

05/19/2010 Draft
DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval by the chartered Science Advisory Board. This report does not represent EPA policy.

[DATE]

EPA-SAB-10-xxx

The Honorable Lisa P. Jackson
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Subject: Advisory on EPA's Research Scoping Document Related to Hydraulic Fracturing

Dear Administrator Jackson:

EPA's Office of Research and Development (ORD) has developed a proposed approach for a policy-relevant research program related to hydraulic fracturing. The purpose of this research program is to ensure drinking water protection and address related public health and environmental issues over the lifecycle of hydraulic fracturing, specifically as it pertains to the extraction of oil and gas from geologic formations. ORD developed this approach in response to the U.S. House of Representatives Fiscal Year 2010 Appropriation Conference Committee Directive to EPA that urged the Agency to conduct a study of hydraulic fracturing and its relationship to drinking water.

In response to a request from ORD, the EPA Science Advisory Board (SAB) convened the Environmental Engineering Committee (EEC) with additional members of the SAB to conduct a review of ORD's research scoping document related to hydraulic fracturing. The SAB Committee held a public meeting on April 7-8, 2010, to provide advice to ORD about this research plan and program. Specifically the SAB was asked to comment on the following three areas:

- Scope of the research program;
- Proposed research categories and topic areas, and process for prioritizing research needs given the Congressional request and a desire by the Agency to complete initial research products by the end of calendar year 2012; and
- Design of a stakeholder process that provides for balanced input.

In general, the Committee found ORD's overall approach and scope for the hydraulic fracturing research plan and program appropriate and comprehensive. The Committee, however, also found several areas that can be enhanced and focused, given the limited funding, resources and time associated with this effort. While a more detailed description of the technical

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 recommendations is contained in the report, the key points and recommendations are highlighted
2 below.

3
4 The Committee discussed the hydraulic fracturing topic on two levels: (1) broad, long-
5 term research goals, and (2) more focused, short-term research needs. The Committee identified
6 a hierarchy of issues that should be considered when assessing these needs: hydraulic fracturing
7 potentially affects water resources and drinking water supplies, and has potential to pose human
8 health and environmental risks. Considering the Congressional request and a desire by the
9 Agency to complete initial research products by the end of calendar year 2012, the Committee
10 recommends that initial, short-term research be directed to study sources and pathways of
11 potential impacts of hydraulic fracturing on water resources, especially potential drinking water
12 sources. While current and potential drinking water sources are a recommended starting
13 point/priority for ORD research, investigations should eventually occur on the impact on water
14 resources more generally, and their aquatic ecosystems and ability to support fishing and
15 recreation.

16
17 The Committee found that the systems and lifecycle perspectives described in the ORD
18 research plan for study of the environmental impacts of hydraulic fracturing are appropriate.
19 Considering the limited time, funding and resources available for the initial study by ORD, the
20 Committee recommends using a lifecycle framework, without actually performing a formal
21 lifecycle assessment, as an organizing tool that will facilitate identifying the most important
22 research questions to address in the initial study. Questions pertaining to the impacts of the
23 various stages of the hydraulic fracturing lifecycle on drinking water sources will be of primary
24 importance and consistent with the research request from Congress.

25
26 The Committee believes ORD should identify knowledge gaps by outlining the hydraulic
27 fracturing lifecycle and considering which components of the lifecycle pose potential risk to
28 water resources and should be included in ORD's research efforts. The Committee recommends
29 that ORD should emphasize human health and environmental concerns that are specific to or
30 significantly influenced by hydraulic fracturing rather than on concerns that are common to all
31 oil and gas production activities. As a priority, the Committee believes ORD should develop a
32 risk-based research prioritization approach that would provide the scientific knowledge
33 necessary for characterizing the risk of human and ecological exposure to hydraulic fracturing
34 fluids and products.

35
36 Regarding potential relationships of hydraulic fracturing to drinking water sources, the
37 Committee recommends that ORD carefully compile and review available data and knowledge
38 on hydraulic fracturing and interaction with drinking water sources in peer-reviewed literature, in
39 industry, in professional and non-governmental organizations, and in government agencies at the
40 beginning of the research study. It is important to realize that the open peer-reviewed literature
41 in this field is limited and other literature must be carefully critiqued regarding its limitations and
42 appropriateness for addressing ORD's specific research needs. These efforts will help ensure
43 accurate identification of data and knowledge gaps, maximize use of existing information, and
44 optimize use of limited research funds. Considering the range of potential environmental

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 impacts associated with hydraulic fracturing and the range of geographic/geologic regions and
2 site-specific conditions in which hydraulic fracturing may be implemented, the Committee
3 recommends that ORD consider performing in-depth case studies at five to ten different
4 locations selected to represent the full range of regional variability of hydraulic fracturing across
5 the nation. In order to define relationships between hydraulic fracturing processes and drinking
6 water resources, the Committee believes that significantly improved data and information are
7 needed on the occurrence, volume, composition, treatability and/or disposal of hydraulic
8 fracturing source fluids, flowback water, and produced water that is co-mingled with the
9 flowback water, and the sources of the constituents (i.e., additive, reaction product, or leaching
10 product) throughout different phases of the hydraulic fracturing lifecycle.
11

12 Regarding potential health and environmental risks associated with hydraulic fracturing,
13 the Committee believes that such potential risks can only be assessed after sources and pathways
14 of possible exposure are much better understood. Several activities must occur before such
15 potential risks are assessed, including: a) characterization of the composition and variability of
16 the source fluids, flowback water and produced water that is co-mingled with the flowback
17 water; b) assessment of possible synergistic effects of mixtures of chemicals in fracturing fluids
18 as well as synergistic effects of chemical mixtures interacting with materials in the fractured
19 injection zone; c) evaluation of potential pathways to human and ecosystem exposure under a
20 range of hydraulic fracturing process conditions relative to different geological formations and
21 conditions; d) analysis of the existence and formation of hydraulic fracturing injection and
22 product fluid transport pathways as a result of hydraulic fracturing; and e) identification of the
23 conditions most likely to lead to impact on drinking water sources. Another important factor to
24 assess is the effect of hydraulic fracturing processes on water quantity. Changes in water
25 quantity in groundwater or surface water can have significant influences on human and
26 ecosystem health. Also, potential secondary effects associated with hydraulic fracturing should
27 be considered (e.g., arsenic mobilization in groundwater and aquifers due to enhanced methane
28 transport and resulting changes in redox conditions).
29

30 Knowledge of the characteristics of the injected fluids, the reactions that occur in the
31 injection zone, the characteristics of the fluids leaving the injected zone, and the pathways for the
32 fluids leaving the injection zone will be needed for assessing the likelihood of impacts on
33 drinking water sources, exposure of humans and ecosystems to hydraulic fracturing fluids and
34 products, and the associated uncertainties involved in the assessment. The ORD research plan
35 provides several lists of possible specific research questions. The Committee recommends that
36 ORD identify a few overarching, fundamental questions which can then be placed in order of
37 priority before revising the research plan. Examples of such questions would be: what are the
38 fundamental physical and chemical water-related processes for each phase of the hydraulic
39 fracturing lifecycle, and what are the quality and quantity of source fluids, flowback water and
40 produced water co-mingled with the flowback water.
41

42 The Committee recommends developing a balanced, collaborative advisory group of
43 stakeholders representing a broad range of perspectives. In addition to providing information to
44 ORD, the stakeholder group would be engaged throughout the research process. ORD's

05/19/2010 Draft

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 objectives and process for stakeholder engagement with the research should be carefully
2 designed. One important objective for engagement with stakeholders should be to gain access to
3 and leverage the existing knowledge base on hydraulic fracturing and its environmental impacts.
4 There is a wealth of data and experience in industry, advocacy groups, state agencies, and other
5 groups for ORD to draw upon in the research effort. It will also be important for ORD to engage
6 with other federal agencies to share data, collaborate, leverage expertise, and align research
7 priorities for optimal use of limited resources.
8

9 The SAB appreciates the opportunity to provide EPA with advice on this important
10 subject. We look forward to receiving the Agency's response and potential future discussions
11 with the Agency.
12
13
14

15 Sincerely,
16
17
18

19
20 Dr. Deborah L. Swackhamer, Chair
21 EPA Science Advisory Board
22
23

Dr. David A. Dzombak, Chair
SAB Environmental Engineering Committee

05/19/2010 Draft

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

NOTICE

This report has been written as part of the activities of the EPA Science Advisory Board, a public advisory committee providing extramural scientific information and advice to the Administrator and other officials of the Environmental Protection Agency. The Board is structured to provide balanced, expert assessment of scientific matters related to problems facing the Agency. This report has not been reviewed for approval by the Agency and, hence, the contents of this report do not necessarily represent the views and policies of the Environmental Protection Agency, nor of other agencies in the Executive Branch of the Federal government, nor does mention of trade names or commercial products constitute a recommendation for use. Reports of the EPA Science Advisory Board are posted on the EPA Web site at: <http://www.epa.gov/sab>.

05/19/2010 Draft

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 **U.S. Environmental Protection Agency**

2 **Science Advisory Board**

3 **SAB Environmental Engineering Committee (EEC) Augmented for the**
4 **Evaluation and Comment on EPA's Proposed Research Approach for**
5 **Studying the Potential Relationships Between Hydraulic Fracturing and**
6 **Drinking Water Resources**

7
8
9 **CHAIR**

10
11 **Dr. David A. Dzombak**, Walter J. Blenko Sr. Professor of Environmental Engineering,
12 Department of Civil and Environmental Engineering, Carnegie Mellon University,
13 Pittsburgh, PA

14
15
16 **EEC MEMBERS**

17
18 **Dr. Viney Aneja**, Professor, Department of Marine, Earth, and Atmospheric Sciences, School of
19 Physical and Mathematical Sciences, North Carolina State University, Raleigh, NC

20
21 **Dr. Robin L. Autenrieth**, Associate Dean for Graduate Programs and Professor, College of
22 Engineering, Texas A&M University, College Station, TX

23
24 **Dr. John P. Connolly**, Senior Technical Advisor and Principal Engineer, Anchor QEA, LLC,
25 Montvale, NJ

26
27 **Dr. Herschel Elliott**, Professor, Department of Agricultural and Biological Engineering, Penn
28 State University, University Park, PA

29
30 **Dr. Arpad Horvath**, Associate Professor, Department of Civil and Environmental Engineering,
31 University of California, Berkeley, CA

32
33 **Dr. Cindy M. Lee**, Professor, Department of Environmental Engineering and Earth Sciences,
34 Clemson University, Anderson, SC

35
36 **Dr. Earthea Nance**, Assistant Professor of Environmental Planning and Hazard Mitigation,
37 Department of Planning and Urban Studies, University of New Orleans, New Orleans, LA

38
39 **Dr. Catherine Peters**, Associate Professor, Department of Civil and Environmental
40 Engineering, Princeton University, Princeton, NJ

41
42 **Dr. Danny Reible**, Professor, Department of Civil, Architectural and Environmental
43 Engineering, University of Texas, Austin, TX

05/19/2010 Draft

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34

Dr. Sujoy Roy, Director, Research and Development, Tetra Tech Inc., Lafayette, CA

Dr. Mark A. Shannon, Professor, and Director, the WaterCAMPWS Center, Department of Mechanical Science and Engineering, University of Illinois, Urbana-Champaign, Urbana, IL

Dr. Paul Westerhoff, Professor and Director of the School of Sustainable Engineering and The Built Environment, Arizona State University, Tempe, AZ

Dr. Thomas M. Young, Professor, Department of Civil & Environmental Engineering, University of California-Davis, Davis, CA

OTHER SAB MEMBERS

Dr. Jeffrey Griffiths, Associate Professor, Department of Public Health and Community Medicine, School of Medicine, Tufts University, Boston, MA

Dr. Susan Korrick, Assistant Professor of Medicine, Department of Medicine, Brigham and Women's Hospital, Channing Laboratory, Harvard Medical School, Boston, MA

Dr. Duncan Patten, Research Professor, Hydroecology Research Program, Land Resources and Environmental Sciences, Montana State University, Bozeman, MT

Dr. James Shortle, Professor, Agricultural Economics and Rural Sociology, Pennsylvania State University, University Park, PA

SCIENCE ADVISORY BOARD STAFF

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

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

**U.S. Environmental Protection Agency
Science Advisory Board**

CHAIR

Dr. Deborah L. Swackhamer, Professor and Charles M. Denny, Jr., Chair in Science, Technology and Public Policy and Co-Director of the Water Resources Center, Hubert H. Humphrey Institute of Public Affairs, University of Minnesota, St. Paul, MN

SAB MEMBERS

Dr. David T. Allen, Professor, Department of Chemical Engineering, University of Texas, Austin, TX

Dr. Claudia Benitez-Nelson, Associate Professor, Department of Earth and Ocean Sciences and Marine Science Program, University of South Carolina, Columbia, SC

Dr. Timothy Buckley, Associate Professor and Chair, Division of Environmental Health Sciences, College of Public Health, The Ohio State University, Columbus, OH

Dr. Thomas Burke, Professor, Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD

Dr. Deborah Cory-Slechta, Professor, Department of Environmental Medicine, School of Medicine and Dentistry, University of Rochester, Rochester, NY

Dr. Terry Daniel, Professor of Psychology and Natural Resources, Department of Psychology, School of Natural Resources, University of Arizona, Tucson, AZ

Dr. George Daston, Victor Mills Society Research Fellow, Product Safety and Regulatory Affairs, Procter & Gamble, Cincinnati, OH

Dr. Costel Denson, Managing Member, Costech Technologies, LLC, Newark, DE

Dr. Otto C. Doering III, Professor, Department of Agricultural Economics, Purdue University, W. Lafayette, IN

Dr. David A. Dzombak, Walter J. Blenko Sr. Professor of Environmental Engineering, Department of Civil and Environmental Engineering, College of Engineering, Carnegie Mellon University, Pittsburgh, PA

Dr. T. Taylor Eighmy, Vice President for Research, Office of the Vice President for Research, Texas Tech University, Lubbock, TX

05/19/2010 Draft

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43

Dr. Elaine Faustman, Professor, Department of Environmental and Occupational Health Sciences, School of Public Health and Community Medicine, University of Washington, Seattle, WA

Dr. John P. Giesy, Professor and Canada Research Chair, Veterinary Biomedical Sciences and Toxicology Centre, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

Dr. Jeffrey Griffiths, Associate Professor, Department of Public Health and Community Medicine, School of Medicine, Tufts University, Boston, MA

Dr. James K. Hammitt, Professor, Center for Risk Analysis, Harvard University, Boston, MA

Dr. Rogene Henderson, Senior Scientist Emeritus, Lovelace Respiratory Research Institute, Albuquerque, NM

Dr. Bernd Kahn, Professor Emeritus and Associate Director, Environmental Radiation Center, School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, GA

Dr. Agnes Kane, Professor and Chair, Department of Pathology and Laboratory Medicine, Brown University, Providence, RI

Dr. Nancy K. Kim, Senior Executive, New York State Department of Health, Troy, NY

Dr. Catherine Kling, Professor, Department of Economics, Iowa State University, Ames, IA

Dr. Kai Lee, Program Officer, Conservation and Science Program, David & Lucile Packard Foundation, Los Altos, CA

Dr. Cecil Lue-Hing, President, Cecil Lue-Hing & Assoc. Inc., Burr Ridge, IL

Dr. Floyd Malveaux, Executive Director, Merck Childhood Asthma Network, Inc., Washington, DC

Dr. Lee D. McMullen, Water Resources Practice Leader, Snyder & Associates, Inc., Ankeny, IA

Dr. Judith L. Meyer, Distinguished Research Professor Emeritus, Odum School of Ecology, University of Georgia, Lopez Island, WA

Dr. Jana Milford, Professor, Department of Mechanical Engineering, University of Colorado, Boulder, CO

05/19/2010 Draft

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

- 1 **Dr. Christine Moe**, Eugene J. Gangarosa Professor, Hubert Department of Global Health,
2 Rollins School of Public Health, Emory University, Atlanta, GA
3
- 4 **Dr. Eileen Murphy**, Manager, Division of Water Supply, New Jersey Department of
5 Environmental Protection, Trenton, NJ
6
- 7 **Dr. Duncan Patten**, Research Professor, Hydroecology Research Program , Department of Land
8 Resources and Environmental Sciences, Montana State University, Bozeman, MT
9
- 10 **Dr. Stephen Polasky**, Fesler-Lampert Professor of Ecological/Environmental Economics,
11 Department of Applied Economics, University of Minnesota, St. Paul, MN
12
- 13 **Dr. Stephen M. Roberts**, Professor, Department of Physiological Sciences, Director, Center for
14 Environmental and Human Toxicology, University of Florida, Gainesville, FL
15
- 16 **Dr. Amanda Rodewald**, Associate Professor, School of Environment and Natural Resources,
17 The Ohio State University, Columbus, OH
18
- 19 **Dr. Joan B. Rose**, Professor and Homer Nowlin Chair for Water Research, Department of
20 Fisheries and Wildlife, Michigan State University, East Lansing, MI
21
- 22 **Dr. Jonathan M. Samet**, Professor and Flora L. Thornton Chair, Department of Preventive
23 Medicine, University of Southern California, Los Angeles, CA
24
- 25 **Dr. James Sanders**, Director and Professor, Skidaway Institute of Oceanography, Savannah,
26 GA
27
- 28 **Dr. Jerald Schnoor**, Allen S. Henry Chair Professor, Department of Civil and Environmental
29 Engineering, Co-Director, Center for Global and Regional Environmental Research, University
30 of Iowa, Iowa City, IA
31
- 32 **Dr. Kathleen Segerson**, Professor, Department of Economics, University of Connecticut, Storrs,
33 CT
34
- 35 **Dr. V. Kerry Smith**, W.P. Carey Professor of Economics , Department of Economics , W.P
36 Carey School of Business , Arizona State University, Tempe, AZ
37
- 38 **Dr. Herman Taylor**, Director, Principal Investigator, Jackson Heart Study, Jackson, MS
39
- 40 **Dr. Barton H. (Buzz) Thompson, Jr.**, Robert E. Paradise Professor of Natural Resources Law
41 at the Stanford Law School and Perry L. McCarty Director, Woods Institute for the
42 Environment, Stanford University, Stanford, CA
43

05/19/2010 Draft

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 **Dr. Paige Tolbert**, Professor and Chair, Department of Environmental Health, Rollins School of
2 Public Health, Emory University, Atlanta, GA

3
4 **Dr. Thomas S. Wallsten**, Professor and Chair, Department of Psychology, University of
5 Maryland, College Park, MD

6
7 **Dr. Robert Watts**, Professor of Mechanical Engineering Emeritus, Tulane University,
8 Annapolis, MD

9
10

11 **SCIENCE ADVISORY BOARD STAFF**

12 **Dr. Angela Nugent**, Designated Federal Officer, 1200 Pennsylvania Avenue, NW
13 1400F, Washington, DC, Phone: 202-343-9981, Fax: 202-233-0643, (nugent.angela@epa.gov)

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42

A. BACKGROUND ON SCOPING MATERIALS FOR INITIAL DESIGN OF EPA RESEARCH STUDY ON POTENTIAL RELATIONSHIPS BETWEEN HYDRAULIC FRACTURING AND DRINKING WATER RESOURCES

EPA’s Office of Research and Development (ORD) prepared the “Scoping Materials for Initial Design of EPA Hydraulic Fracturing Research Study” document, and requested that the Science Advisory Board (SAB) Environmental Engineering Committee (EEC) review this document and generate ideas/suggestions on ORD’s proposed approach for developing a policy-relevant research program related to hydraulic fracturing. EPA provided the following charge to the SAB EEC, and asked the EEC to generate ideas, suggestions and comments on the overall approach that will be used to frame the hydraulic fracturing study design and the areas that will be addressed by research. EPA sought specific advice on the development of the scope of the study, the approach to analyze data gaps and research needs, the stakeholder process, and the identification of the critical research questions. EPA also noted that SAB feedback will be used to guide the development of a scientifically sound study to establish the relationship between drinking water resources and hydraulic fracturing as it pertains to the extraction of oil and gas from geologic formations.

B. EPA’s CHARGE TO THE COMMITTEE

Background

In its Fiscal Year 2010 Appropriation Conference Committee Directive to EPA, the U.S. House of Representatives urged the Agency to conduct a study of hydraulic fracturing and its relationship to drinking water, specifically:

“The conferees urge the Agency to carry out a study on the relationship between hydraulic fracturing and drinking water, using a credible approach that relies on the best available science, as well as independent sources of information. The conferees expect the study to be conducted through a transparent, peer-reviewed process that will ensure the validity and accuracy of the data. The Agency shall consult with other Federal agencies as well as appropriate State and interstate regulatory agencies in carrying out the study, which should be prepared in accordance with the Agency’s quality assurance principles.”

Hydraulic fracturing (HF) is a well stimulation technique used by gas producers to explore and produce natural gas from sources such as coalbed methane and shale gas formations. The gas extraction process includes: site exploration, selection and preparation; equipment mobilization-demobilization; well construction and development; mixing and injecting fracturing fluids; hydraulic fracturing of the formation; produced water and waste management, transport,

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 treatment, and/or disposal; gas production (infrastructure for storage and transportation); and site
2 closure.

3
4 EPA’s Office of Research and Development (ORD) has developed a proposed approach for
5 developing a policy-relevant study related to hydraulic fracturing. The purpose of the study is to
6 evaluate the relationship between hydraulic fracturing and drinking water. Socio-economic
7 factors may also play a role in understanding how to address potential health and environmental
8 concerns. To ensure that meaningful results are produced in a timely manner, it is important to
9 clarify the overall scope of the study and define explicit short-term and long-term goals. In
10 developing the study design and potential research products, it is important to consider the types
11 of information that might be needed to inform policy decisions.

12 ORD is currently engaged in compiling available information; identifying data gaps and research
13 needs; defining and prioritizing study objectives; and developing a timeline to implement the
14 study. An important part of this effort will be stakeholder involvement.

15
16 **Specific Request**

17
18 ORD has requested that the SAB Environmental Engineering Committee (EEC), as augmented
19 for the hydraulic fracturing review, generate ideas/suggestions and comments on the overall
20 approach that will be used to frame the hydraulic fracturing study design and the areas that will
21 be addressed by research. ORD is seeking specific advice on the development of the scope of
22 the study, the approach to analyze data gaps and research needs, the stakeholder process, and the
23 identification of the critical research questions. SAB feedback will be used to guide the
24 development of a scientifically sound study to establish the relationship between drinking water
25 resources and hydraulic fracturing as it pertains to the extraction of oil and gas from geologic
26 formations.

27
28 **Charge to SAB**

29
30 **1. Proposed Scope of Study:**

31 Congress urged EPA to carry out a study on “the relationship between hydraulic
32 fracturing and drinking water.” Key to determining the scope of the study is understanding
33 whether or not the scope of the study should be narrowly focused or broadly focused, taking into
34 account water resources and related public health and environmental issues over the lifecycle of
35 hydraulic fracturing.

36
37 Charge Question 1: What recommendations does the SAB EEC have regarding this
38 question of scope?

39
40
41
42 **2. Proposed Research Topics:**

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 ORD has identified the following proposed research categories relevant to hydraulic
2 fracturing pertaining to extraction of oil and gas from geologic formations and its
3 relationship to drinking water:
4

- 5 • Characterization of the Hydraulic Fracturing Lifecycle
- 6 • Potential Relationships to Drinking Water Resources
- 7 • Potential Health and Environmental Risks.

8
9 Charge Question 2A: What recommendations does the SAB EEC have regarding these
10 proposed research categories and the related questions in the scoping paper?
11

12 Charge Question 2B: What process does the SAB EEC suggest for prioritizing research
13 needs given the Congressional request and a desire by the Agency to complete initial research
14 products by the end of calendar year 2012?
15

16
17 **3. Stakeholder Process:**

18 It will be critical to engage the stakeholder community in the planning process to
19 establish a research program that is reflective of diverse interests and viewpoints.
20

21 Charge Question 3: What advice does the SAB EEC offer for designing a stakeholder
22 process that provides for balanced input in developing a sound scientific approach for the
23 overall research strategy?
24

25
26
27 **C. RESPONSE TO THE CHARGE**

28
29 The EEC of the EPA Science Advisory Board met in April 2010 to deliberate on the three
30 charge questions raised by ORD to address the Scoping Materials document. These questions
31 focused on: (1) scope of the research program; (2A) proposed research categories and topic
32 areas; (2B) process for prioritizing research needs given the Congressional request and a desire
33 by the Agency to complete initial research products by the end of calendar year 2012; and (3)
34 design of a stakeholder process that provides for balanced input.
35

36 The EEC reviewed the Scoping Materials document and background materials provided
37 by ORD, and considered public comments and oral statements that were received. The cover
38 letter highlights the outcome of the Committee's deliberations and the recommendations, and the
39 following Response to the Charge Questions provides details regarding these recommendations.
40

41
42 **Charge Question 1: What recommendations does the EPA EEC have regarding the**
43 **question of scope?**
44

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 The Committee discussed the hydraulic fracturing topic on two levels: (1) broad, long-
2 term research needs/ideals, and (2) more focused, short-term research goals. The Committee
3 identified a hierarchy of issues that should be considered when assessing these needs: hydraulic
4 fracturing potentially affects water resources and drinking water supplies, and has potential to
5 pose human health and environmental risks. Considering the Congressional request and a desire
6 by the Agency to complete initial research products by the end of calendar year 2012, the
7 Committee recommends that initial, short-term research be directed to study sources and
8 pathways of potential impacts of hydraulic fracturing on water resources, especially drinking
9 water sources. While current and potential drinking water sources are a recommended starting
10 point/priority for ORD research, investigations should eventually occur on the impact on water
11 resources more generally, and their aquatic ecosystems and ability to support fishing and
12 recreation.

13
14 ORD has interpreted the charge to investigate “the relationship between hydraulic
15 fracturing and drinking water” with a systems perspective, and developed a research plan with a
16 related broad scope. The SAB EEC supports the systems perspective reflected in the ORD
17 research plan. Environmental science has been moving toward analysis that encompasses larger-
18 scale systems, such as at watershed scale, in order to account for the inter-relationships that
19 ultimately determine ecosystem health and hence the health of human communities that depend
20 on these ecosystems. There is now widespread recognition that focusing too narrowly in
21 assessing impacts of activities can lead to incomplete understanding of ecosystem inter-
22 relationships and health.

23
24 The use of a lifecycle framework to plan a research study on the potential human health
25 and environmental impacts of hydraulic fracturing is appropriate. However, a formal lifecycle
26 assessment does not necessarily need to be undertaken. It would be useful to outline the
27 hydraulic fracturing lifecycle and think about the components that would be included in a
28 lifecycle assessment to help identify critical knowledge gaps. Considering the time and
29 resources available for the initial study by ORD, the Committee recommends use of a lifecycle
30 framework, without actually performing a lifecycle assessment, to identify the most important
31 research questions to address in the initial study. Questions pertaining to the impacts of the
32 various stages of the hydraulic fracturing lifecycle on drinking water sources will be of primary
33 importance and consistent with the research request from Congress.

34
35 Economic analyses such as cost-benefit analysis are not included in the ORD research
36 plan. The Committee supports the omission of such analysis from the ORD research plan for
37 this initial study. There are a number of first-order science issues that need to be addressed first.

38
39 The ORD research plan has been formulated in part by the goal of conducting policy-
40 relevant research. While it is difficult to predict which scientific results will be of greatest use to
41 EPA and other government agencies when they establish policies and regulations in the future,
42 the Committee believes that the research plan includes topics that will be relevant to policy
43 formulation.

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 The Committee believes that ORD should emphasize environmental concerns that are
2 specific to or significantly influenced by hydraulic fracturing rather than on concerns that are
3 common to all oil and gas production activities. For example, management of produced water is
4 a concern of all oil and gas production activities but hydraulic fracturing may influence the
5 quantity and quality of produced water and the ORD research plan should address those
6 influences.

7
8
9 **Charge Question 2A: What recommendations does the SAB EEC have regarding these**
10 **proposed research categories and the related questions in the scoping paper?**

11
12 Characterization of the Hydraulic Fracturing Lifecycle

13
14 The use of a lifecycle framework to plan a research study on the environmental impacts
15 of hydraulic fracturing is appropriate. Lifecycle assessment (LCA) is a formal process for which
16 the International Organization for Standardization developed an international standard, ISO
17 14040. However, a formal LCA does not necessarily need to be undertaken in this case. It
18 would be useful to outline the hydraulic fracturing lifecycle and think about the components that
19 would be included in a LCA to help identify critical knowledge gaps. A careful compilation and
20 review of data and knowledge available in the peer-reviewed literature, in industry, in
21 professional and non-governmental organizations, and in government agencies should be
22 conducted to ensure accurate identification of data gaps. It is important to realize that the open
23 peer-reviewed literature in this field is limited and other literature must be carefully critiqued
24 regarding its limitations and appropriateness for addressing ORD's specific research needs.

25
26 To the extent possible, in order to avoid duplicative research and focus on the
27 Congressional request, the research plan should focus on issues that are uniquely associated with
28 or significantly influenced by hydraulic fracturing, including both conventional and
29 unconventional impacts that could occur at any point in the hydraulic fracturing lifecycle.
30 However, it will be difficult to separate some issues associated with conventional oil and gas
31 production in the evaluation of hydraulic fracturing and movement of chemicals through fissures
32 in interconnected geological formations.

33
34 Development of a lifecycle framework for hydraulic fracturing can help EPA ORD
35 prioritize knowledge gaps and decide what to study. In developing the lifecycle framework,
36 ORD must identify appropriate boundaries for the assessment in order to help inform and focus
37 the hydraulic fracturing research planning. An important boundary issue is where to draw the
38 line between hydraulic fracturing-specific questions and questions pertaining to all oil and gas
39 production operations. With definition of such boundaries, LCA can be used to separate
40 conventional, well-understood issues such as impacts of site development, road construction, and
41 trucking, from impacts that are not well understood, such as fate of chemicals in source fluids,
42 flowback water and produced water that is co-mingled with the flowback water in storage ponds.
43 LCA will be useful in identifying cumulative risks from both conventional and unconventional
44 practices throughout the hydraulic fracturing lifecycle. Boundary definition should also be

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 guided by considering the types of comparisons that EPA or others may wish to undertake in the
2 future, such as comparison of hydraulic fracturing impacts with those of other gas or energy
3 production processes.
4

5 In developing the LCA framework, it will be necessary to think about the desired
6 functional unit (e.g., single well, a multi-well pad, geological unit, or a watershed), the desired
7 time horizon, and the most appropriate metrics (e.g., water use per unit of gas produced, total
8 volume of water use for a region or watershed, number of conventional wells avoided each meter
9 of horizontal drilling, mass of additives per unit of gas produced, greenhouse gas emissions per
10 unit of gas produced). When choosing boundaries, time horizons, functional units, and metrics,
11 EPA should acknowledge and recognize the degree to which such choices would address certain
12 positive and negative impacts of hydraulic fracturing technology in the study and the degree to
13 which such choices may preclude addressing certain impacts.
14

15 While there are multiple environmental impacts that could be associated with hydraulic
16 fracturing, water issues are central and are the focus of the Congressional request for the research
17 study. Because drinking water may be connected to many other water sources, water resources
18 should be the central theme for the lifecycle framework development. Evaluation of the lifecycle
19 assessment should be aimed at identifying knowledge gaps relevant to managing impacts on
20 current and potential future drinking water sources and systems, and prioritizing these
21 knowledge gaps for research. Although current and potential drinking water sources are a
22 recommended starting point/priority for ORD research, the impact on water resources more
23 generally, and their aquatic ecosystems and ability to support fishing and recreation, should
24 eventually be investigated.
25

26 Potential Relationships to Drinking Water Sources
27

28 As discussed under Charge Question 2B, the Committee believes ORD should carefully
29 compile and review available data and knowledge on hydraulic fracturing and interaction with
30 current and potential future drinking water sources at the beginning of the research study. When
31 compiling information on current and potential future drinking water sources, the definition of
32 drinking water source should be broad, because some surface waters and deep aquifers bodies
33 not currently considered drinking water sources will likely be viewed as such in the future. Also,
34 many of these water sources are now or may be hydrologically connected.
35

36 Considering the range of potential environmental impacts associated with hydraulic
37 fracturing and the range of geographic/geologic regions and site-specific conditions in which
38 hydraulic fracturing may be implemented, it will be difficult to study hydraulic fracturing with
39 sufficient depth and breadth for the allotted time and budget of the research study. ORD should
40 identify reasonable short term goals and accomplishments (e.g., within one to three years) and
41 long term goals and accomplishments (e.g., within five to ten years or longer) for this research.
42

43 The research planning team should consider performance of in-depth case studies at five
44 to ten different locations selected to represent the full range of regional variability across the

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 nation. ORD has used the in-depth case study approach successfully in other multi-objective
2 research programs. The in-depth case study approach is an efficient way to conduct research on
3 groups of systems that exhibit significant variability between systems. Through careful design,
4 the case-study approach can yield in-depth process understanding with some degree of
5 generalization. This approach can provide a valuable basis for exchange of information between
6 resource development companies (e.g., oil and gas industries) and interested citizen groups.
7 Case studies offer the potential to increase our understanding of human and ecological exposure
8 in relation to hydraulic fracturing activities in a rapid manner. Case studies can reveal those life
9 cycle assessment parameters of significance for hydraulic fracturing analysis. Case studies can
10 also help identify existing best management practices (BMPs) that favorably affect quality and
11 quantity of source fluids, flowback water and produced water that is co-mingled with the
12 flowback water. Case studies may also provide information on the impact of the composition
13 and variability of source fluids on flowback/produced water. For example, some operators may
14 use different source fluid additives that have different implications for flowback/produced water
15 contaminants and management. (e.g., acidic additives may enhance metal leaching from the
16 formation into flowback/produced water.) Case studies should be carefully designed to assess
17 the range and variability of environmental and exposure conditions of areas where hydraulic
18 fracturing is and will be occurring and where hydraulic fracturing fluids may be released. Also,
19 because of the high cost of installing and operating hydraulic fracturing systems, it is
20 recommended that the EPA partner with industries who would develop and operate the wellsites
21 while EPA conducts research at the sites (e.g., to install monitoring stations, monitoring, wells,
22 etc).

23
24 In order to define relationships between hydraulic fracturing processes and water sources,
25 the Committee believes that significantly improved data and information are needed on the
26 occurrence, volume, composition, treatability and/or disposal of hydraulic fracturing source
27 fluids, flowback water and produced water that is co-mingled with the flowback water and the
28 sources of the constituents (i.e., additive, reaction product, or leaching product) throughout
29 different phases of the hydraulic fracturing lifecycle. The composition of hydraulic fracturing
30 source fluids, flowback water and produced water that is co-mingled with the flowback water,
31 and the sources of the constituents need to be understood to provide knowledge about physical-
32 chemical mechanisms governing flowback and produced water chemistry and insight into ways
33 to control this chemistry. For improved detection, reliable surrogate constituents should be
34 investigated. The potential and desirability of introducing tracer constituents in hydraulic
35 fracturing fluids for studying fate and transport in these complex fractured systems should also
36 be investigated.

37
38 To help assess impacts to water sources, ORD should consider doing mass balances on
39 chemicals of concern and water quantity in areas where hydraulic fracturing is or will be
40 occurring. Also, because impacts to water quantity affect water quality, ORD should assess
41 hydraulic fracturing impacts to water quantity for both surface water and groundwater.

42
43 After compiling and reviewing available data and knowledge on hydraulic fracturing and
44 interaction with current and potential future drinking water sources at the beginning of the

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 research study, ORD should identify how to best address any potential problems identified
2 through this effort, such as water treatability issues and applicability of emerging treatment
3 technologies. The research plan should include a focused effort on treatability of hydraulic
4 fracturing flowback and produced water that is co-mingled with the flowback water in several
5 contexts. Research should be conducted on the effectiveness of municipal wastewater treatment
6 systems with respect to hydraulic fracturing flowback and produced water that is co-mingled
7 with the flowback water, as these waters are often being directed to Publicly Owned Treatment
8 Works (POTWs). There are new methods emerging for treatment of very high Total Dissolved
9 Solids (TDS) waters, such as membrane distillation. The potential for these technologies to be
10 effective in treating hydraulic fracturing process waters should be systematically investigated.
11 Research should be also conducted to determine the effectiveness of existing drinking water
12 treatment technology, including public water treatment and point of use technology, for
13 removing hydraulic fracturing flowback and produced water constituents that become introduced
14 to water supply sources. Such constituents might be introduced into drinking water sources
15 through inadequate treatment in POTWs or through pathways such as stormwater runoff.
16

17 In developing the research study plan, specific potential uses of the results should be
18 considered. If one potential outcome is to develop scientific information to facilitate assessment
19 of risk at particular sites, development of site assessment methodologies and related data
20 requirements and acquisition methodologies is needed.
21

22 Potential Health and Environmental Risks
23

24 Health and environmental risk associated with hydraulic fracturing can only be assessed
25 after sources and pathways of possible exposure are much better understood. Several activities
26 must occur before such potential risks are assessed, including: a) characterization of the
27 composition and variability of the source fluids, flowback water and produced water that is co-
28 mingled with the flowback water; b) assessment of possible synergistic effects of mixtures of
29 chemicals in fracturing fluids as well as synergistic effects of chemical mixtures interacting with
30 materials in the fractured injection zone; c) evaluation of potential pathways to human and
31 ecosystem exposure under a range of hydraulic fracturing process conditions relative to different
32 geological formations and conditions; d) analysis of the existence and formation of hydraulic
33 fracturing injection and product fluid transport pathways as a result of hydraulic fracturing; and
34 e) identification of the conditions most likely to lead to impacts on drinking water resources.
35

36 As discussed above under Potential Relationships to Drinking Water Sources, another
37 important factor to assess is the effect of hydraulic fracturing processes on water quantity.
38 Changes in water quantity in groundwater or surface water can have significant influences on
39 human and ecosystem health. Also, potential secondary effects associated with hydraulic
40 fracturing should be considered (e.g., arsenic mobilization in groundwater and aquifers due to
41 enhanced methane transport and resulting changes in redox conditions). It would be helpful to
42 evaluate the cumulative impacts that additional uses of water resources have on water quality and
43 quantity in water resource systems where hydraulic fracturing activities are occurring or are
44 being considered (e.g., pumping of water for agriculture and urban/industrial uses). After these

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 efforts have been conducted, an initial analysis should be conducted that identifies the exposure
2 routes likely to pose the greatest human health risk.

3
4 Geographic Information System (GIS) mapping with overlays of hydraulic fracturing
5 activities and locations of human populations and ecological receptors would provide useful
6 initial insights into potentially exposed populations and ecosystems. GIS mapping would be
7 helpful in intersecting aquifer and surface water conditions with potential receptor and exposed
8 populations, could be used to map reported incidents of problems potentially caused by hydraulic
9 fracturing activities, and would help with the design of future health and ecosystem studies.
10 There are readily available databases, including those related to the U.S. Census, Medicaid,
11 Medicare, and others, to which GIS mapping techniques could be applied to assess spatial
12 associations between hydraulic fracturing activities and human disease. This mapping would
13 provide preliminary insights into locations for targeted current and/or future research.

14
15 Occupational exposure information and data for hydraulic fracturing processes could be a
16 potential source of information to guide initial evaluations. Such information could, for
17 example, give some initial information on the potential health effects of mixtures of chemicals
18 present in hydraulic fracturing fluids.

19
20 The EPA and U.S. Department of Energy are developing risk assessment approaches and
21 data for geologic sequestration of carbon dioxide. Knowledge, tools, and data are being
22 developed through these efforts that are applicable to risk assessment for hydraulic fracturing.
23 The Committee encourages ORD to make use of the ongoing research and expertise pertaining to
24 geologic sequestration of carbon dioxide.

25
26 Regardless of which topics are ultimately selected for investigation, ORD should invest
27 in and develop effective strategies for communicating and defending the chosen research topics
28 of focus.

29
30
31 **Charge Question 2B: What process does the SAB EEC suggest for prioritizing research
32 needs given the Congressional request and a desire by the Agency to complete initial
33 research products by the end of calendar year 2012?**

34
35 Priorities

36
37 ORD should carefully compile and review available data and knowledge on hydraulic
38 fracturing and interaction with drinking water resources in the peer-reviewed literature, in
39 industry, in professional and non-governmental organizations, and in government agencies at the
40 beginning of the research study. These efforts would help ensure accurate identification of data
41 and knowledge gaps, maximize use of existing information, and optimize use of limited research
42 funds.

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 This compilation and review of existing data and knowledge will need to be conducted
2 with critical evaluation of the quality and relevance of the information. For example, some
3 previous studies on hydraulic fracturing were conducted for different purposes such as on
4 optimizing gas extraction efficiency, and the data collected and presented in this context are not
5 likely to be sufficient for understanding solute generation or migration. It is important to engage
6 the current state of oil and gas engineering and science to identify and evaluate existing
7 knowledge and pertinent data. It is also important to realize that the open peer-reviewed
8 literature in this field is limited and other literature must be carefully critiqued regarding its
9 limitations and appropriateness for addressing ORD's specific research needs.

10
11 Knowledge of the characteristics of the injected fluids, the reactions that occur in the
12 injection zone, the characteristics of the fluids leaving the injected zone, and the pathways for the
13 fluids leaving the injection zone will be needed for assessing impacts on water resources,
14 exposure of humans and ecosystems to hydraulic fracturing fluids and products, and the
15 associated uncertainties involved in the assessment. As a priority, ORD should develop a risk-
16 based research prioritization approach that would provide the scientific knowledge necessary for
17 characterizing the risk of conditions that can lead to human and ecological exposure to hydraulic
18 fracturing fluids and products at levels that impart health risks. ORD should also prioritize
19 research towards the reactions and transport of hydraulic fracturing fluids in the complex
20 subsurface environment, because experience with reservoir engineering and subsurface
21 remediation makes clear that there is much to learn on developing basic scientific understanding
22 of these processes.

23
24 The ORD research plan provides several lists of possible specific research questions. To
25 help identify priority topics for research, ORD should develop several overarching, fundamental
26 questions, perhaps through grouping the many questions suggested by ORD. These overarching
27 questions can then be placed in order of priority. The Committee recommends that ORD
28 conduct such an exercise before revising the research plan. The Committee discussed some
29 fundamental questions, but did not undertake to prioritize them.

30
31 Fundamental Questions

- 32
- 33 • What are the fundamental physical and chemical water-related processes for each phase
34 of the hydraulic fracturing lifecycle (below ground and above ground in treatment
35 processes and surface water)?
 - 36 • What is the quality and quantity of injected fluids, flowback water and produced water
37 that is co-mingled with the flowback water?
 - 38 • How does the specific composition of TDS vary among flowback and produced waters?
 - 39 • What do field case studies tell us about the effects of hydraulic fracturing on the
40 reactions, fate, and transport of injected constituents, and the fate and transport of
41 potential contaminants in particular regions and geologic regimes?
 - 42 • What do field data convey about region-specific issues related to hydraulic fracturing and
43 its environmental impacts?

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

- 1 • In what way does hydraulic fracturing, at one or multiple sites, alter existing surface and
- 2 subsurface flow paths?
- 3 • What are existing best management practices (BMPs) that affect quality and quantity of
- 4 flowback and produced water?
- 5 • What are opportunities to develop technologies that could lead to green additives or
- 6 improved approaches to managing process waters or waters impacted by hydraulic
- 7 fracturing?
- 8 • What are the mass balances for water and constituents of concern at a hydraulic
- 9 fracturing site?

10
11
12 **Charge Question 3: What advice does the SAB EEC offer for designing a stakeholder**
13 **process that provides for balanced input in developing a sound scientific approach for the**
14 **overall research strategy?**
15

16 The Committee recommends development of a balanced, collaborative advisory group of
17 stakeholders representing a broad range of perspectives. Hydraulic fracturing for oil and gas
18 development affects ecosystems and communities directly and is a topic of significant public
19 interest. The technology also has the potential to vastly increase US gas production and is of
20 great interest for energy security and economic development. Formation of an advisory group of
21 stakeholders for the research effort will help inform the research, including helping the research
22 teams to become aware of data and expertise that can benefit the research. To ensure that the
23 stakeholder process is inclusive, collaborative, transparent, and legitimate, ORD should strive for
24 broad representation on the advisory group.
25

26 The group could be comprised of representatives of industry, environmental groups,
27 affected residents, state regulators, and other individuals. This group could assist ORD in
28 accessing data held by the various groups and in establishing stakeholder-based evaluation
29 criteria. At the conclusion of the research period, this group could assist other units of EPA in
30 the transition from research results to policy recommendations. The group could also be used to
31 help develop a community-based participatory research component that would develop technical
32 capacity in affected communities. One approach would be to establish community-based
33 sampling and testing centers in partnership with pro bono scientists and engineers, environmental
34 groups, universities, and residents. Household water, private well water, and stream samples
35 could be tested to provide screening level information. Hot spots could be identified for further,
36 more comprehensive testing.
37

38 EPA needs to first set clear, realistic goals, expectations and objectives for hydraulic
39 fracturing stakeholder engagement. EPA should then develop and undertake various approaches
40 for stakeholder engagement with regard to the hydraulic fracturing issue. The stakeholder group
41 should be engaged throughout the research process. With respect to stakeholder engagement for
42 informing hydraulic fracturing research, the needs and responsibilities of ORD vs. other offices
43 within EPA need to be considered. The Committee recommends that ORD's objectives and
44 process for stakeholder engagement with the research should be carefully designed based on best

DO NOT CITE OR QUOTE

This Draft Committee Report has been prepared for quality review and approval of the chartered SAB. This report does not represent EPA policy.

1 available social science. This will help determine the appropriate composition and charge for the
2 advisory group of stakeholders that will provide advice and information on hydraulic fracturing
3 research activities.

4
5 Based on submitted written and oral public comments to the draft ORD hydraulic
6 fracturing research plan, it is clear that there is a wealth of data and experience in industry, in
7 professional and non-governmental organizations, in state agencies, and in other groups for ORD
8 to draw upon in the research effort. One important objective for engagement with stakeholders
9 should be to gain access to and leverage the existing knowledge base on hydraulic fracturing and
10 its environmental impacts.

11
12 There are many technological development activities and development and study of best
13 management practices with respect to hydraulic fracturing that are ongoing in the states. It
14 would be helpful if EPA engaged with relevant states to inventory and conduct performance
15 evaluations of the effectiveness of state hydraulic fracturing regulatory, technological
16 development and BMP activities. Among other benefits of such an endeavor, the Committee
17 expects that opportunities for collaborative EPA and state research efforts will be identified
18 through serious engagement with the states.

19
20 Through the discussions with stakeholder groups and the engagement with states,
21 opportunities to leverage ongoing or planned community-based sampling and testing should be
22 explored, with appropriate consideration of quality assurance/quality control requirements and
23 utilizing community resources for meaningful contributions to meeting research objectives.
24 There may be particular opportunities to engage community resources at case-study sites, if ORD
25 decides to pursue case studies as a component of the research effort.

26
27 It will also be important for ORD to engage with other federal agencies to share data,
28 collaborate, leverage expertise, and align research priorities for optimal use of limited resources.

29
30