel members suggested that the EPA could add discussion to the injection section of Chapter 6 of the draft Assessment Report on the differences between oil well and drinking water well construction and maintenance. A Panel member noted that while Pennsylvania is one of two states that did not have requirements for private water well construction and maintenance, the Pennsylvania State University Extension Service offices provide many publications and information to the public on these topics. The Panel member suggested that these publications could be added as additional references under the water acquisition section of the draft Assessment Report. A Panel member noted that the State of Colorado published a document on the state of public understanding of well water, and that the National Groundwater Association (NGWA) has also developed a large amount of information on this topic. Another Panel member stated that there are textbooks on this topic, and that it would require numerous pages of text to summarize available material on this topic.

A Panel member stated that it may not be appropriate for the draft Assessment Report to provide a large amount of information on construction of private water wells and how the public could keep chemicals away from such wells. Dr. Dzombak suggested that it would be appropriate to include some discussion on the relationship between private water wells to hydraulic fracturing activities into the draft Assessment Report, but that the discussion should be limited and

photographs are not necessary within this discussion. Dr. Dzombak suggested that this discussion perhaps be included in Chapter 4 of the draft Assessment Report which focused on water acquisition, and not be included in the section on well construction since that section focused on hydraulically fractured wells. A Panel member suggested that this discussion perhaps be included in Chapter 3 of the draft Assessment Report which focused on drinking water resources of the United States, and the Panel agreed with this suggestion.

Several Panel members agreed to work with the Designated Federal Officer after the teleconference to incorporate the above-noted changes into the draft SAB Report. Upon discussion, Mr. Hufford stated that he would remove his second recommendation for modification of statements within the second draft SAB Report from his dissenting opinion, with incorporation of the above-noted changes.

Topic #1, sub-topic #7, Dissenting Opinion from Walt Hufford, of the March 2, 2016 'Suggested Topics' document: Recommendation #3 regarding Comments associated with investigations in Dimock, Pennsylvania; Pavillion, Wyoming; and Parker County, Texas

Mr. Hufford expressed his view that while the SAB could recommend that the draft Assessment Report should include an update on the ongoing work associated with Dimock, Pennsylvania; Pavillion, Wyoming; and Parker County, Texas, the SAB should not suggest this recommendation as a determination by the SAB that oil and natural gas operations have impacted potable water wells at these three locations. Mr. Hufford noted that all three of these locations are in litigation, and that the data associated with each location is voluminous. He also recommended that this SAB recommendation should be provided as a general comment rather than as a recommendation linked to any particular stage of the HFWC, since such linkage would potentially imply that the SAB considers that stage of the HFWC to be relevant to these three cases.

The Panel discussed Mr. Hufford's points, and agreed that this SAB recommendation should be provided as a general comment and not link to a stage of the HFWC. Upon discussion, Mr. Hufford stated that he would remove his second recommendation for modification of statements within the second draft SAB Report from his dissenting opinion, with incorporation of the above-noted changes.

Upon completion of discussion of the seven topics prepared by Mr. Hufford, Dr. Dzombak then asked Mr. Hufford to summarize his position on his dissenting opinion. Mr. Hufford noted that he had three remaining dissenting opinions. He noted he would still dissent on the first topic regarding the EPA's finding of "no widespread, systemic impacts on drinking water resources within the United States." He stated that he would potentially remove his dissenting opinions regarding prospective case studies and spills during the chemical mixing stage in the HFWC pending his review of changes to be incorporated into the draft SAB report on these topics after the teleconference.

Dr. Dzombak asked whether any Panel members would be joining Mr. Hufford in his dissent on the first topic regarding the EPA's finding of "no widespread, systemic impacts on drinking water resources within the United States." Drs. Dunn-Norman and Steve Almond, and Mr. John Fontana, stated that they would join Mr. Hufford in his dissent on this topic. Another Panel member stated that he would review changes that would be incorporated into the draft SAB report after the teleconference before making a decision on whether to dissent on any topic.

Summary of Next Steps

Dr. Dzombak then outlined next steps for the Panel. He noted that the Panel would address in the March 10, 2016 teleconference the remaining ‘Suggested Topics for Discussion’⁹ outlined in the agenda³ that was posted on the Panel’s March 7, 2016 teleconference website. He noted that if the Panel reached substantive agreement on the overall contents for the updated draft SAB Panel Report at the end of the March 10, 2016 teleconference, then he and the Designated Federal Officer would update the Panel’s February 16, 2016 second draft report to incorporate changes that were discussed during the Panel’s March 7 and March 10, 2016 teleconferences, with assistance from some Panel members who would be consulted on particular topics (for example, those who volunteered to help with edits on particular topics during the March 7 teleconference.) Dr. Dzombak also noted that he and the Designated Federal Officer received additional suggested edits from several Panel members during the previous three weeks that would help clarify the text of the second draft Panel report and which would not change the overall intended substance or advice of the second draft Panel report. Dr. Dzombak stated that he would consider all suggested changes received from Panel members to the February 16, 2016 second draft SAB Panel Report, and would use his judgement in deciding which Panel member comments should be incorporated into the updated second draft SAB Report based on consideration of consistency with consensus views of the Panel.

Dr. Dzombak stated that assuming the Panel reached substantive agreement on the contents for the updated draft SAB Panel Report during the March 10, 2016 teleconference, the Designated Federal Officer and he planned to send Panel members the third draft Panel report for review on or around March 21, 2016. Dr. Dzombak stated that when they receive this third draft Panel report, individual Panel members should respond to the Designated Federal Officer on whether they: (a) concur; (b) concur with minor editorial changes; or (c) non-concur with moving forward and sending the updated draft Panel report to the chartered SAB for quality review and final approval.

Dr. Dzombak stated that the SAB Hydraulic Fracturing Research Advisory Panel served under the auspices of the chartered SAB, and noted that the chartered SAB would conduct a quality review of the updated draft Panel report that would focus on the following four questions:

- (1) Were the original charge questions adequately addressed?
- (2) Are there any technical errors or omissions in the report or issues that are inadequately dealt with in the Panel’s report?
- (3) Is the Panel’s draft report is clear and logical? and
- (4) Are the conclusions drawn or recommendations provided supported by the body of the Panel’s report?

Dr. Dzombak noted that once Panel consensus was reached on sending the updated draft SAB Panel report to the chartered SAB for quality review, the updated draft SAB Panel report would be sent to the SAB Staff Office’s Designated Federal Officer for the chartered SAB in preparation for the chartered SAB’s quality review of the updated draft SAB Panel report. Dr. Dzombak noted that the ‘quality review’ draft of the SAB Panel report would be posted on SAB’s website, and then discussed on a public teleconference or meeting of the chartered SAB during which public comments would be considered and comments from the chartered SAB will be discussed. Dr. Dzombak noted that the SAB Staff Office would provide notice in the Federal Register and on SAB’s website on the date and logistics for this quality review teleconference or meeting. The quality review meeting will be conducted by the chartered SAB. Panel members

will be welcome to attend the chartered SAB meeting but attendance is optional.

A Panel member asked what would be the anticipated Panel activities following the completion of its peer review of the draft Assessment Report. The Designated Federal Officer stated that he would follow-up with the EPA on this question.

At 6:05 pm Eastern Time, Dr. Dzombak noted that the teleconference would suspend for the day, and continue on March 10, 2016. The Designated Federal Officer noted that the teleconference was in recess until March 10, 2016 at 12:00 pm Eastern Time.

March 10, 2016

At 12:00 pm Eastern Time on March 10, 2016, the Designated Federal Officer resumed the teleconference. The Designated Federal Officer noted that the March 10, 2016 teleconference was a continuation of the Panel's March 7, 2016 discussion on the topics outlined in the agenda³ that was posted on the Panel's March 7, 2016 teleconference website. The Designated Federal Officer noted that on March 9, 2016, the SAB Staff Office posted a document onto the Panel's March 7 teleconference website entitled "Follow-up regarding Dissenting Opinion Discussion from Dr. David Dzombak"¹⁰. The Designated Federal Officer noted that the strike/shade text provided in this document indicated the Panel's suggested changes to its February 16, 2016 second draft report resulting from the Panel's March 7 Panel teleconference.

The Designated Federal Officer also noted that during the March 7, 2016 Panel teleconference, a Panel member asked what would be the anticipated Panel activities following the completion of its peer review of the draft Assessment Report. The Designated Federal Officer read the following response to this question that he received from the EPA:

The EPA thanks the ad hoc panel for their work and their comments concerning the Agency's hydraulic fracturing drinking water study and draft assessment. We look forward to the delivery of the panel's final peer review report. The EPA will use the SAB's comments and suggestions, and those made by members of the public, to revise the hydraulic fracturing drinking water assessment report. At this time, the EPA considers the work of the panel complete upon delivery of the final peer review report and has no plans to ask the ad hoc panel for additional consultation or review.

Dr. Dzombak noted that the Panel would continue the discussion from the March 7, 2016 teleconference regarding his March 2, 2016 'Suggested Topics for Discussion'⁹ document that was posted on the Panel's March 7, 2016 website. Dr. Dzombak noted that a goal for the teleconference was to complete discussion on all suggested topics for discussion identified in the March 2, 2016 'Suggested Topics' document and reach substantive agreement from all Panel members on how to adjust the Panel's draft SAB report based on those discussions. Following completion of the Panel's discussion on his March 2, 2016 'Suggested Topics' document, Dr. Dzombak noted that the Panel would then review the March 9, 2016 'Follow-up regarding Dissenting Opinion Discussion' document that was also posted on the Panel's March 7, 2016 website, and discuss whether this document accurately summarized the Panel's March 7 teleconference discussions regarding agreed-upon changes to the Panel's February 16 second draft Panel report. Dr. Dzombak noted that Panel members should plan to raise any additional topics that they would like to bring up that may not have already been discussed during the Panel's March 7 and March 10 teleconference upon completion of the Panel's discussion on the March 9, 2016 'Follow-up' document.

Topics #2 and #3 of the March 2, 2016 ‘Suggested Topics’ document: Comments on widespread, systemic impacts, and use of the term “impact”

Dr. Dzombak noted that Topics #2 and #3 from his ‘Suggested Topics’ document were already discussed and resolved as part of the seven topics from Mr. Hufford’s Dissenting Opinion (Topic 1) that the Panel discussed during the Panel’s March 7, 2016 teleconference. Dr. Dzombak stated that the Panel would begin discussion on Topic #4, page 20 of his March 2, 2016 ‘Suggested Topics for Discussion’ document.

Topic #4 of the March 2, 2016 ‘Suggested Topics’ document: General Comment regarding changes to the draft Assessment Report

The Panel discussed inconsistencies in the SAB Panel’s second draft report’s recommendations that suggested either making changes to the draft Assessment Report or making changes to the Assessment Report. After discussion, the Panel agreed that the Designated Federal Officer would review and revise the SAB Panel’s draft report to differentiate consistently and appropriately recommendations to the draft Assessment Report, recommendations for what should be in the final Assessment Report, and recommendations for future activities after the Assessment Report is finalized. The Designated Federal Officer would also revise the SAB Panel’s draft report to properly capitalize or not capitalize the word “agency.”

Topic #5 of the March 2, 2016 ‘Suggested Topics’ document: General Comment regarding recommendation for EPA ORD staff to conduct a field visit to a hydraulic fracturing site

The Panel discussed a Panel member’s suggestion that the SAB Panel’s report should recommend that the EPA ORD staff and/or any contractor who is involved in rewriting the draft Assessment Report should conduct a field visit to a hydraulic fracturing site. The Panel member suggested that such a visit would likely assist the EPA in incorporating best practices for hydraulic fracturing into the Assessment Report. The Panel member also suggested that photographs of hydraulic fracturing activities should be included within the Assessment Report since they would greatly assist the public in understanding hydraulic fracturing activities.

Dr. Dzombak stated that he expected that numerous staff within ORD who helped to develop the draft Assessment Report have visited field sites. A few Panel members agreed that the EPA should include photographs of hydraulic fracturing activities within the Assessment Report, and that the Assessment Report should note there may be local differences between locations based on regulatory differences between the states. A Panel member stated that it is unclear how the EPA would decide which HFWC photographs should be incorporated into the Assessment Report. Another Panel member stated that the Panel should not micromanage how the EPA does its work, and suggested that the SAB Panel’s draft report should recommend that the Assessment Report include graphics and pictures of hydraulic fracturing activities but not be specific on which graphics and pictures should be incorporated.

After discussion, the Panel agreed that the SAB Panel’s draft report should recommend that the Assessment Report include graphics and pictures of hydraulic fracturing activities, and that the SAB Panel’s draft report should not provide specific recommendations on which graphics and pictures should be incorporated.

Topic #6 of the March 2, 2016 ‘Suggested Topics’ document: SAB advice that the EPA should incorporate in its final Assessment Report, vs. SAB advice for the EPA to consider in conducting future activities

The Panel discussed Panel member concerns that the SAB Panel’s draft report should more clearly distinguish which SAB advice should be addressed in the EPA’s final Assessment Report and which advice should be addressed by the EPA as longer-term, future activities after the EPA’s Assessment Report is finalized. Several Panel members noted it is unclear whether the EPA would produce a subsequent report after finalizing its Assessment Report. A few Panel members noted there are some conflicting recommendations within the SAB Panel’s second draft report regarding when certain advice should be addressed, including the draft advice regarding best management practices.

A Panel member stated that the SAB Panel’s draft report could request the EPA to identify options for how the EPA could provide requested information to the public. The Panel member noted that several topics raised within the SAB Panel’s second draft report included recommendations for future longer-term activities, and the Panel member questioned whether such recommendations should actually be conducted before the Assessment Report is finalized. The Panel member stated that the EPA should incorporate responses to the draft advice regarding best management practices into the Assessment Report before it is finalized.

Dr. Dzombak stated that there was insufficient time during the teleconference to identify each instance in the SAB Panel’s second draft report where recommendations for short vs. future longer-term activities occurred, and to consider whether those recommendation are appropriate. Dr. Dzombak recommended that the Designated Federal Officer coordinate with the Panel’s writing teams for each of the eight charge questions after the teleconference to adjust recommendations for short vs. future longer-term activities within the SAB Panel’s second draft report as appropriate. Dr. Dzombak suggested that the writing teams focus their efforts towards identifying future, longer-term activities. Dr. Dzombak also noted that any Panel member could also separately suggest changes to any recommendations within the SAB Panel’s second draft report that should be addressed either as short or future longer-term activities and inform the Designated Federal Officer of those suggestions. The Panel agreed with this approach.

Topic #7 of the March 2, 2016 ‘Suggested Topics’ document: Whether efforts to describe certain water acquisition potential impacts should be a longer-term future activity

A Panel member noted that the EPA could provide more details within the final Assessment Report on how water acquisition for HFWC activities and the associated potential impacts on lowered streamflow and water tables that are experiencing regional water-level decline could affect the quality of drinking water within the final Assessment Report, rather than considering this effort as a longer-term future activity.

Several Panel members suggested that while the EPA could provide a general understanding of these potential impacts within the final Assessment Report, it would take years to conduct the necessary field work and validation efforts to fully assess this topic. These Panel members suggested that these field work and validation efforts should be considered as a longer-term future activity. The Panel agreed that the SAB Panel’s draft report should be revised consistent with these suggestions.

Topic #8 of the March 2, 2016 ‘Suggested Topics’ document: Best management practices

A Panel member suggested that the SAB Panel’s second draft report recommendations for the EPA’s Assessment Report to describe best management practices should note that the EPA’s Assessment Report is not intended to be used as a guide for best management practices and to note that hydraulic fracturing practices are rapidly evolving. Dr. Dzombak noted that this topic would be addressed consistent with changes to be incorporated to the SAB Panel’s draft report resulting from the Panel’s discussion on best management practices within Topic #1, sub-topic #5, of the dissenting opinion from Mr. Walt Hufford, as noted within the March 2, 2016 ‘Suggested Topics’ document. The Panel discussed this topic during the Panel’s March 7, 2016 teleconference.

Topic #9 of the March 2, 2016 ‘Suggested Topics’ document: Background and pre-existing baseline chemistry

The Panel discussed the SAB Panel’s second draft report recommendation that the EPA should include additional discussion on background and pre-existing baseline chemistry of surface and groundwater in the Assessment Report. A Panel member noted that if there are insufficient case histories regarding such background and pre-existing baseline chemistry, the Panel should recommend that the EPA should conduct additional studies on this topic. Another Panel member suggested that the Panel’s recommendations on this topic be rewritten to improve the clarity of this Panel recommendation.

A Panel member stated that the Panel discussed suggested revisions to the text of the Panel’s second draft report regarding the need for additional case histories as part of the Panel’s March 7, 2016 teleconference discussion on prospective case studies.

The Panel discussed various suggested revisions to the text of the Panel’s second draft report to improve the clarity of the draft report’s recommendations on this topic. Several Panel members noted that this was a complex topic for the EPA to address in its Assessment Report. A Panel member suggested that background conditions related to water levels should be considered as part of these assessments. Another Panel member stated that while it is challenging to properly assess background and pre-existing baseline chemistry of surface and groundwater, the SAB report should clearly indicate the importance that the EPA conduct these analyses as part of its Assessment Report.

The Panel agreed that the Panel’s second draft report should be revised to further describe the scientific complexities of assessing background and pre-existing baseline chemistry of surface and groundwater, and also discuss the importance of assessing water levels when assessing background conditions. A Panel member agreed to work with the Designated Federal Officer after the teleconference to adjust the language of the draft SAB Report consistent with the above-noted changes.

Topic #10 of the March 2, 2016 ‘Suggested Topics’ document: Data limitations on chemicals of concern

A Panel member recommended that the SAB Panel’s second draft report be revised to more completely describe the specific data limitations that the EPA should address associated with the EPA Assessment Report’s descriptions of chemicals of concern. Several Panel members agreed

with this recommendation and suggested that the SAB Panel's second draft report be revised to note all data limitations that the EPA should address within the Assessment Report. A Panel member stated that the EPA should describe what data were available to the EPA but not used by the EPA in developing its Assessment Report.

The Panel agreed to develop a new thematic section in the Executive Summary of the Panel's second draft report titled 'data limitations and what needs to be done to address such limitations'. Within this new section, the Panel agreed to move existing relevant text from the Panel's second draft report to a new sub-section that focused on data limitations associated with chemicals of concern. Dr. Dzombak noted he would review the text that would be moved to this new sub-section to improve the clarity of the text.

Topic #11 of the March 2, 2016 'Suggested Topics' document: Non-drinking water sources

A Panel member suggested that the Panel's second draft report remove recommendations that the EPA assess impacts to non-drinking water sources, since the EPA's Assessment Report focused on impacts on drinking water. Another Panel member suggested that use of historically underutilized sources of water such as seawater, brackish water, and wastewater for hydraulic fracturing could reduce the impacts of hydraulic fracturing water acquisition on drinking water sources and that therefore it would be beneficial if the Panel recommended that the EPA conducted such an assessment. Several Panel members stated that the Panel's second draft report should not delete recommendations that the EPA assess impacts to non-drinking water sources, since some water basin commissions are seeking to conserve those waters within their basin. Several Panel members expressed the view that the Panel's second draft report should be revised to reflect that potential impacts to drinking water resources from water withdrawals are not always only local and temporary. A Panel member also noted that in Garfield County, Colorado, 100% wastewater is used for hydraulic fracturing purposes due to the dry climate in the area.

After discussion, the Panel agreed that the SAB Panel's draft report should recommend that the EPA Assessment Report expand on the discussion of the use of underutilized sources of water including seawater, brackish water, mine drainage, and wastewater that could reduce the impacts of water acquisition for hydraulic fracturing purposes on drinking water resources. The Panel also agreed to include the reference to dry climate in the SAB Panel's draft report discussion on Garfield County, Colorado.

Topic #12 of the March 2, 2016 'Suggested Topics' document: Stresses to water resources

A Panel member suggested noting in the SAB Panel's draft report that while stresses to surface or groundwater resources associated with water acquisition and hydraulic fracturing are often localized and temporary in time, such stresses could be important and significant. Upon discussion, the Panel agreed to make this change in the SAB Panel's draft report.

Topic #13 of the March 2, 2016 'Suggested Topics' document: Regulatory framework surrounding water withdrawals

A Panel member suggested that the SAB Panel recommend that the EPA include additional clarifications in the draft Assessment Report on legal, management and market (or economic) frameworks, in addition to regulatory frameworks, in which HFWC activities are managed in order to minimize the potential for negative impacts.

A Panel member stated that the imposed restrictions by the State of Pennsylvania on water used by the hydraulic fracturing industry have helped to maintain flow requirements in Pennsylvania streams, and suggested that such approaches could be used elsewhere in the United States. The Panel member also suggested that the SAB Panel's draft report should refer to the EPA's draft Assessment Report discussion regarding how the Susquehanna River Basin regulatory program has helped to mitigate impacts associated with hydraulic fracturing. Another Panel member noted that the State of Pennsylvania has an initiative to allow oil and gas companies to take waters impacted by acid mine drainage and use those waters as part of a water management plan. Several Panel members noted that the removal of such impacted waters improved surface water quality.

Upon discussion, the Panel agreed to add text to the SAB Panel's draft report recommending that the EPA consider the regulatory framework in Pennsylvania. The Panel also agreed that the draft Assessment Report should highlight situations where the regulatory framework has helped to mitigate such impacts. A Panel member also suggested deleting a sentence from the SAB Panel's draft report noting that water withdrawals for hydraulic fracturing can contribute significantly to groundwater depletion particularly in arid environments, and the Panel agreed to this suggestion.

Topic #14 of the March 2, 2016 'Suggested Topics' document: Water Use database

A Panel member stated that the SAB Panel's draft report should provide recommendations regarding the EPA's use of the 'Water Use in the United States' database under the draft report's recommendations regarding water acquisition and not under the draft report's recommendations regarding chemicals of concern. Upon discussion, the Panel agreed to revise the SAB Panel's draft report to incorporate this recommendation.

Topic #15 of the March 2, 2016 'Suggested Topics' document: FracFocus insight into chemicals used during hydraulic fracturing operations that are considered confidential business information (CBI)

A Panel member requested that additional details be provided to supplement the SAB Panel's draft report's recommendation that the EPA consider how the current version of the FracFocus database provided insights into chemicals used during hydraulic fracturing operations that are considered confidential business information (CBI). A Panel member suggested that this recommendation note that the FracFocus database may provide data on chemical type and class for CBI chemical information provided within the database. Another Panel member asserted that more recent versions of the FracFocus database provide information on trends of greener chemical usage within the hydraulic fracturing industry.

A Panel member agreed to check whether data on chemical type and class for chemical information was provided within the FracFocus database, and to work with the Designated Federal Officer to adjust the language of the draft SAB Report consistent with the above-noted recommendation and observations.

Topic #16 of the March 2, 2016 'Suggested Topics' document: Recent seismic event in Oklahoma

A Panel member noted that the Charge Question 4 response on well injection in the SAB Panel draft report recommended that the EPA should discuss the relationship between induced seismicity from HFWC activities and potential impacts of HFWC activities on drinking water resources. The Panel member stated that this recommendation should note that states are effective in addressing the potential impacts of induced seismicity on drinking water resources. The Panel member noted that the State of Oklahoma instituted significant restrictions on saline water injection within two days of a seismic event in Oklahoma. A Panel member suggested that the SAB Panel's draft report should not include recommendations for the EPA to discuss induced seismicity from HFWC activities within the draft Assessment Report. Several Panel members suggested that the SAB Panel's recommendations for the EPA to discuss induced seismicity from HFWC activities should be moved to the Charge Question 6 response regarding HFWC wastewaters.

Upon discussion, the Panel agreed to revise the SAB Panel's draft report's recommendation on this topic to note that the EPA should consider related state regulatory responses associated with the potential impacts of induced seismicity on drinking water resources.

Two Panel members agreed to work with the Designated Federal Officer to adjust the language of the draft SAB Report consistent with the above-noted changes.

Topic #17 of the March 2, 2016 'Suggested Topics' document: Use of tracers during HFWC operations

A Panel member noted that the SAB Panel's draft report recommended that the EPA should significantly expand and clarify the discussion in the Assessment Report on the use by industry of tracers for injection fluids, as well as the efforts made by the EPA to develop tracers, and describe how tracers might be an approach that could allow assessment of releases of contamination and interpretation of the source of contamination if it occurs. The Panel member suggested that since the use of tracers in hydraulic fracturing is minimal, there is limited information and experience upon which EPA could base a significant expansion and clarification in the Assessment Report.

A Panel member noted that tracers are used during hydraulic fracturing operations to track fracturing height growth and are not used to assess environmental conditions. Several Panel member stated that researchers have proposed the use of tracers during hydraulic fracturing operations to assess environmental conditions, and noted that they would provide a reference regarding this ongoing research.

The Panel agreed to delete the term 'significantly' from the SAB Panel's draft report recommendation that the EPA significantly expand its discussion on the use of tracers. The Panel also agreed that the EPA should summarize what chemicals and isotopes are used for tracers and provide more information on the locations and the degree to which tracers are being used during HFWC activities.

Topic #18 of the March 2, 2016 'Suggested Topics' document: Vertical distance between water bodies and target zones

A Panel member suggested that regarding the Panel's draft report recommendation that the EPA present more information on the vertical distance between surface-water bodies, the target zones

being fractured, and the depths of most aquifers compared to the depths of most hydraulically fractured wells, the EPA should also assess the increased potential for impacts on drinking water quality in shale resources where the vertical distance between the production zone and a current or future drinking water source is relatively small.

A few Panel members stated that the phrase ‘relatively small’ should be clarified, since relatively small in Texas may be relatively big in Ohio, for example. The Panel agreed to note in the updated draft SAB Panel Report that the phrase ‘relatively small’ was relative to local hydrogeological condition.

A Panel member asked whether this recommendation suggested that the EPA develop guidance on the vertical separation of wells from surface water bodies and the zone for completion of the hydraulic fracturing well. Dr. Dzombak noted that this recommendation asked the EPA to provide additional perspective in the Assessment Report on the concept of vertical separation. Another Panel member stated that this recommendation referred to the distance between underground sources of drinking water and target horizons for oil and gas activities.

A Panel member stated that the SAB Panel’s draft report recommendation on this topic should reference available graphic representations of microseismic analyses in the Barnett Shale and other formations that depicted the scenarios raised in this recommendation. The Panel member further stated that this recommendation should also include information on changes to geomechanics and fracture morphology that occur based on this vertical separation. Several Panel members agreed that this information would be useful to add to this recommendation. Dr. Dzombak asked the Panel member to send that information to the Designated Federal Officer for incorporation into the SAB Panel’s draft report.

Topic #19 of the March 2, 2016 ‘Suggested Topics’ document: Definitive statements regarding whether some or all hydraulically fractured wells are or are not leaking

A Panel member noted that the SAB Panel’s draft report recommended that the draft Assessment Report should not make definitive statements regarding whether some or all hydraulically fractured wells are leaking. Several Panel members stated that it would be appropriate for the draft Assessment Report to make such statements, but that the EPA could not assess the rate of leakage unless such an assessment was supported by available data and appropriate analysis. Several Panel members expressed concern that this recommendation was not linked to specific text in the draft Assessment Report, and that definitive statements regarding whether some or all hydraulically fractured wells are leaking could not be found in the Assessment Report. After discussion, the Panel agreed to delete this sentence from the SAB Panel’s draft report.

Topic #20 of the March 2, 2016 ‘Suggested Topics’ document: Use of the term “chemicals” when describing constituents in flowback and produced waters

A Panel member stated that the SAB Panel’s draft report’s use of the term “chemicals” was misleading and ambiguous, since to many readers the term “chemical” implied a manufactured compound. The Panel member noted that flowback and produced water will also contain dissolved, naturally occurring cations and anions. After discussion, the Panel agreed that the term “constituents” should be used instead of the term “chemicals” within the SAB Panel’s draft report where appropriate.

Topic #21 of the March 2, 2016 ‘Suggested Topics’ document: Statements noting model predictions and results are not evidence

A Panel member noted that the SAB Panel’s draft report stated that the EPA’s model predictions for fracture propagation and fluid migration were not “evidence.” The Panel member noted that this statement in the SAB Panel’s draft report is confusing. Several Panel members agreed that the sentence is confusing, and the Panel agreed that additional clarification should be provided in the SAB Panel’s draft report on this recommendation.

A Panel member suggested noting in the text that models provide possible outcomes that are limited by the assumptions made in design and implementation of the model, and that any reference to a model should state the assumptions and limitations of the model. The Panel member also stated that the text should note that predictive models must be validated with measurements in order to justify making predictive simulations. The Panel agreed to incorporate these clarifications into the SAB Panel’s draft report, and a Panel member agreed to work with the Designated Federal Officer to adjust the language of the draft SAB Report consistent with the above-noted changes.

Topic #22 of the March 2, 2016 ‘Suggested Topics’ document: Water acquisition and streams/wells running dry

A Panel member noted that the SAB Panel’s draft report provided recommendations for the EPA to characterize imbalances between water supply and demand. The Panel member suggested that the Panel’s draft report should note that the EPA’s finding that there were no reported cases where water use for hydraulic fracturing alone caused a stream or well to run dry is not an appropriate criterion to use to determine an occurrence of impacts. Upon discussion, the Panel agreed to incorporate this suggestion into the draft SAB Report. The Panel member also noted that a stream with substantially decreased water availability or a well experiencing regional water-level decline as a result of water acquisition may be significantly impacted. The Panel member also suggested that the SAB Panel’s draft report should recommend that the EPA’s analyses regarding water supply and demand should focus on impacts and not assess benefits as was recommended in SAB Panel’s second draft report. The Panel member noted that the EPA’s analysis should assess positive (beneficial) and negative (detrimental) impacts and the full scale and range of severity of impacts. A Panel member stated that some impacts from hydraulic fracturing activities were beneficial, such as the use of acid mine drainage within HFWC operations.

Upon discussion, the Panel agreed that it would be appropriate for the SAB Panel’s second draft report to recommend that the EPA discuss positive and negative impacts within the Assessment Report.

Topic #23 of the March 2, 2016 ‘Suggested Topics’ document: Reinsert paragraph that was deleted from 1/7/16 1st draft Panel report

A panel member noted that in the SAB Panel’s second draft report, a paragraph was deleted from the Panel’s January 7, 2016 draft report that stated major limitations of the FracFocus Chemical Disclosure Registry database and the Water Use in the United States database that the EPA relied upon to develop the draft Assessment Report. The Panel member suggested reinserting the deleted paragraph into the next draft SAB Panel report, and after discussion, the Panel agreed to

reinsert this paragraph into the Panel's draft report.

Topic #24 of the March 2, 2016 'Suggested Topics' document: Assessment of abandoned wells

A panel member noted that the SAB Panel's second draft report should state that during the well injection stage of hydraulic fracturing, the identification of abandoned wells and determination of abandoned well integrity is a critical task in order to conduct HFWC activities in a responsible manner.

A Panel member noted that the State of Ohio required well operators to locate all wells within a one-mile radius of oil and gas wells, and noted that the SAB Panel's draft report should recognize how some states have oil and gas well drilling regulatory requirements related to abandoned wells. The Panel discussed these suggestions and agreed that the SAB Panel's draft report should incorporate these suggestions. A Panel member stated she would work with the Designated Federal Officer to adjust the language of the draft SAB Report consistent with the above-noted changes.

Topic #25 of the March 2, 2016 'Suggested Topics' document: Well file review assessment of leaking hydraulically fractured wells

A Panel member expressed concern that the SAB Panel's draft report recommended that the EPA examine and assess more or all of the 20,000 well files referenced in the draft Assessment Report. Another Panel member stated that it would be a large task to review all of the 20,000 well files, and suggested that perhaps the EPA could review more well files than it had reviewed in preparing the draft Assessment Report, but not all 20,000 referenced.

Two statisticians from the Panel noted that since the February 1 and February 2, 2016 Panel teleconferences, they had received additional information from the EPA's ORD staff on the EPA's well file review to assist the Panel in developing its draft report. These Panel members stated that the EPA identified approximately 24,000 well files for its analyses, and that it would not be realistic for the SAB Panel to recommend that the EPA should expand its well file review due to restrictions that the Paperwork Reduction Act placed on the agency for contacting companies to request more information.

A Panel member stated that the Paperwork Reduction Act would not unduly restrict the EPA in its well file analyses. Another Panel member noted that it would be helpful if the EPA analyzed additional well file records since the agency could reduce the statistical uncertainties associated with its well file assessment through such an analyses. The Panel member noted that there were two orders of magnitude uncertainty associated with the EPA's well file analysis. Several Panel members noted that this uncertainty could be reduced through additional efforts to review available well files.

Upon discussion, the Panel agreed that it would recommend that the EPA examine and assess substantially more than the 327 well files that the EPA evaluated out of the approximately 24,000 available well files that are referenced in the draft assessment report.

Topic #26 of the March 2, 2016 ‘Suggested Topics’ document: Spatial proximity of wells to each other, to water sources, and to geologic faults

A Panel member suggested that within the EPA’s Final Assessment Report, the EPA should provide a clearer description on the three dimensional nature of well injection. The Panel member also suggested that the Panel should consider recommending that the EPA’s analyses regarding the spatial proximity of wells to each other and to water sources and to known geologic faults be conducted before finalizing the Assessment Report rather than as longer-term future activities.

A Panel member suggested that the agency provide more information in the final Assessment Report on the three-dimensional nature and aspects of well injection, but that the EPA’s analyses regarding the spatial proximity of wells to each other and to water sources and to known geologic faults should be conducted as longer-term future activities. The Panel agreed to adjust the language of the draft SAB Report consistent with this suggestion.

Topic #27 of the March 2, 2016 ‘Suggested Topics’ document: Rarity of seismic events

A Panel member expressed concern that the SAB Panel’s draft report stated that induced seismicity at hydraulic fracturing sites is anticipated to be a rare occurrence. The Panel member noted that induced seismicity at hydraulic fracturing sites in Kansas and Oklahoma is not rare, and stated that the cause of such events is believed to be deep-well injection for wastewater disposal. Several Panel members agreed that induced seismicity at hydraulic fracturing sites is not a rare event.

A Panel member suggested that the Panel should avoid reaching a conclusion on the frequency of induced seismicity at hydraulic fracturing sites, since it was the EPA’s job to state whether such events were rare or not. Another Panel member stated that the EPA should better distinguish between microseismic and other seismic events. A Panel member suggested that the SAB should recommend that the EPA recognize in the Assessment Report that various research has been completed on this topic by the USGS, universities and the states.

Upon discussion, the Panel agreed to adjust the language of the draft SAB Report to delete the statement that induced seismicity at hydraulic fracturing sites is anticipated to be a rare occurrence. The Panel also agreed to recommend that the EPA provide an overview of the state of seismic monitoring technology and advances of monitoring technology on the detection of seismicity, and provide documentation and monitoring data that are available for induced seismicity for hydraulic fracturing and deepwell injection activities. The Panel also agreed to recommend that the EPA discuss trends associated with such induced seismicity, including whether deep well injection of wastewater is being reduced because of regulatory changes driven by public concerns about seismic activity.

Topic #28 of the March 2, 2016 ‘Suggested Topics’ document: Conflicting SAB advice regarding distinguishing between flowback and produced water

A Panel member noted that the SAB Panel provided conflicting advice in different sections of the draft SAB Report on whether the EPA should or should not distinguish between flowback and produced water within the EPA’s Assessment Report. A Panel member noted that while members of the public and technical experts may be confused by these terms or were

uncomfortable with the ambiguity arising from a sharp demarcation between these terms, it is important to distinguish between these terms. The Panel member stated that Chapter 7 of the draft Assessment Report provided a reasonably good description of the distinction between flowback and produced water. The Panel member suggested that the EPA more clearly describe the timeframes pertaining to the various stages of the HFWC, and note that while flowback water is produced during a relatively short period of time, produced water is produced throughout the lifetime of an oil and gas well.

The Panel discussed the importance of distinguishing between flowback and produced water within the Assessment Report. Several Panel members agreed that the EPA did a reasonably good job summarizing this topic in the draft Assessment Report, and suggested that these waters should be distinguished since the constituents differed in the waters as a result of differences in time and geological influences associated with the generation of these waters. Several Panel members stated that the EPA should add more clarity to its definitions of both flowback and produced waters since these terms have caused significant confusion among Panel members and the public. A few Panel members stated their understanding of how these waters were distinguished. Dr. Dzombak and several Panel members suggested that the EPA should clarify in the Assessment Report how to distinguish between these waters.

A Panel member recommended that these waters should be distinguished when it is important to make these distinctions. A Panel member stated that it is important to maintain distinctions between these waters where possible because it is important to know what constituents go into wells vs. comes out of wells. Another Panel member stated it is unclear whether flowback or produced waters were assessed within tables in the appendices of the draft Assessment Report, and suggested that the EPA amend these tables to clarify this distinction. Another Panel member noted that sometimes hydraulic fracturing activity in highly porous rocks resulted in both flowback and produced waters being returned together to the surface during the hydraulic fracturing operation.

A Panel member suggested that the draft SAB Report not recommend that the EPA either distinguish or not distinguish between flowback and produced waters in the Assessment Report. The Panel member noted that fluid temperature and quality changes over the time that a hydraulically fractured well is in operation, and stated that the SAB Panel should recommend that the EPA describe situations when it is useful to distinguish and useful to not distinguish between these waters.

Upon discussion, the Panel agreed that the draft SAB Report should be revised to remove recommendations for not distinguishing between flowback and produced waters, and to note that distinguishing these waters is important for risk assessment purposes. The Panel also agreed to recommend that the EPA consider strengthening its definitions of flowback and produced waters, and consider the relevance of operational factors, pressure monitoring, water quality aspects, and other factors that may be associated with these definitions.

Topic #29 of the March 2, 2016 ‘Suggested Topics’ document: Source of salt in waters

A Panel member suggested that the draft SAB Report’s recommendations regarding the sources of salts in produced waters should be revised to improve clarity of the discussion. Several Panel members noted that the term ‘salt’ is ambiguous, and that the text could be referring either to dissolved solids, salinity, halite, dissolved cations, or dissolved salts depending on the context of

the recommendation. A Panel member volunteered to rewrite the language of the draft SAB Report to improve the clarity of this recommendation and send the updated language to the Designated Federal Officer. The Panel agreed with this approach.

Topic #30 of the March 2, 2016 'Suggested Topics' document: Long distance travel incidents

A Panel member suggested that the Panel should avoid stating how rarely long-distance travel incidents associated with releases of chemicals were reported to occur, since the SAB Panel did not conduct a thorough literature review to substantiate this claim. A Panel member suggested that the EPA could quantify the frequency of such releases by contacting state departments of transportation to gather information on accidents and materials carried by transporters, and noted this analysis would likely be a substantial effort. Another Panel member stated that they would provide a reference to a roadbed study on this topic that could be cited within the draft SAB Report. A Panel member suggested that the draft SAB Report could note that such long distance travel incidents may have been rarely reported.

After discussion, the Panel agreed to add a citation to the available roadbed study to the draft SAB Report, and to note that such long distance travel incidents may have been rarely reported.

Topic #31 of the March 2, 2016 'Suggested Topics' document: Comparison between number of identified cases where drinking water resources were impacted and the number of drinking water resources that have been impacted

A Panel member noted that the draft Assessment Report stated that the number of identified cases where drinking water resources were impacted was small compared to the number of hydraulically fractured wells. The Panel member stated that in addition to comparing the number of impacted drinking water resources against the number of hydraulically fractured wells, the EPA should compare the number of impacted drinking water resources against the number of drinking water resources. Several Panel members agreed with this recommendation, noting that an analysis that compared impacted drinking water resources against drinking water resources would be more appropriate statistically.

A Panel member commented that a release on one wellpad would not contaminate an entire drinking water resource, and noted that releases from underground storage tanks to aquifers often are investigated and remediated without resulting in contamination of the entire drinking water resource affected by the release.

Several Panel members suggested that the EPA consider assessing other scenarios associated with the number of identified impact cases, including, for example, a comparison of the number of impacted drinking water wells against the total number of drinking water wells in the area. A Panel member suggested that if the number of impacted drinking water wells were compared against the total number of drinking water wells, the ratio of impact cases would reduce since there were many drinking water wells that were not impacted by hydraulic fracturing.

Dr. Dzombak suggested that rather than suggesting that the EPA assess specific metrics, the Panel should recommend that the EPA consider assessing other additional benchmarks for comparison. The Panel agreed with this suggestion for amending the draft SAB Report's recommendations.

Dr. Dzombak then noted that the Panel's discussions on the thirty-one topics raised in his March 2, 2016 'Suggested Topics for Discussion'⁹ document was completed.

Panel Discussion on the March 9, 2016 'Follow-up regarding Dissenting Opinion Discussion' Document

Dr. Dzombak stated that during the Panel's March 7, 2016 teleconference, the Panel discussed the dissenting opinion prepared by Panel member Walt Hufford, and developed agreed-upon changes to its February 16, 2016 second draft report language responding to three of Mr. Hufford's four dissenting opinions, and also changes to the draft report responding to Mr. Hufford's three recommendations for changes. Dr. Dzombak noted that one dissenting opinion from Mr. Hufford remained which would be incorporated into the SAB Panel's third draft report.

Dr. Dzombak noted that his March 9, 2016 'Follow-up regarding Dissenting Opinion Discussion' document¹⁰ was posted on the Panel's March 7, 2016 website. Dr. Dzombak stated that this March 9, 2016 document provided the Panel's suggested changes to its February 16, 2016 second draft report resulting from the Panel's discussion of Mr. Hufford's four dissenting opinions and three recommendations during the Panel's March 7, 2016 teleconference. Dr. Dzombak noted that several members of the Panel had helped to craft the updated language reflected in the March 9, 2016 document. Dr. Dzombak noted that the Panel would discuss whether this March 9, 2016 document accurately summarized the Panel's March 7 teleconference discussions and whether the Panel agreed with the suggested changes.

Topic #1, Dissenting Opinion from Walt Hufford, of the March 9, 2016 'Follow-up regarding Dissenting Opinion Discussion' document: EPA's finding of "no widespread, systemic impacts on drinking water resources within the United States"

The Panel discussed the suggested changes noted in the March 9, 2016 'Follow-up' document on this topic, and agreed to incorporate most of the suggested changes to the draft SAB Report that were noted in the March 9, 2016 document. The Panel discussed the definition of the word 'impact' that the EPA provided in Appendix J of the draft Assessment Report, and whether this definition should be changed. Several Panel members noted that the EPA should describe the meaning of the term "any observed change" that the EPA included within this definition. Several Panel members also suggested adding recommendations that the EPA include possible modifying adjectives before the EPA's conclusion statement on page ES-6 of the draft Assessment Report that the agency did not find evidence that hydraulic fracturing activities have led to widespread, systemic impacts on drinking water resources in the United States.

Upon discussion, the Panel agreed to adjust the language of the draft SAB Report to suggest that the EPA consider including modifying adjectives before the words "widespread, systemic impact" in the statement on page ES-6 of the draft Assessment Report. The Panel also agreed to adjust the language of the draft SAB Report to recommend that the EPA carefully consider whether to revise the definition of "impact" as provided in Appendix J of the draft Assessment Report, and that the EPA discuss what is meant by "any observed change" in the definition of "impact" in Appendix J, perhaps with use of an example.

Mr. Hufford also suggested that the text of the draft SAB Report note that most members of the SAB Panel agreed that the EPA's statement on this topic requires clarification and additional

explanation. The Panel agreed that the text of the draft SAB Report should be adjusted to incorporate this suggested change.

Topic #2, Dissenting Opinion from Walt Hufford, of the March 9, 2016 ‘Follow-up regarding Dissenting Opinion Discussion’ document: Prospective case studies

The Panel discussed the suggested changes noted in the March 9, 2016 ‘Follow-up’ document on this topic, and agreed to incorporate most of the suggested changes to the draft SAB Report that were noted in the March 9, 2016 document. Mr. Hufford stated that he had concerns regarding the following sentence in the draft SAB Report: “Due to challenges associated with access (involving industry partners and landowners) and timing (for the study report and well development), these prospective studies were not conducted by the EPA.” Mr. Hufford stated that there were several other reasons why the EPA did not conduct the prospective studies, and that technical challenges also affected the EPA’s progress on conducting the prospective studies. A Panel member stated that the Panel should not speculate in its draft report on why the EPA did not conduct the prospective studies.

The Panel agreed to delete language from the draft SAB Report that described the SAB Panel’s understanding of the reasons why the prospective studies were not completed. The Panel also agreed that the draft SAB Report would note that the planned prospective studies were not conducted or completed by the EPA, and that the reasons for not conducting them were not described in the draft Assessment Report. The Panel further agreed to note that the EPA should evaluate lessons learned from its initial attempts and implementation challenges in developing the prospective case studies, and describe in the final Assessment Report its plans for conducting prospective studies and other research that the EPA had planned but did not conduct.

The Panel also agreed to delete a repetitive sentence in the draft SAB Report on this topic, and to adjust the sentence that noted that a Panel member did not find the lack of prospective case studies to be a limitation to the draft Assessment Report by adding a clause to clarify that the lack of such studies is not a limitation based on the perspective that investigations conducted by universities, consulting firms, and other external stakeholders could be used in lieu of the agency conducting such studies.

Topic #3, Dissenting Opinion from Walt Hufford, of the March 9, 2016 ‘Follow-up regarding Dissenting Opinion Discussion’ document: Major Finding associated with chemical mixing stage in the HFWC

The Panel discussed the suggested changes noted in the March 9, 2016 ‘Follow-up’ document on this topic, and agreed to incorporate all of the suggested changes to the draft SAB Report noted in the March 9, 2016 document.

Topic #4, Dissenting Opinion from Walt Hufford, of the March 9, 2016 ‘Follow-up regarding Dissenting Opinion Discussion’ document: Data limitations and uncertainties

The Panel discussed the suggested changes noted in the March 9, 2016 ‘Follow-up’ document on this topic, and agreed to incorporate most of the suggested changes to the draft SAB Report noted in the March 9, 2016 document. Mr. Hufford stated that he had concerns regarding the following sentence in the draft SAB Report: “The SAB agrees there are important gaps and uncertainties in publicly available data that the EPA relied upon in its analyses on sources and

quantities of water used in hydraulic fracturing.” Mr. Hufford stated that the SAB did not audit the EPA’s work on this topic and that he cannot agree to this language. Mr. Hufford stated that the sentence should be revised to note that there were important gaps and uncertainties in publicly available data that the EPA relied upon in its analyses on sources and quantities of water used in hydraulic fracturing. The Panel agreed to make this change to the draft SAB Report.

Topic #5, Dissenting Opinion from Walt Hufford, of the March 9, 2016 ‘Follow-up regarding Dissenting Opinion Discussion’ document: Recommendation #1 regarding Proposed Major Finding – Role of regulatory agencies in the HFWC process

The Panel discussed the suggested changes noted in the March 9, 2016 ‘Follow-up’ document on this topic, and agreed to incorporate most of the suggested changes to the draft SAB Report that were noted in the March 9, 2016 document. A Panel member stated that the text of the draft SAB Report referred to state regulations and standards in a few places, and the Panel member stated that this text should instead refer to federal, state and tribal regulations and standards. The Panel agreed to make these changes to the draft SAB Report.

Topic #6, Dissenting Opinion from Walt Hufford, of the March 9, 2016 ‘Follow-up regarding Dissenting Opinion Discussion’ document: Recommendation #2 regarding Proposed Major Finding –Potable water well construction and maintenance, and education of the public on water well results

The Panel discussed the suggested changes noted in the March 9, 2016 ‘Follow-up’ document on this topic, and agreed to incorporate most of the suggested changes to the draft SAB Report that were noted in the March 9, 2016 document. A Panel member stated that the draft SAB Report language should not refer to “regulatory frameworks of the oil and gas industry,” and the Panel agreed to delete the clause “of the oil and gas industry” from this sentence. Other Panel members suggested changing the term “mineral constituents” to “dissolved mineral constituents,” and adding the term “other” before the word “contaminants;” the Panel agreed to make these changes in the draft SAB report.

Topic #7, Dissenting Opinion from Walt Hufford, of the March 9, 2016 ‘Follow-up regarding Dissenting Opinion Discussion’ document: Recommendation #3 regarding Comments associated with investigations in Dimock, Pennsylvania; Pavillion, Wyoming; and Parker County, Texas

The Panel discussed the suggested changes noted in the March 9, 2016 ‘Follow-up’ document on this topic, and agreed to incorporate most of the suggested changes to the draft SAB Report that were noted in the March 9, 2016 document. Dr. Dzombak stated that the recommendations in the draft SAB Report regarding investigations in Dimock, Pennsylvania; Pavillion, Wyoming; and Parker County, Texas were adjusted to not associate these recommendations to any particular stage of the HFWC, and to make these recommendations an overarching comment in the draft SAB Report’s cover letter and Executive Summary. The Panel agreed to make these suggested changes in the updated draft SAB Report.

Dr. Dzombak then asked Mr. Hufford to provide an update on the status of his dissenting opinion that was posted in the Panel’s February 16, 2016 second draft report. Mr. Hufford thanked the Panel for their consideration and deliberations related to his dissenting opinion. Mr. Hufford noted that his dissenting opinion Topic #1 regarding the EPA’s finding of “no widespread, systemic impacts on drinking water resources within the United States” should remain as his sole dissenting opinion in the Appendix of the Panel’s third draft SAB report. Mr. Hufford stated that

this dissenting opinion should use the language he submitted that was posted in the Panel's February 16, 2016 second draft report. Mr. Hufford noted that the concerns described in his three other dissenting opinions and three recommendations that were noted in his dissenting opinion language in the Panel's February 16, 2016 second draft report were adequately addressed through the Panel's discussions and the agreed-upon additional changes to the Panel's second draft report.

Dr. Dzombak stated that three Panel members - Drs. Stephen Almond and Shari Dunn-Norman, and Mr. John Fontana- have stated that they would be joining Mr. Hufford's dissenting opinion Topic #1 regarding the EPA's finding of "no widespread, systemic impacts on drinking water resources within the United States." Mr. Fontana stated that he agreed with that statement, and Dr. Dzombak noted he would follow-up with Drs. Almond and Dunn-Norman to confirm that they would join Mr. Hufford on this dissent. Dr. Dzombak asked if any other Panel members wanted to join Mr. Hufford's dissenting opinion.

A Panel member asked Mr. Hufford whether the data and analysis in the draft Assessment Report served as the basis for his dissent, or whether Mr. Hufford's experiences and information that are not described in the draft Assessment Report served as the basis for his dissent. Mr. Hufford stated that the data provided in the draft Assessment Report and the data in public comments that were submitted for consideration by the Panel served as the basis for his dissent. Mr. Hufford stated that the data were correct, and that the EPA could have better articulated the data that it relied upon in its Assessment Report. Several Panel members responded that the Panel is not saying whether or not the data are correct. The Panel members stated that the EPA did not adequately justify its ambiguous statements, and that the Panel is asking the EPA to clarify its statements.

Dr. Dzombak asked whether any Panel members would like to discuss any other issues. A Panel member noted that the EPA's draft Assessment Report did not define the term 'containment' well. The Panel member noted he would submit wording to the Designated Federal Officer to incorporate into the updated draft Panel report that would recommend that the EPA improve this definition. Another Panel member stated that the second draft Panel report's cover letter to the Administrator did not clearly describe the timeline of prior SAB Panel activities. The Panel member stated that she would submit wording to the Designated Federal Officer to clarify this timeline.

Summary of Next Steps

Dr. Dzombak noted that the Panel had completed its discussion on the second draft Panel report, and reached substantive agreement from all Panel members on the overall contents of the updated draft SAB Panel Report. He stated that during the March 7 and March 10, 2016 teleconferences, several Panel members agreed to send the Designated Federal Officer revised wording to the second draft Panel report by March 14, 2016. Dr. Dzombak then reiterated the summary of next steps that he provided towards the end of the Panel's March 7, 2016 teleconference.

Regarding the upcoming quality review by the chartered SAB, Dr. Dzombak noted that he would participate in the chartered SAB quality review, and that typically the chartered SAB would have requests for modifications to the draft Panel report in response to the above-noted four questions. Dr. Dzombak stated that the chartered SAB has a range of options for disposition of the report,

including:

- (a) Accept the draft report as is;
 - (b) Accept the draft report subject to revision by the chair of the Panel, and return the draft report to the chair of the chartered SAB;
 - (c) Revise the draft report and resubmit the draft report to the chartered SAB for review;
- or
- (d) Return the draft report to the Panel for additional work, and resubmit the draft report to the chartered SAB for review.

Dr. Dzombak noted that he may request that certain Panel members be available to participate during the chartered SAB quality review, or request assistance from certain Panel members in redrafting sections of the Panel's report, depending on the questions that may be raised by the chartered SAB during quality review and his need for such assistance. He noted that the quality review meeting will be conducted by the chartered SAB. Panel members will be welcome to attend the chartered SAB meeting but attendance is optional.

Dr. Dzombak asked whether Panel members had any questions regarding this plan for moving forward. A Panel member asked what consequences would occur if a Panel member did not concur on the updated draft Panel report. The Designated Federal Officer responded that if a Panel member did not concur on the full updated draft Panel report or a portion of the report, the Panel's report would state that the Panel member did not concur on the full report or a portion of the report.

A Panel member expressed concern regarding the second draft Panel report's advice regarding the EPA's conclusion statement on page ES-6 of the draft Assessment Report that the agency did not find evidence that hydraulic fracturing activities have led to widespread, systemic impacts on drinking water resources in the United States. The Panel member expressed concern that the second draft Panel report's language on this topic included the clause: "While the EPA's conclusion may be correct..." The Panel member noted that this statement may infer that the Panel concluded that the EPA's conclusion is correct. Dr. Dzombak responded that each Panel member must make their personal decision on whether to concur or not concur with the updated draft Panel report.

The Designated Federal Officer stated that he and Dr. Dzombak would prepare minutes for the Panel's March 7 and March 10, 2016 teleconference and that these minutes would be posted onto the SAB Panel teleconference website when they were final.

Dr. Dzombak stated that the SAB Hydraulic Fracturing Research Advisory Panel is a very large Panel, and that there were many issues that the Panel had to address. He stated that the Panel's spirit of collegiality enabled the Panel to get to this point in the Panel's advisory process.

Dr. Dzombak asked if the Panel members had any additional questions or comments. Hearing none, Dr. Dzombak thanked the Panel members, the EPA staff, and SAB Staff Office. With the teleconference business concluded, the Designated Federal Officer adjourned the teleconference at 6:45 pm ET.

Respectfully Submitted:

/Signed/
Mr. Edward Hanlon
Designated Federal Officer

Certified as Accurate:

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

NOTE AND DISCLAIMER: The minutes of this public teleconference reflect diverse ideas and suggestions offered by Panel members during the course of deliberations within the teleconference. Such ideas, suggestions and deliberations do not necessarily reflect consensus advice from the Panel members. The reader is cautioned to not rely on the minutes to represent final, approved, consensus advice and recommendations offered to the Agency. Such advice and recommendations may be found in the final advisories, commentaries, letters or reports prepared and transmitted to the EPA Administrator following the public meetings or teleconferences.

Materials Cited

The following teleconference materials are available on the SAB website (www.epa.gov/sab) or through the following SAB Hydraulic Fracturing Research Advisory Panel March 7, 2016 teleconference page:

<https://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/d451dd9ce7752a9285257f17006edb7e!OpenDocument&Date=2016-03-07>

¹ Science Advisory Board Panel's February 16, 2016 draft report regarding SAB's review of the EPA's draft *Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources (External Review Draft – June 2015)*

² December 29, 2015 Federal Register Notice announcing the public teleconference (80 FR 81321 – 81323)

³ Agenda for February 1, 2016 public teleconference

⁴ Oral Statement submitted by Mr. Hugh MacMillan

⁵ Oral Statement submitted by Mr. Jackie Stewart

⁶ Oral Statement submitted by Ms. Mary Winfree

⁷ Oral Statement submitted by Mr. William Fleckenstein

⁸ Oral Statement submitted by Ms. Yvonne Watson

⁹ March 2, 2016 "Suggested Topics for Discussion" document from Dr. David Dzombak in preparation for the Panel's March 7, 2016 Teleconference

¹⁰ March 9, 2016 "Follow-up regarding Dissenting Opinion Discussion" document from Dr. David Dzombak in preparation for the Panel's March 10, 2016 Teleconference

ATTACHMENT A – ROSTER

U.S. Environmental Protection Agency Science Advisory Board Hydraulic Fracturing Research Advisory Panel

CHAIR

Dr. David A. Dzombak, Hamerschlag University Professor and Department Head, Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh, PA

MEMBERS

Dr. Stephen W. Almond, Director of Research & Development, Fritz Industries, Inc, Houston, TX

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Mr. John V. Fontana, Professional Geologist and President, Vista GeoScience LLC, Golden, CO

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Mr. Walter R. Hufford, Director of Government and Regulatory Affairs, Talisman Energy USA Inc. - REPSOL, Warrendale, PA

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Mr. Edward Hanlon, Designated Federal Officer, U.S. Environmental Protection Agency, Science Advisory Board Staff, Washington, DC

ATTACHMENT B – Other Attendees

List of Members of the Public Who Requested Information on Accessing the Teleconference Line or Live Webcast, or Who Participated On the Teleconference or Live Webcast:

March 7 and March 10, 2016

Name	Affiliation
Adgate, Andrew	No Affiliation Given
Adler, Kevin	No Affiliation Given
Albert, Jay	XTO Energy
Angiola, Gina	No Affiliation Given
Armstrong, Matt	No Affiliation Given
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Aschenbach, Ernie	VDGIF
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Baldwin, Lily	Chevron Energy Technology Company
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Baughman, Ann	No Affiliation Given
Bentley, Tracee	American Petroleum Institute Colorado Petroleum Council
Bergstrom, Mike	No Affiliation Given
Bernstein, Jenna	No Affiliation Given
Bolakas, John	Woodard & Curran
Boone, Rick	Engineering Consulting
Borawski, Teddy	No Affiliation Given
Brasch, Walter	No Affiliation Given
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Brown, Kenny	No Affiliation Given
Brown, Michael	No Affiliation Given
Buffone, Steven	No Affiliation Given
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Chadwick, Dan	EPA
Cohn, Peter	No Affiliation Given
Connolly, Matt	No Affiliation Given
Conti, David	No Affiliation Given
Corey, Joanne	No Affiliation Given
Crane, Jessica	No Affiliation Given
Davila, Alejandro	No Affiliation Given
Dean, Nancy	No Affiliation Given
Deborah K. Thomas	No Affiliation Given
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Dixon, Danny	No Affiliation Given
Dlouhy, Jen	Bloomberg
Dwyer, John	No Affiliation Given
Dwyer, Karen	Stone Crab Alliance
Everage, Beth	Consumer Energy Alliance
Faber, Colleen	No Affiliation Given
Feil, Kim	No Affiliation Given
Feinstein, Laura	No Affiliation Given
Feldscher, Kyle	No Affiliation Given
Fenton, John	No Affiliation Given
Fleckenstein, William	Colorado School of Mines
Fleming, Megan	EPA
Francis, Dick	Shell
Frantz, Joe	No Affiliation Given
Freeman, Marc E.	No Affiliation Given
Furman, Victor	No Affiliation Given

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Green, Sam	No Affiliation Given
Guldi, Richard	No Affiliation Given
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Herrera, Roxana	No Affiliation Given
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Jackson, Tom	Baker Botts, LLP
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Jolly, Margaret Leslie	No Affiliation Given
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Litvak, Anya	No Affiliation Given
Lock, Matthew	No Affiliation Given
Long, Michelle	No Affiliation Given
Ludwig, R.	No Affiliation Given
MacMillan, Hugh	Food And Water Watch
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Mathis, Mike	No Affiliation Given
McBride, David	Anadarko Petroleum
McFadden, Angela	No Affiliation Given
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Meixsell, Tara	No Affiliation Given
Mesbah, Dina	No Affiliation Given
Miller, Pete	No Affiliation Given
Mills, Andrew	No Affiliation Given
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Nguyen, Juliette	No Affiliation Given
Noel, John	No Affiliation Given

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Puls, Robert	No Affiliation Given
Reuterskiold, Susan Dowling	No Affiliation Given
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Ridley, Caroline	No Affiliation Given
Ring, Shari	The Cadmus Group
Rock, Andrew	Florida Coalition Against Fracking
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Roles, Rick	No Affiliation Given
Ryan, Vanessa	No Affiliation Given
Sandilos, Robert	No Affiliation Given
Saunders, Nichole	Environmental Defense Fund
Schecter, Allegra	No Affiliation Given
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Weaver, Jim	No Affiliation Given
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Williams, Susan	No Affiliation Given
Williams, Wes	No Affiliation Given
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