U.S. Environmental Protection Agency
Science Advisory Board
Public Meeting
Meeting Minutes

Date and Time: June 14, 2016, 8:30 a.m. to 5:00 p.m.
June 15, 2016, 9:00 a.m. to 12:00 p.m.

Location: Westin Alexandria, 400 Court House Square, Alexandria, VA 22314

Purpose: To conduct a quality review of a draft Science Advisory Board (SAB) report on recommendations on the Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources; to receive briefings from other EPA federal advisory committees, and Office of Research and Development on topics of interest for possible future SAB advice.

Meeting Participants:
SAB Members

Dr. Peter S. Thorne, Chair
Dr. Joseph Arvai
Dr. Kiros T. Berhane
Dr. Sylvie M. Brouder
Dr. Ingrid Burke
Dr. Michael Dourson
Dr. Joel J. Ducoste
Dr. David A. Dzombak
Dr. Elaine M. Faustman
Dr. Susan P. Felter
Dr. William Field
Dr. H. Christopher Frey
Dr. Steven Hamburg
Dr. Cynthia M. Harris
Dr. Robert J. Johnston
Dr. Kimberly L. Jones
Dr. Catherine J. Karr
Dr. Francine Laden
Dr. Robert E. Mace
Dr. Mary Sue Marty
Dr. Denise Mauzerall
Dr. Kristina D. Mena *
Dr. Surabi Menon
Dr. James R. Mihelcic
Dr. H. Keith Moo-Young
Dr. James Opaluch
Mr. Richard L. Poirot
Dr. Kenneth M. Portier
Dr. David B. Richardson
Dr. Tara L. Sabo-Atwood
Dr. William Schlesinger
Dr. Gina Solomon,
Dr. Daniel O. Stram
Dr. Jay Turner
Dr. Jeanne M. VanBriesen
Dr. John Vena
Dr. Elke Weber
Dr. Charles Werth
Dr. Peter J. Wilcoxen
Dr. Robyn S. Wilson*

*Members on telephone
(For the full SAB see Roster[1])

SAB Staff:
Mr. Thomas Carpenter, Designated Federal Officer (DFO), for the Chartered SAB
Mr. Thomas Brennan, SAB Staff Office Deputy Director
Dr. Edward Hanlon, DFO, Hydraulic Fracturing Research Panel

Other Attendees: Names of those in attendance and those who requested the teleconference call-in number are provided in Attachment A and Attachment B, respectively.

Meeting Summary:

Convene the meeting

Mr. Thomas Carpenter, Designated Federal Officer (DFO) for the chartered SAB, formally opened the meeting and noted that this federal advisory committee teleconference was announced in the Federal Register[2]. The SAB is an independent, expert federal advisory committee chartered under the authority of the Federal Advisory Committee Act (FACA). The SAB is authorized by the Environmental Research, Development, and Demonstration Authorization Act (ERDDAA), to provide advice to the EPA Administrator on scientific and technical issues that support the EPA's decisions. The DFO noted that the Federal Register notice announcing the meeting had provided the public with an opportunity to provide written and oral comment.

The DFO stated that the SAB consists entirely of special government employees (SGEs) appointed by EPA to their positions. As SGEs, chartered SAB members are subject to all applicable ethics laws and implementing regulations. EPA has determined that advisors participating in this meeting have no financial conflicts of interest or appearance of a loss of impartiality under ethic regulations specified in 5 CFR §2635 relating to the topic of this meeting. The DFO noted that Dr. Thomas Parkerton recused himself and will not attend the meeting.

Purpose of the teleconference and review of the agenda

The SAB Chair, Dr. Peter Thorne, stated that there were two major purposes for the SAB Meeting 1) to hear public comments on the SAB Draft Review of Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources and conduct the quality review of the document; and 2) receive briefings from other EPA federal advisory committees, and Office of Research and Development on topics of interest for possible future SAB advice. Hearing no questions from Board members, Dr. Thorne proceeded to the agenda[3]

Quality Review of the Draft SAB (4-26-2016) Review of Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources

Dr. Peter Thorne stated that the SAB convened to conduct a quality review of the SAB Draft (4-26-2016) Review of Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources. Dr. Thorne noted that there were 31 registered speakers and reminded those listening and in attendance the SAB also heard public comments on June 8, 2016 via teleconference to accommodate the members of the public interested in this issue. Minutes from the June 8 teleconference are posted on the SAB website.

Dr. Thorne reminded members that the purpose of the quality review is to determine if the report is ready to transmit to the Administrator as a SAB report and under what conditions. In reaching that determination he asked members to focus on the SAB's four quality review questions:

- Were the charge questions adequately addressed?
- Are there any technical errors or omissions in the report or issues that are not adequately dealt with in the draft report?
- Is the draft report clear and logical?

- Are the conclusions drawn or recommendations provided supported by the body of the draft report?

He noted the review would begin with public comments through the morning. After lunch the Chair of the Hydraulic Fracturing Research Panel (hereafter referred to as the panel), would provide an overview of the report followed by the lead reviewer comments and then comments from other board members. The Board would then discuss and vote on a disposition for the report. Dr. Thorne welcomed the public commenters and noted that some may be participating via teleconference. Registered speakers presented in the order they registered and were alloted five minutes. Dr. Thorne suggested that SAB members hear several commenters and ask any questions to small group of four or five commenters to facilitate the meeting flow. Dr Thorne then proceeded to invite the registered speakers[4] to address the SAB members and meeting participants.

Public commenters

Dr. Katie Brown, Ph.D., Energy in Depth, commented that the draft SAB Report did not overturn the EPA's conclusions 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. She stated that the SAB is asking the EPA to change its finding that fracturing fluid spills have. not impacted ground water because the EPA has not provided "evidence of absence of impact." She stated that the SAB was asking EPA to essentially prove a negative, she noted there is nothing in the SAB's draft recommendations that suggests that the EPA's finding of "no widespread, systemic" groundwater impacts from hydraulic fracturing is incorrect. She stated that the SAB should maintain its role as a scientific body and base its recommendations on the science and the facts.

Dr. Hugh MacMillan, Food & Water Watch, summarized his written statement [5] and expressed concern regarding the agency's assessment and its discussion of widespread and systemic impacts from hydraulic fracturing. He noted the Review Panel's report exposes the agency for not having a clear scientific basis to support its controversial top-line finding. The agency only defined "widespread, systemic" implicitly, as being beyond current levels of damage. And as the panel has made clear, the EPA fell far short of quantifying the frequency and severity of the actual impacts to drinking water resources. He urged the Board to convey the sense of the panel to the EPA.

Aaron Mintzes, Earthworks, provided comments on alleged spills and contamination in Pavillion WY, Parker County, TX, and Dimock PA. Mr. Mintzes also provided citations and links to additional information regarding the cites and that information is posted on the SAB webpage[6] summarized in his written public comments.

Erik Milito, American Petroleum Institute, noted that hydraulic fracturing was safe, environmentally protective, and provides environmental benefits. He noted that the U.S. Department of Energy (DOE) studied hydraulic fracturing and various other oil and gas technologies, and in 1999 released a report entitled "Environmental Benefits of Advanced Oil and Gas Exploration and Production Technology." He stated that the DOE report identified several environmental benefits of hydraulic fracturing, including: a) optimized recovery of valuable oil and gas resources; b) fewer wells drilled, resulting in less waste requiring disposal; and c) protection of groundwater resources. He stated that in the late 1990s about 25,000 wells were being hydraulically fractured annually, and that according to DOE, at least 2 million wells

have been hydraulically fractured. He noted that hydraulic fracturing has reduced greenhouse emissions to low levels, and that consumers have lower energy costs using natural gas. He stated that production of natural gas helps the U.S. address geopolitical concerns, and that the science in support of EPA's conclusion of no widespread, systemic impacts is credible and clear. He noted that any other conclusion would ignore science.

Kris J. Nygaard, Ph.D., ExxonMobil Upstream Research Company, summarized his written comments[7]regarding regulatory role of state oil and gas agency in groundwater investigations and a presentation also provided to the National Research Council Workshop on Risks of Unconventional Shale Gas Development

Craig L. Stevens, Patriots From The Oil & Gas Shales, expressed his concerns regarding lax controls on hydraulic fracturing and provided a summary of their analysis of contaminated wells and results from Agency Toxic Substances and Disease Registry and Center for Disease Control. He noted water and air sampling indicated formaldehyde and BTEX were present.

Ray Kemble[8] noted there was a failed water supply well 500 feet from his home in Pennsylvania. He noted there was nothing wrong with the well before hydraulic fracturing occurred in the area. He asked why the 'Halliburton loophole' prevented the investigations at the Dimock, Pennsylvania; Pavillion, Wyoming; and Parker County, Texas sites from being discussed in the EPA's draft Assessment Report. He stated that several nearby homeowners have gag orders preventing them from speaking about the problems at their homes associated with hydraulic fracturing activities. He stated that he was a former gas worker who worked for industry and noted there was a nine square mile moratorium on drilling in Dimock Pennsylvania. He stated that hydraulic fracturing occurred in Dimock Pennsylvania in three wells in 2012, and that since that time six new wells have been contaminated. He noted that in 2014 and 2016 arsenic and barium levels were above regulatory limits. He noted that he would make the data available to the SAB.

Jim Zernell, Newfield Exploration, summarized his written statement[9]. He stated that the SAB should accept the summary findings of the EPA, which are based on sound fact and scientific studies. To advise the EPA otherwise and discount the results of the technical data, would only serve to bolster anti-fossil fuel activists who continue to make wild claims of rampant environmental damage based on a lack of knowledge, conjecture and un-truths—not on years of scientific analysis. He expressed concern regarding the recommendations and supports the scientific findings by the EPA that there has not been, nor does the operation of hydraulic fracturing pose "widespread, systemic impacts to drinking water resources in the United States."

Hope Forpeace commented[10] on the SAB draft report noting it is not possible to know how 'widespread' and 'systemic' water contamination is and expressed concern there are no examples of contamination in the EPA report. She cited the contamination in Pavillion, WY, Parker County RX, and Dimock PA as examples of hydraulic fracturing contamination.

Robert McCaskin introduced himself as an Ottawan Indian and master driller. Mr. McCaskin noted that his experience with the drilling is that safety should be the first priority. He commented that much of the drilling continues without a regulator/inspector present and found much of the drilling to produce wells without integrity (i.e., of 27 wells he worked only 3 had well casing integrity). He also noted basic concepts like not drilling next to schools to reduce potential exposures are not applied.

Melissa Troutman, a reporter with the Public Herald, spoke on her own behalf. She noted that there is substantially more water contamination in the Pennsylvania play than PA Department of Environmental Protection and US EPA have acknowledged. She cited 2013 data published by the Public Herald for 17 of the 40 PA counties that have hydraulic fracturing activities. 278 other wells were confirmed as contaminated by PA DEP. She claimed the Public Herald data indicates that 2,309 cases document regulatory indifference to the citizens claims of contamination.

Scott Gale, Halliburton Energy Services, Inc., spoke about the reuse of water returned after initial well fracturing as an approach to reducing contamination. He agreed with the dissenting opinion in the report that there is not widespread systemic problems arising from hydraulic fracturing. Mr. Gale responded to questions from the SAB members regarding defining a regional basis and exposure noting that 11% of the chemicals in the report are listed in the FRACFocus dataset. He believes that Dimock, Parker County and Pavilion case studies should not be used as representative cases and they provide no supportive evidence.

Steve Gorzula, Independent Environmental Consultant, provide a written statement[11]. He summarized that the June 2015 draft Assessment report statement "We 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. He noted the World Bank Guidelines should be used and a cost benefit analysis should be conducted.

Hillevi Einsein, an independent contractor, noted that responsible hydraulic fracturing is an important energy source for the United States now a global leader in oil and gas operations. She noted that 9.4 million US citizens live within one mile of a well.

Bruce Thompson, American Exploration and Production Council, provided a summary of his written statement[12]. He expressed regret that the Panel has now recommended that the agency's science-based conclusion be clarified, modified or eliminated. After over 5 years of digging and review of peer-reviewed studies, factual evidence as well as anecdotal offerings, the Panel reached a conclusion that apparently disappointed those on the anti-hydraulic fracturing side of the debate. It would be contrary to the mission of this Board for it to yield to political pressure without a basis in science and alter the conclusion of the Panel. There is no science to support a change and to proceed otherwise is to say we must continue the endless search for evidence to support a conclusion that is hoped for but that does not exist. He urged the Board to adopt the Dissenting Opinion of the Panel that the conclusion reached in the initial draft report is sound, science-based and supported by numerous findings of the academic community, government agencies and professional societies and does not, therefore, require modification or additional explanation. Mr. Thompson also responded to a member regarding the encasing wells and emphasized that encasement is protective.

Greg Kozera, Virginia Oil and Gas Association, presented slides[13] spoke about the importance of hydraulic fracturing to the US energy independence. He noted that the greatest risk of exposure to fracturing fluids is surface transportation to wells and possible spills on site. He also highlighted additional innovative exploration techniques to yield higher extraction like utilizing coal seams and methane extraction in abandoned mines.

Carl Carlson, Range Resources, summarized his written statement[14] and noted several concerns. Two concerns expressed in the draft SAB review letter were that: 1) EPA did not conduct planned prospective studies of hydraulic fracturing; and 2) concern with EPA's top line finding concerning the limited scope of confirmed impacts. He believed that the mere two planned study sites would not have provided a representative sampling useful in drawing valid conclusions. He also stated that the systems that EPA evaluated were clearly those that contain drinking water resources, being surface water and groundwater. EPA further qualified its top line finding with a discussion of the assessment's limitations. Range Resource has found that the potential impacts of hydraulic fracturing on drinking water resources are well understood, are neither widespread nor systemic, and that the risk of impacts will continue to diminish as state regulations and industry practices continue to evolve. He notes they support the dissenting view attached as Appendix B to the SAB draft report.

Peter Miller, Range Resources, summarized his written statement[15] and echoed the concerns of Mr. Carlson. He notes the draft report focused on a single phrase within the EPA's Executive Summary; the straight-forward, high-level conclusion statement from page ES-6 that "We did not find evidence that these mechanisms have led to widespread, systemic impacts on drinking water resources in the United States." He provided examples of wide spread impacts form several reports and note that they cited other sources of pollution as the primary impairments to water quality. He found the statement in question: "We did not find evidence that these mechanisms have led to widespread, systemic impacts on drinking water resources in the United States" provides clarity and certainty; it is not confusing or unclear except to those who are not in agreement with it.

Mr. Jeff Zimmerman representing Damascus Citizens for Sustainability, NYH2O, and Citizens for Water, presented his oral statement. Mr. Zimmerman noted that the EPA's statement within its draft Assessment Report that the EPA did not find evidence of widespread, systemic impacts to drinking water resources from hydraulic fracturing activities was unsupported. Mr. Zimmerman noted that over 400 families in Pennsylvania signed nondisclosure agreements with hydraulic fracturing companies, and that there were 6,000 hydraulic fracturing wells near these families. He stated that there are thousands of hydraulic fracturing sites elsewhere in the United States, according to figures developed by Dr. Anthony Ingraffea of Cornell University, and that the available data clearly indicate that there is a widespread, systemic impact to drinking water resources from hydraulic fracturing.

James McMormick, Vets 4 Energy, supported the EPA study. Introduced himself as an organic farmer and bee-keeper in West Virginia. He found that oil and gas industry in that region was supportive of agriculture and bee keeping.

Ronald Wilcox read from his written statement[16] and expressed support for hydraulic fracturing techniques and cited the recent Bureau of Ocean Energy Management and the Bureau of Safety and Environmental Enforcement studies concluding there would be no significant impact on the water quality or the health of the ocean, and further indicates that fracking presents only a minimal risk when performed according to industry standards.

Rollin Reisinger spoke in support of hydraulic fracturing and expressed concern about the agenda driven "junk science" being presented. He noted the "plural of anecdote is not data."

Lynn Thorp, Clean Water Action, summarized key points from her written statement[17]. She noted the Panel undertook a transparent review process over a series of months resulting in reasonable, consensus recommendations that were relatively minor compared to the breadth of EPA's Assessment. Rejection of the Panel's recommendations could be seen as an attempt to obfuscate the impacts of hydraulic fracturing and limit the public's understanding of potential threats to drinking water.

She stated that the SAB should encourage EPA to ensure that the impressive body of work represented in the Final Assessment leads to stronger drinking water protection by publishing a road map for addressing the vulnerabilities outlined in the Assessment. This road map should include: identification of actions that can be taken using existing authorities and within current programs; recommendations for addressing vulnerabilities that cannot be addressed by current programs; identification of further research needs, and an explanation of actions to reduce uncertainties in future research work.

Jill Cooper, Anadarko voiced her support for the EPA draft study.

Dr. Yuri Gorby described the "Halliburtion Loophole" that removed source of underground drinking water from oil and gas exploration, the decline in research funding for hydraulic fracturing and expressed concern that a cradle to grave approach has not been developed to provide oversite.

Marigrace Butela, Dunbar Township Tax Collector, provided comment on alleged groundwater contamination in Carmichaels, PA, a Duke study that found radioactivity associated with hydraulic fracturing and accusation of extensive industry influence over EPA National Fracking Study. She provided news article that[18] are posted on the SAB webpage.

During the public comment period several members asked for clarification about failed wells, defective wells and the process to shut down wells from public commenters. Mr. Thompson and Carlson noted there may be as many as 500,000 undocumented wells and described typical drilling sites in the Marcellus shale. Mr. Kozera responded to a question from a member regarding the number of failed wells (3% or 6,000 wells) with a description of the process to seal and encase wells. They described the drilling, encasement and fracturing of the well in steps prior to allowing the oil and gas to enter in the well. They discussed the depth of well compared to aquifer levels and the complexity of wells with the advent of horizontal drilling techniques. Mr. Kemble and Ms. Troutman noted that casing failure has been documented as a cause for groundwater contamination. Public commenters described flowback water, additives and drilling processes to maintain wells during fracturing and oil and gas recovery. Dr. Gorby discussed radionuclide considerations. Ms. Cooper noted that surface loss and best management practices to reduce surface releases are not required jurisdictionally but some companies do employ them.

Presentation from the Panel Chair

Dr. David Dzombak, Chair of the SAB Hydraulic Fracturing Research Advisory Panel, thanked the SAB members for their written comments[19] and members of the public for their submissions. Dr. Dzombak summarized the Panels work and members comments in his presentation[20]. He noted the hydraulic fracturing issue has undergone multiple consultations and reviews by the SAB leading up to the report before the SAB today.

He summarized the meeting schedule and workload taken on by the panel. They met as a panel on 9 separate occasions either in person or teleconference. Each meeting the panel took public comments. In addition to those comments, the panel reviewed the 477 distinct substantive comments out of the 100,000 public comments submitted to the docket for the draft report.

In his presentation he identified the most pressing preliminary comments from SAB members and how they could be addressed. Those comments were:

- Prioritizing the recommendations
- Reducing repetitive sections
- Clarifying the discussion on best management practices, and
- Presentation of the panel's concern on evidence of widespread systemic concern and hydraulic fracturing

Dr. Dzombak closed by thanking Mr. Ed Hanlon for his support and indefatigable work as the Designated Federal Officer, Dr. Jefferey Frithsen and the EPA team for their attentive responses to the Panel 's questions and the public for their engagement throughout the process.

Comments from Lead Reviewers

Dr. Thorne then introduced the lead reviewers to present their findings.

Dr. Kimberly Jones noted the committee did a very nice job of addressing the 8 charge questions. The SAB response is thorough and attempts to address each of the 4 sub-questions linked to the charge questions (organized by chapter). The response included specific recommendations, some of which could conceivably be addressed in the short-term (i.e., clarifying conclusions). The responses should give more guidance on the prioritization of the recommendations so that the Agency can prepare a response that reflects these prioritizations.

She noted the dissenting opinions reflect the complexity of evaluating a report that attempts to assess an important topic that currently has limited and evolving scientific datasets. The Agency will likely understand this issue, however as a public document, and repeated qualifications such as "4 of the 30 panel members", may add an air of dissent to the recommendations and weaken the response. Similarly, the repeated mention of "all but two Panel members…" on many recommendations sounds like consensus was not reached. Since this is a consensus document, it should not be necessary to repeatedly note the dissension in the body of the report, but to acknowledge it and include the minority reports (as has been done in Appendix B).

She found that the conclusions and recommendations in the report are supported. The issue, evidently, is with interpretation of many qualifiers in the recommendations. The dissenting opinions point to the difficulty in interpreting a large body of research, determining what is "good enough" regarding securing and interpreting new data, and how specific the wording has to be in the Agency document. Given this challenge, the panel's draft report should go farther in highlighting the most important recommendations (prioritization) and giving clear, unambiguous language for the recommendations. Some recommendations are clear, but the qualifiers muddy the waters a bit on others. The prioritization could be addressed by identifying recommendation the EPA should address in the near term and which could be addresses in the longer term

Dr. Robert Mace, the second lead reviewer agreed with Dr. Jones and found that the Advisory Panel provided an impressive and reasonable review of the draft report. His comments addressed a few potential omissions and identify review comments that could be amplified or clarified. Dr. Mace stated that his comments reflect his experience and knowledge of hydraulic fracturing and water resources. There are two omissions from the hydraulic fracturing water cycle in EPA's draft report that were not adequately discussed: (1) potential water quality and quantity impacts from drilling an oil, gas, or rig-supply well and (2) potential water quality impacts from disposing flowback liquids and produced water in injection wells. Dr. Mace pointed to several areas that should be clarified as the report is targeted to the general public and contains jargon and heavy use of acronyms

Dr. Gina Solomon, the third reviewer agreed with the previous comments. She continued to emphasize that the committee should better triage its recommendations. While she found the report addressed all the charge questions, the report is repetitive and would benefit from a copy edit. Many statements on p.4 of the letter are too vague to be useful recommendations. For example, on lines 1-6 the committee recommends that the agency "should include additional major findings" but it's not completely clear what the additional findings should be, beyond the general topic area of "well construction, well integrity, and well injection problems" all of which are already discussed in the EPA report. Similar concerns exist with lines 8-9, recommending unspecified "additional major findings" associated with spill events and leaks, both of which are also covered in the EPA report. It would be very helpful for the committee to be more specific about the major findings that they are recommending.

The report provides long lists of recommendations but does not point to a reasonable number of recommendations that should be high priority to address. She appreciates that the committee acknowledges that "there are a large number of recommendations included in the body of the SAB report" (p. 2, lines 34-35) but despite flagging some as longer-term future activities, there are still far too many recommendations, some of which are surely more important than others. Similarly, there are major, highlighted recommendations in the report that seem to Dr. Solomon to be things that would involve a lot of work for very little incremental benefit. One example is the recommendation that EPA list all "best management practices" that the industry is doing voluntarily to attempt to reduce impacts on water.

She noted the EPA document is not intended to be a textbook on the hydraulic fracturing water cycle (HFWC), and the review sometimes seems to lose track of the purpose of the EPA document. The review needs to be focused much more on assuring that the EPA document presents the key issues clearly and in a balanced fashion, and less on assuring that every possible study is referenced, and every peripheral issue explained.

Dr. Charles Werth agreed with the previous comments and further found the SAB's review of EPA's draft Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources is comprehensive, methodical, technically sound, and in all instances, the charge questions were thoroughly addressed.

He noted there is little discussion of alternative injection fluids. These alternatives could include energized fluids, foams, and gases. As an example, foams contain 53% to 95% gas by volume, so they use much less water. When is foam use advantageous for hydrocarbon recovery? What is the impact on water resources compared to conventional fracking fluids? Are similar chemicals used in foams? How much is flow back and produced water reduced, and how is their water

quality impacted? The Frac Focus data base has information on chemical masses and types used in various fracking fluids, and it seems important for inclusion if not already done.

He described the current news reports of Class II injection wells being associated with seismic activity and the detection of hydrogen sulfide detection in the proximity of wells and noted the report does not address these issues. The discussion regarding BMPs did not discuss pit liner requirements and this seems to be a clear preventative measure.

Regarding the widespread and systematic contamination, he wondered if it would be possible to quantitate or support what seems like a very vague statement.

Dr. Dzombak responded to the lead reviewers' comments and described the Panel's discussions on each subject.

- On prioritizing recommendations, they have gone through the report and identified the 12 most important recommendations and clarified the remaining recommendation are lesser priority.
- He noted that there are two dissenting opinions in the report and the panel discussed the possibility of additional dissenting opinions. The panel worked diligently to limit the dissenting opinions and found that the general description was more favorable than additional highly specific discussion of disagreement among panelists.
- He would conduct a copy edit to reduce the repetitive style of the report. He noted that the interwoven nature of the EPA study's chapters created a need to point readers to different sections and this may be abetter approach than repeating the recommendation or supporting evidence multiple times.
- The EPA report did not have case studies as originally planned. While many commenters were disappointed the EPA could not overcome the barriers to procuring permission, confidential business information and an agreement with parties controlling the potential case study sites. The Panel found that the agency negotiated in good faith to include them but could not in the time available. They will add an explanation as such.
- They will look to add to the discussion of flowback fluids to address Dr. Mace's comments.
- He will add language to note that 29- of the panelist found the EPA conducted a comprehensive report and concurred on the SAB draft review.
- He will add additional references that have been cited.
- Additional discussion about drinking water and TNORM and disinfection by-product can be added to that section.

<u>Discussion</u>
Dr. Thorne asked other members of the SAB if they had additional comments

Drs. Mihelcic and Richardson agreed that there needs to be more discussion on the case studies and why they were not included in the report. If not a statement on the need for case studies, then at least an explanation on why they were not included to close the discussion on the previous SAB recommendation on the study plan. Dr. Burke, Berhane and Dourson agreed.

Dr. Berhane commented that local impacts can be severe, and the discussion of local impacts needs to be strengthened. He noted that localized impacts may arise from systemic issues.

Dr. Burke noted the SAB is providing an advisory report and the EPA will how to address the evolving knowledge on hydraulic fracturing.

Dr. Vena wondered if a separate document targeted to stakeholder and the public should be developed. He also expressed concern about the qualified nature of the statement that there is no widespread or system issue. Board members discussed the need to include discussion of localized impacts and their severity.

Disposition of the Report

Dr. Thorne thanked the members of the SAB for the discussion and comments to revise the draft report. He reminded members that there are three options to finalize the report based on the Board's discussion.

1. approval of the report (either "as is" or subject to editorial changes, and review by the SAB Chair);
2. approval of the report subject to re-review by the SAB Chair, Panel Chair, and designated Board members; or
3. return of the draft report to the authoring panel or committee for further work so that a revised report may be brought before Board for a second Quality Review.

Dr. Thorne asked members if they had any additional questions or comments regarding the revisions. Hearing no requests to further the discussion he called for a motion. Dr. Vena requested a clarification on option 2 and who would participate in the revisions. Dr. Thorne replied that is usually the Chairs and lead reviewers but other members could be designated in the motion.

Dr. Burke motioned that the Chairs, lead reviewers and any volunteers revise the report and submit a final draft based on the discussions to forward to the Administrator. Dr. Solomon seconded the motion. Dr. Thorne called for any discussion on the motion, hearing no requests for further discussion he called for the vote. The motion for the Chairs, lead reviewers, and volunteers to revise the report was unanimously accepted.

Dr. Thorne thanked the members of the public for their comments.

The DFO called the meeting in recess until 9:00 June 15, 2016

Wednesday, June 15, 2019
Using Citizen Science for Environmental Protection

Mr. Jay Benforado, Chief Innovation Officer, Office of Research and Development presented the agency's efforts to use citizen science to support. Mr Benforado's presentation[21] explained the agency's interpretation of citizen science, the direction in the 2015 memo from the Office of Science and Technology Policy and the EPA's plans to address societal and scientific challenges through citizen science and crowdsourcing. He discussed the areas that EPA planned on addressing, noted regulatory challenges, and provided some examples of projects testing the application of data collection form citizens.

Mr. William Ross, Jr., Chair National Advisory Council for Environmental Policy and Technology (NACEPT) provided an overview of the NACEPT report and next steps work on

Citizen Science. Mr. Ross noted the NACEPT is a representative federal advisory committee and the member as such represent stakeholder sectors. Their task was to provide advice on technology transfer for environmental policy advice and more specifically what are the sources of citizen science for EPA and regulatory or policy development. The report *Environmental Protection Belongs to the Public, A Vision for Citizen Science at EPA* will be posted on the NACEPT webpage and is available here.

Mr. Ross noted that the NACEPT found citizen science is a huge opportunity for the EPA. It creates many partnership opportunities and empowers communities to participate and have a direct impact on public health. He provided an example in Tonawanda, NY where citizen science reporting on benzene exposure forced EPA to take an active role in reducing exposure.

Mr. Ross and Benforado discussed the implications of their respective efforts with Board members. Both acknowledged the difficulty in using citizen science to support regulatory or litigation matters. One member suggested that EPA's role is in developing common testing protocols for citizens. He noted an effort in Louisville suffered from poor detectors and sensors. He suggested that the SAFE CAST program following Fukushima's accident is a success story where most of the data on radiation came from the citizenry. He noted there are not common protocols and there is a great need to create a structure for data that can be curated and has quality control objectives to avoid over promising and confusion to the community.

Another member noted that biometric and biostatistical data are increasing in their availability. He related that the American Cancer Society is evaluating crowd sourcing techniques to find ways to address the spatial and temporal variability in the data. Mr. Benforado agreed there needs to be a design to allow quality review and the ORD is looking for data scientists to help develop the structures.

Several members commented on how community participation has increased healthy components within communities and also helped link communities together. Other members commented on the other agencies (i.e., NOAA and NASA) that are already working on seed funding grants, larger competitive grants and partnering project communities.

Updates from EPA Federal Advisory Committee Liaisons

Board of Scientific Counselors (Bosc): ORDs Strategic Research Actions Plans

Dr. Deborah Swackhamer, Chair of the BoSC discussed the executive committee and subcommittee work on the Strategic Research Action Plans (STRAP) in the Office of Research and Development. She noted that the SAB participated in a joint review of the STRAPs with the Bosc and the BOSC is working with the ORD to refine and implement the STRAP using the advice from the SAB BOSC initiative. Dr. Swackhamer explained the structure of each committee and the STRAP, anticipated research goals, budgets, level of effort, and timelines to implement the STRAPs. Her presentation is available on the webpage[22].

Chemical Safety Advisory Committee (CSAC) Update

Dr. Kenneth Portier, Chair of the CSAC presented a brief overview of the CSACs charter and structure[23]. He noted that the committee is statutorily authorized by the Toxic Substances Control Act as amended in 2016 and is just beginning its work.

Dr. Thorne then turned to the DFO to adjourn the meeting. The DFO adjourned the meeting at 11:45 a.m.

Respectfully Submitted and Certified as Accurate,

/signed/	/signed/
_____	_____
Mr. Thomas Carpenter	Dr. Peter S. Thorne
SAB DFO	SAB Chair

NOTE AND DISCLAIMER: The minutes of this public meeting reflect diverse ideas and suggestions offered by committee members during the course of deliberations within the meeting. Such ideas, suggestions, and deliberations do not necessarily reflect definitive 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.

Materials Cited

The following meeting materials are available on the SAB website, http://www.epa.gov/sab, at the page for the June 14-15, 2016 meeting: https://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/ec5b66b4fe61164485257f92005d6f20!OpenDocument&Date=2016-06-14

[1] Roster of SAB members
[2] Federal Register published Vol. 81 No.85. Tuesday, May 3, 2016 (26551-26552)
[3] Agenda
[4] List of Registered Speakers
[5] Statement from Food and Water Watch presented by Hugh MacMillan, PhD.
[6] Comments on the draft Hydraulic Fracturing Assessment Review. Citations submitted by Aaron Mintzes, Earthworks regarding Dimock, PA, Pavillion WY and Parker Co. TX .
[7] Comments on the draft Hydraulic Fracturing Assessment Review. Citation to the Kell Report regarding incident frequency data provided by Dr. Kris Nygaard, ExxonMobil Upstream Research.
[8] Comments on the draft Hydraulic Fracturing Assessment Review. Citations, test results, ATSDR report, and correspondence from PA DEP and EPA submitted by Ray Kemble regarding Dimock, PA hydraulic fracturing.
[9] Statement from Jim Zernell, Newfield Exploration Company.
[10] Comments on the draft Hydraulic Fracturing Assessment Review: Submitted by Hope Forpeace.
[11] Statement from Dr. Steve Gorzula.
[12] Statement from the American Exploration & Production Council President, V. Bruce Thompson.
[13] Slides to accompany statement from Gregory Kozera.
[14] Statement from Range Resources presented by Carl Carlson.
[15] Statement from Range Resources presented by Pete Miller.
[16] Statement from Ronald Wilcox.
[17] Statement from Clean Water Action Clean Water Fund presented by Lynn Thorp.
[18] Comments on the draft Hydraulic Fracturing Assessment Review. Comments on hydraulic farcturing in Dunbar Township PA, and articles on radioactivity, industry lobbying, and water contamination. (PDF, 1 pp., 4,163,646 bytes).
[19] Comments from Members of the Chartered SAB on the SAB Draft Report Draft SAB (4-26-2016) Review of Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources. June 13, 2016.
[20] David Dzombak Presentation-quality review of the draft SAB review of the Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources-June 14, 2016.
[21] Presentation by Jay Benforado, Chief Innovation Officer, Office of Research and Development. EPA Strategic Plan for Citizen Science June 15, 2015.
[22] Presentation on the Board of Scientific Counselors. Presented by Dr. Deborah L. Swackhamer.
[23] TSCA Scientific Peer Review Committees. https://www.epa.gov/tsca-peer-review.

Attachment A: Names of those who attended the meeting

June 14, 2017

Name of attendee	**Affiliation**
Pete Miller	Rage Resources
Bob Moran	Halliburton
Craig Stevens	Patriots From The Oil & Gas Shales
Pamela King	E&E Publishing
Aaron Mintzes	Earthworks
Sahri Ring	Cadmus Group
John Feroldi	Concerned Citizen
Alyssa Feroldi	Concerned Citizen
Jeanette Garrard	
Sue Shallal	US Environmental Protection Agency (EPA), Science Advisory Board Staff Office (SABSO)
Bill Holland	Sip Global
Gayathri Vaichyanatham	E&E News
Margaret Ware	Zimmerman Associates
Kris Nygaard	ExxonMobile
Erik Milito	API
Scott Gale	Halliburton
Stephanie Meadows	American Petroleum Institute
Hugh MacMillian	Food and Water Watch
Rollin Reisinger	
Bridget DiCosmo	Inside EPA
Diane Hara	Vets 4 Energy
James McCormik	Vets 4 Energy
Hillevi Eisen	
Greta Hauberg	Market Place
John Weinberge	
James Zernell	Newfield Exploration
Lloyd Hetrick	Newfield Exploration
Jeff Frithsen	US EPA, Office of Research and Development (ORD)
Carl Carlson	Range Resources
Ziggy Keyhu	
Yuri Gorby	Renssalear Polytechnic University
Ray Kemble	Dimock PA
Steele Gamble	Energy Citizens
Sarah Solomon	US EPA – ORD
Jeff Zimmerman	Damascus Citizens
William Houser	ExxonMobile
Walt Hufford	Reposol, Hydraulic Fracturing Panel
Kathryn Kaizor	US EPA
Gary Kozera	VOGA
Katy Napotnik	DDC
Caroline Ridley	US EPA
Stephanie Sanzone	US EPA, SABSO

June 14, 2017

Name of attendee	Affiliation
Skyler Kopko	Self
Alison Williams	EEI
Lynn Thorp	Clean Water Action
Colleen Neve	AAPG
Katie Brown	Energy Indepth
Kevin Teitchman	US EPA
Steve Gorzula	Independent Consultant
Barb Morrissey	WA Dept of Health CHPAC Chair
Susan Burden	US EPA, ORD
Dave Walczak	Self
Robert Lee	Self
Joan Chu	Self
Bruce Thompson	American Exploration and Production Council
James Mihelcic	University of South Florida
Melissa Mejias	IADC
Melissa Troutman	Public Herald
Ronald Wilcox	Self
Sharon Nappier	US EPA
Scott Tong	Market Place Radio

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Name of attendee	Affiliation
Jay Benforado	US EPA, ORD
Kevin Kuhn	US EPA, ORD
William Ross	National Advisory Committee Environmental Policy and Technology
Brittnee Preston	Oklahoma Water Resources Board
Skyler Kopko	
Steve Mectlu	
Zurfur Keller	
Iris Goodman	US EPA, SABSO

Attachment B: Names and Affiliation of those who requested the teleconference call-in number

Charles Middleton, Texas Commission on Environmental Quality
Maria Hegstad, Inside EPA,
Dr. Azra Tutuncu, Colorado School of Mines and EPA SAB Hydraulic Fracturing Panel Member
Megan Fleming, U.S. Environmental Protection Agency (USEPA)
Kevin Frederick, Wyoming Department of Environmental Quality
Jessica Wilhelm, US EPA
JP Nicot, jp.nicot@beg.utexas.edu, affiliation University of Texas
Jonathan Koplos, The Cadmus Group,
Mary Ellen Tuccillo, The Cadmus Group
Steve LeDuc, US EPA
Chris Knightes,US EPA
Elana Schor, Politico
Bryce Payne, Gas Safety Inc
Jesse Sandlin, Devon Energy
A Brown,
Kinga Revesz
Ben Packard, US EPA
Jay Albert, Xto Energy
John Stanek, US EPA
Dale Perry, US EPA
Scott Tong, Marketplace National Public Radio
Alex Pappas Bracewell LLP
James C Kenney, US EPA
Hannah Doherty, Delaware River Basin Commission
Steve Lipsky, private citizen
Cary L Betz, Texas Commission on Environmental Quality
Eric Rosenfield, Office of Management and Budget
Jeff Zimmerman, Damascus Citizens for Sustainability,
Micah Bennett
George E. King, Apache Corporation,
Teddy Borawski, Department of Conservation and Natural Resources,
Kevin Teichman, US EPA
Jim Standley, Texas Alliance of Energy Producers
Dr. Richard W. Goodwin, P.E. Environmental & Energy Engineering Consultant
Lorrie Council, Texas Commission on Environmental Quality
Catherine Dickert, New York State Dept. of Environmental Conservation
Dr. Richard Guldi
Kelsey Maloney, US EPA,
Mike Soraghan, EnergyWire, E&E Publishing,
Susan Spratlen
Dana Dolney, Shalefield Stories, Friends of the Harmed
Shirley Eakin,
Jeanie Moten,
Brigid Landy, K&L Gates,
Johnny Mitchell, ESC Lab Sciences,
Yogin Kothari, Union of Concerned Scientists

Tim Eriksen, Moody and Associates, Inc.,
Doug Duncan, U.S. Geological Survey,
Hope Forpeace, AK Productions,
Steven Fleming, Apache Corporation,
Zachary Ceplecha, FTS International
Deirdre Mason , Association of State Drinking Water Administrators,
John WeHunt, Conoco Phillips
Tom Jackson, Baker Botts, LLP
David Dunlap, KCPS
Chris Frye, US EPA Region 8
Jack Kruell,
Brigid R Landy, K&L Gates
Red Cavaney, Consultant,
Maggi Young, Chesapeake Energy
Lily Lee, Wyoming Department of Environmental Quality (WDEQ)
Nicole Twing, WDEQ