Summary Minutes of the United States Environmental Protection Agency (U.S. EPA) of the Joint Meeting of the Science Advisory Board (SAB) and Board of Scientific Counselors (BOSC) July10-11, 2012

Date and Time: July 10, 2012, 8:30 a.m. to 6:00 p.m.; July 11, 2012, 8:30 a.m. – 3:00 p.m. Eastern Time

Location: The Renaissance Raleigh North Hills Hotel, 4100 Main at North Hills Street, Raleigh, NC 27609

Purpose: To provide advice on 1) Office of Research and Development's (ORD's) plans to implement its strategic research directions in six major program areas; 2) strengthening program integration in ORD; and 3) encouraging and measuring successful innovation in ORD.

SAB and BOSC Members:

SAB Members

Dr. Deborah Swackhamer, Chair
Dr. George Alexeeff
Dr. David Allen
Dr. Joseph Arvai
Dr. Ingrid Burke
Dr. Costel Denson
Dr. Otto Doering
Dr. Michael Dourson
Dr. David Dzombak
Dr. Elaine Faustman
Dr. Jeffrey Griffiths
Dr. Barbara Harper
Dr. Kimberly L. Jones
Dr. Bernd Kahn
Dr. Madhu Khanna
Dr. Nancy Kim
Dr. Cecil Lue-Hing
Dr. Eileen Murphy
Dr. James Opaluch
Dr. Duncan Patten
Dr. Stephen Polasky
Dr. Amanda Rodewald
Dr. Jonathan Samet
Dr. James Sanders
Dr. Jerald Schnoor
Dr. Gina Solomon
Dr. Daniel Stram
Dr. Peter Thorne
Dr. Paige Tolbert
Dr. John Vena
Dr. Roberts Watts
Dr. John Therakan
Dr. Russell Thomas
Ms. Marie Zuikov

BOSC Members

Dr. Katherine von Stackelberg, Chair
Dr. Ed Carney
Dr. Susan Cozzens
Dr. Lisa Dilling
Dr. Henry Falk
Dr. Charles Haas
Dr. Earthea Nance
Dr. Rosemarie Szostak

Dr. Judith Meyer
Dr. H. Keith Moo-Young

Liaisons to the SAB:

Dr. Pamela Shubat
Dr. Daniel Schlenk

EPA presenters:

Mr. Lek Kadeli, Acting Assistant Administrator, ORD
Dr. Robert Kavlock, Deputy Assistant Administrator for Science, ORD
Dr. Peter Preuss, Chief Innovation Officer, ORD
Dr. C. Andrew Miller, ORD
Dr. Anne Rea, ORD
Dr. Sally Darney, ORD
Dr. Kate Guyton, ORD
Dr. Douglas Wolf, ORD

DFOs:

Dr. Angela Nugent, SAB Staff Office, Designated Federal Officer for the Chartered SAB and the Sustainable and Health Communities Breakout Group
Mr. Greg Susanke, ORD, Designated Federal Officer for the BOSC and the Human Health Risk Assessment Breakout Group
Dr. Thomas Brennan, SAB Staff Office, Designated Federal Officer for the Homeland Security Breakout Group
Mr. Edward Hanlon, SAB Staff Office, Designated Federal Officer for the Safe and Sustainable Water Resources and Homeland Security Breakout Group
Dr. Suhair Shallal, SAB Staff Office, Designated Federal Officer for the Chemical Safety for Sustainability Breakout Group
Dr. Holly Stallworth, SAB Staff Office, Designated Federal Officer for the Air, Climate and Energy Breakout Group
Dr. Vanessa Vu, SAB Staff Office Director

Meeting Summary July 10, 2012:

The meeting generally followed the issues and timing as presented in the agenda.[1]

Convene the meeting

Dr. Nugent and Mr. Susanke formally opened the meeting and noted that this joint federal advisory committee meeting of the SAB[2] and BOSC[3] had been announced in the Federal Register.[4] They briefly described the mission of the two advisory committees and the authorities under which the committees operate. The SAB an independent, expert federal advisory committee chartered under the authority of the Federal Advisory Committee Act (FACA). The SAB is empowered by law, Environmental Research, Development, and Demonstration Authorization Act (ERDDAA), to provide advice to the EPA Administrator on scientific and technical issues that support EPA's decisions. The BOSC was established and operates at the request of ORD under authority of the Federal Advisory Committee Act. It provides advice and recommendations on both the technical and management aspects of ORD and its research programs.

The DFOs noted that the Federal Register notice meeting announcement had provided the public with an opportunity to provide written and oral comment. There was no request for oral comment. One written public comment[5] had been submitted, provided to SAB and BOSC members and posted on the SAB web page for the meeting. Attachment A lists attendees from the public at this advisory meeting.

Goals and agenda for the meeting

Dr. Deborah Swackhamer, the SAB Chair, welcomed the group. She called on SAB and BOSC members to evaluate ORD's implementation of its strategic research programs since the SAB and BOSC meeting in June 2011 and to provide useful advice for future implementation. Dr. Katherine von Stackelberg, the BOSC Chair, added her welcome.

Dr. Swackhamer briefly summarized ORD's charge for the meeting, which included questions for each ORD research program and overall questions related to program integration and innovation.[6] The SAB DFO briefly summarized the supporting review and background materials provided to the members in hard copy and posted on the SAB website.[7]

ORD Overview Remarks and Introduction of National Program Directors

Mr. Lek Kadeli, ORD Acting Assistant Administrator, noted that ORD embraces federal advisory committees and welcomes the expert advice they provide, especially in the form of constructive comments. He characterized the past several years as ones of change and progress for ORD. He acknowledged former Assistant Administrator Paul Anastas for his "leadership and drive" in conceptualizing and initiating the "Path Forward." Mr. Kadeli pledged his commitment to making those changes take deep root. He also acknowledged the important role of Drs. Robert Kavlock, Ramona Trovato and William Benson in supporting ORD's strategic work, as well as the efforts of former Deputy Assistant Administrator for Science, Dr. Kevin Teichman, who currently works on inter-agency collaborations and serves as a senior ORD Science Advisor.

Mr. Kadeli introduced ORD's new National Program Directors: Dr. Daniel Costa - Air, Climate, and Energy; Dr. Tina Bahadori -- Chemical Safety for Sustainability; Dr. Kenneth Olden -- Human Health Risk Assessment; Dr. Suzanne van Drunick - Safe and Sustainable Water Resources; Dr. Jonathan Herrmann -- Homeland Security; and Dr. Michael Slimak –Sustainable and Healthy Communities (acting). He also introduced Dr. David Dix, who leads ORD's Computational Toxicology Program, Dr. James Johnson, Director of ORD's National Center for Environmental Research, and Dr. Kenneth Olden, Director of the ORD's National Center for Environmental Assessment. He noted the major change in ORD leadership ranks in the past year.

Mr. Kadeli emphasized that ORD seeks science advice to maintain and improve its research programs and their application in new risk management settings in the face of declining federal budgets, and that ORD's current path will allow it to best meet financial challenges and issues facing the agency. He asserted his belief that ORD's recent changes position ORD to be successful in providing high quality science with the highest impact, and in working with federal

partners. The changes will take advantage of the passion, energy and commitment of ORD staff. He concluded his remarks by expressing thanks to the SAB and BOSC for their past advice.

Dr. Robert Kavlock, Deputy Assistant Administrator for Science, ORD, provided a slide presentation[8] that gave an overview of ORD progress since the SAB-BOSC meeting in June 2011 and since receipt of the ORD-BOSC report on ORD strategic research directions in October 2011.[9] Dr. Kavlock described the past three years as planning, while this year marked the transition to implementing integrated programs. He noted that ORD will deliver 93 research products from its six research programs in FY 2012. ORD has focused on integrating research within each ORD research program and seeking opportunities for integration across ORD research programs. In integrating across programs, ORD is "striving for balance between effectively integrating cross-cutting issues, but not creating additional, stand alone research programs." He briefly introduced ORD's five integration examples, which cover a wide variety of science issues, from research in early phases of development to technical assistance. He also described ORD's general efforts to integrate the three components of sustainability (environment, society and economy) into ORD research programs. Dr. Kavlock stated that the tools and models ORD is developing to support sustainability can also be used to support other decision making. He highlighted the continuing importance of innovation to ORD's programs. He noted that he had met with Dr. Al McGartland of EPA's National Center for Environmental Economics to identify opportunities for the two groups to collaborate and that ORD is seeking other ways to increase its capabilities in the social, behavioral and decision sciences.

After Dr. Kavlock concluded his presentation, SAB and BOSC members had the opportunity to ask several questions. One member asked about the responsibilities of the National Program Directors as compared to the Directors of ORD Laboratories and Centers. Dr. Kavlock responded that National Program Directors identify what needs to be done and by when. Directors of Laboratories and Centers "figure out how that will be delivered." ORD has developed an approach to matrix management that provides more balanced budget and decision making authority to National Program Directors than ever before. Dr. William Benson has the lead for matrix management with primary responsibility for communications between National Program Directors and Directors of Laboratories and Centers.

The next question concerned legacy research. How is ORD dealing with research activities that do not fit into the current six research programs? Mr. Kadeli responded that Congress as well as program and regional offices have had questions about many ORD research programs existing before "The Path Forward." He noted that ORD had engaged a very broad group of people in defining the problem to be addressed by each research program. As a result of this robust and time consuming process, many groups with initial questions have been patient during the past transition year and have developed increased understanding that ORD could deliver more effective, efficient solutions as it "built this new airplane while flying." He acknowledged that there is a need for "places where we have to set aside old parts" and that change is "not clean in all cases." ORD is holding ongoing conversations about legacy activities with some constituencies, but he noted that ORD's emphasis on problem definition will become "the driver over time."

Another member asked whether ORD could develop a cross-walk that could illustrate how ORD research products relate to EPA regulatory programs. Dr. Kavlock noted that each of ORD's six strategic research action plans has a section on related regulatory programs and requirements. The member expressed the view that it would enhance integration to have "one place" to see such a cross walk for ORD's major programs.

Several members made comments or asked questions about ORD's approach to sustainability. One member stated that ORD does not effectively communicate the importance of health and well-being in its definitions of sustainability. The focus on ecosystem services "loses the beauty of public health and ecological health" in her view. Another member asked about the nature of statutory limitations on EPA's considerations of sustainability. Dr. Kavlock responded that a statute that looks exclusively at risk and does not allow consideration of benefits does not encourage use of sustainability science. He noted that "some colleagues in the risk business are wary of sustainability." Dr. Kavlock also explained that ORD relied on the definition of sustainability in the National Environmental Policy Act because it had a legislative basis. Mr. Kadeli noted that there are challenges to incorporating sustainability but that there is flexibility in implementing statutes. A member noted that the strategic research action plans do not use the term consistently. Yet another member noted that EPA does not consistently communicate information about its new research programs on the EPA website. Dr. Kavlock acknowledged that making such information available to the public will be a future priority of ORD's National Program Directors.

Remarks from the Science Advisor to the EPA Administrator

Dr. Glenn Paulson, the Science Advisor to the EPA Administrator, provided brief remarks. He described his role as focusing on all of EPA and providing advice directly to the Administrator. Administrator Jackson has informed him that he would serve as the lead for sustainability science for the Agency. One of his interests is on metrics to measure sustainability, which might be an appropriate focus for the SAB or BOSC.

Dr. Paulson also identified the science underlying hydraulic fracturing as one of his top four responsibilities. After President Obama endorsed the goal of producing more natural gas, he issued an Executive Order calling for coordination within the federal government. At the same time, EPA, the Department of Energy, and the Department of the Interior formalized an agreement to collaborate on unconventional oil and gas research. The purpose of this multi-agency, multi-year effort is to effectively and efficiently conduct policy-relevant science that supports sound decisions regarding the safe and prudent development of unconventional oil and gas resources. Agencies will focus on improving their understanding of the impacts of UOG production on human health and the environment. The current schedule calls for a draft to be available for public comment by October 13, 2012 and the plan to be finalized by January 13, 2013. He invited SAB and BOSC members to provide individual comments on the draft workplan and he committed to personally reviewing their comments. He noted that EPA is planning "aggressive outreach" to other public health-oriented agencies to involve them in development and comment on the plan.

Examples of Program Integration

Dr. Robert Kavlock introduced five ORD speakers to describe current efforts underway to integrate ORD research programs.

Dr. C. Andrew Miller, the first ORD speaker, provided a presentation entitled "Integration of Climate Research Across ORD."[10] He described the context, goals, and activities of ORD's climate research and approach to climate research integration within ORD and EPA and with other partners. He noted the importance of addressing climate change from a systems approach. Consequently, ORD is using formal mechanisms to coordinate with other federal agencies, and is encountering challenges coordinating the many needs across EPA.

After Dr. Miller concluded his remarks, SAB and BOSC members posed several questions and made comments. Dr. Miller described why he characterized the National Atlas for Sustainability as a key research project supporting climate integration. This geographic information system-based database will provide baseline information about the state of ecosystems and ecosystem services that will allow many different programs to understand climate impacts. He also noted that ORD's research has begun some initial efforts to support development of EPA's climate regulations. ORD is beginning to plan mitigation research involving energy use reduction with some efforts related to terrestrial carbon issues. ORD has not taken steps to address social science issues related to this topic.

Dr. Anne Rea, the second ORD speaker, provided a presentation entitled "Cross-EPA Nitrogen Research & Policy Integration."[11] She emphasized that the research program requires working with partners on integrating science with policy. This integration project relies in great part on the SAB's 2010 report, *Reactive Nitrogen in the United States: An Analysis of Inputs, Flows, Consequences, and Management Options - A Report of the Science Advisory Board*. EPA-SAB-11-013. The SAB report provides a valuable conceptual model for organizing research programs related to nitrogen. She noted that ORD's nitrogen integration effort "sparked" stronger coordination between ORD's Principal Investigators and EPA's Office of Air and Radiation. She described seminar series and workshop to share research information and development of a "roadmap" that would show how different EPA efforts aimed for a "one-EPA" vision, key research questions, and needs related to nitrogen so that EPA's current aggregation of research projects will become an integrated set of projects.

In response to Dr. Rea's comment that inter-agency coordination was difficult, an SAB member emphasized the importance to coordinate with other federal agencies, especially the U.S. Geological Survey. Dr. Rea responded that EPA has had preliminary discussions with that agency, along with the U.S. Department of Agriculture and the Soil and Water Conservation Society.

Dr. Sally Darney, the third ORD speaker, provided a presentation entitled "Integrating Children's Health and Environmental Justice Research Across ORD: Reducing risk while promoting equity and well-being."[12] She acknowledged the value of a workshop sponsored by ORD's National Center for Environment Research in helping to refine ORD's work in this area. Health disparity is the "driver" that helps ORD integrate children's health and environmental

justice. The three pillars of sustainability can be related to the activities included in this integration example. ORD effects integration through internal ORD workgroups devoted to children's health and environmental justice. These workgroup efforts have not yet been integrated. ORD also seeks advice from EPA's Children's Health Protection Advisory Committee on these topics.

After Dr. Darney concluded her remarks, a BOSC member asked how and where EPA receives input from communities to make sure that all vulnerable groups are represented, their topics are being addressed and how to communicate with them. Dr. Darney responded that the Sustainable and Health Communities program has "reached out to community groups" and local environmental justice groups. She acknowledged that EPA must build capacity to improve working with communities and learn from the experience of children's health centers. She also mentioned that the program has started providing training to EPA staff in outreach and communication.

Dr. Kate Guyton, the fourth ORD speaker, provided a presentation entitled "Applying New Chemical Assessment Approaches in Human Health Risk Assessment."[13] She spoke of the priority need to: address risks from chemicals currently lacking toxicity values; provide outputs that can be utilized in economic health benefits analyses; and move beyond single chemical/stressor-based assessments. She described several ORD research products that help to address these needs. She also mentioned that this integration effort is the bridge between ORD's Chemical Safety for Sustainability and the Human Health Risk Assessment programs, and that decision analysis is being used to prioritize work flow.

After she concluded her remarks, SAB and BOSC members had several comments and questions. One asked how ORD tools relate to the "thresholds of toxicological concern" used by international groups. Dr. Guyton responded that ORD's *in vitro* and integration tools can predict that threshold and other information so that the end user can choose from a range of outputs. Another SAB member noted that ORD has not made progress moving beyond single chemical assessments. Dr. Guyton noted that ORD is working on identifying groups of chemicals, such as phthalates, but that more could be done and it would be helpful for the SAB and BOSC to provide advice on this point.

Dr. Douglas Wolf, the fifth ORD speaker, provided a presentation entitled "Research Program Integration: Investigating Implications of Non-Monotonic Dose Response Curves (NMDRCs)."[14] Although not part of the Chemical Safety for Sustainability Strategic Research Action Plan, this integration example responds to an immediate need by a program office. It showcases ORD's rapid response efforts to integrate science across programs to address non-monotonic responses to exposure from chemical stressors for use in risk assessments. The current focus is on endocrine disrupting chemicals. ORD has been able to assemble a group of scientists with the requisite expertise and to plan deliverables on a very tight schedule.

After he finished his remarks, he responded to questions. He acknowledged the value of addressing a paper from the Pew Foundation that addressed the NMDRC issue and the importance of using new data from Tox 21 to help address the NMDRCs issue. He noted that while the issue has been of interest for a long time, new science makes it an emerging concern.

He also acknowledged the importance of developing an approach that involves co-contaminants and multiple contaminants, because contaminants do not come in a pure form.

Encouraging and Measuring Successful Innovation

Dr. Peter Preuss, Chief Innovation Officer, ORD, provided an overview of ORD's recent innovation efforts.[15] He thanked ORD and BOSC members for their preliminary comments relating to innovations. He summarized several Pathfinder Innovation Projects, responses to Open Innovation platform initiatives, and work to create an innovative research culture in ORD. He noted the importance of having communities involved in the entire process since they will be the ones using the tools and products developed. He asked the SAB and BOSC for suggestions for strengthening these efforts and developing useable metrics for the innovation program.

After he concluded his remarks, several questions and comments followed. One member suggested that effective innovation requires a goal, such as how innovations will provide value for EPA in a better, cheaper, faster way, and the need to develop metrics up front. Dr. Preuss responded that ORD is considering targeting the Pathfinder Innovation Projects in some ways to provide needed benefits for ORD's six research programs and that value is a critical parameter. Another member suggested that it would be helpful for ORD to encourage innovation to stimulate research across disciplines and across programs. Dr. Preuss responded that there may be many examples involving sensor and apps for air pollutants relating to environmental justice, community health, personal monitoring, These projects would involve a variety of physical, chemical, biological and social science. He noted that there may be the potential to have topic areas identified by the National Program Directors, who may be able to identify intractable areas where a particular innovation may foster breakthroughs.

Instructions for Breakout Groups

Dr. Deborah Swackhamer provided guidance for the breakout groups. She asked each breakout group to address the charge questions posed by ORD and to be ready to report back on July 11, 2012.

After the Plenary session concluded, the six breakout groups (Air, Climate, and Energy; Safe and Sustainable Water Resources; Homeland Security; Sustainable and Healthy Communities; Chemical Safety for Sustainability' and Human Health Risk Assessment) met from 1:30 p.m. to 6:00 p.m. with the assistance of the DFOs noted on page 3. Attachment B lists the breakout group attendees.

Meeting Summary July 11, 2012:

The DFOs opened the second day of the meeting, which began with reports from the breakout groups.

Air, Climate, and Energy Breakout Group Report

Dr. David Allen, rapporteur for the Breakout Group on Air, Climate, and Energy (ACE), provided a summary of his group's discussion.[16] Dr. Paige Tolbert, facilitator for the group, supplemented his report by noting that the group enthusiastically supported the efforts of the ACE program, which includes all elements from the sustainability paradigm. She observed that the ACE program needs to define success, and will require systems approaches and analyses. The air quality and climate components are the most advanced, while the energy component has good goals but needs more focus and resources.

After the group's presentation was complete, SAB and BOSC members made comments and posed questions. One member supported the ACE discussion of a "One Environment" approach in the strategic research action plan. Dr. Allen noted that such an approach was a logical extension of previous efforts to envision research related to "One Atmosphere." Another member commended the ACE program for its monthly information call, which was broadcast to partners and open to all. Yet another member focused comments on insufficient resources devoted to energy and the environment; EPA's lack of resources will require it to "lean on partners" for key energy research. Several other members suggested that the strategic research action plans generally could be strengthened by identifying relationships with other federal environmental research programs more clearly and more clearly defining EPA's niche in federal environmental research. A member spoke of the importance of ORD's taking initiative to collaborate with other agencies in using the Federal Technology Transfer Act (FTTA), which provides a mechanism for cooperative research and development partnerships with outside entities, such as industry, consortia, academia, trade associations, and state and local agencies. Another member noted that ORD's Homeland Security Program has a track record for innovative research involving coordination with other federal agencies that might be a model for ORD generally.

Members then discussed advice on how to focus limited ORD resources on energy research. Dr. Allen suggested that ORD might best focus on activities where it can serve EPA as a whole and where the energy landscape is changing. He suggested that research related to hydraulic fracturing meets both criteria.

A member emphasized the importance of investing in social science research related to climate change and energy to understand resistance to emerging science. Several members suggested that the SAB and BOSC recommend that ORD conduct social science research planning, drawing on the appendix to the SAB-BOSC 2011 report, which includes the appendix "Expanding ORD Capabilities in Social, Behavioral, and Decision Sciences."

Chemical Safety for Sustainability Breakout Group Report

Dr. Edward Carney, rapporteur for the Breakout Group on Chemical Safety for Sustainability (CSS), provided a summary of his group's discussion.[17] Dr. Elaine Faustman, facilitator for the group, provided some additional comments. She noted that 78% of products described in the CSS strategic research action plan are tools and methods intended to be developed by CSS and implemented by users. She commended the program for the clear linkage of products to decisions. At this stage, however, she explained that the CSS group hesitates to provide comment

or advice about the planned products because they are in development. Another CSS workgroup member noted that CSS faces the challenge of integrating its program with EPA risk assessment policy. CSS will need to work with policy makers and end users to ensure the research products are helpful. This point could be emphasized more in the CSS strategic research action plan.

After the breakout group completed its presentation, other SAB and BOSC members posed questions and made comments. One member noted that the CSS program required a clearer statement about what sustainability means to the program. Another member emphasized the important role of EPA research in chemical safety for nano particles, especially related to fate and transport, and ecological effects. Yet another member praised the CSS program for its emphasis on exposure, because a strong exposure paradigm is needed for use of high throughput assays. Drs. Carney and Faustman spoke of the importance of transparency about results that are outside the normal range of variation of responses to chemicals. Although ORD emphasized adverse outcomes pathways, it did not provide many details or clarification about this aspect of the research. More clarification is needed regarding uncertainty and variability as they relate to adverse outcomes pathways.

Human Health Risk Assessment Breakout Group Report

Dr. John Vena, rapporteur for the Breakout Group on Human Health Risk Assessment (HHRA), provided a summary of his group's discussion.[18] Dr. Jonathan Samet, facilitator for the group, added his view that HHRA presented a mixed picture. ORD has clear and well-planned research programs to support the development of Integrated Risk Information System (IRIS) chemical assessments and Integrated Science Assessments (ISAs) for criteria pollutants, but the component of the program related to evolving methodologies is much less clear. The major challenge involves producing the required IRIS assessments and ISAs and meeting the challenge of incorporating new research results that will be generated by the CSS program and addressing methodological issues such as cumulative risk. He noted that the breakout group will make suggestions about prioritizing research.

After the presentation was complete, other SAB and BOSC members posed questions and made comments. One member expressed frustration that ORD was not pursuing more integration between human health and ecological health approaches. She noted that the HHRA program could learn good practices regarding integration and some key findings from the Safe and Healthy Communities program, which has made it a priority to integrate these two areas. Dr. Vena acknowledged that the HHRA community health theme included undefined and underdeveloped tasks to integrate across human and ecological health. The SAB member responded that the SAB might initiate a project to assist EPA in integrating human health and ecological health methods. A BOSC member spoke of the many opportunities for integrating human health and ecological assessments, especially as they related to exposure pathways. Other members agreed that the HHRA program has unique opportunities to integrate human and ecological assessments; sustainability requires integration of these two approaches.

An SAB member asked about the role of EPA's Risk Assessment Forum in integrating risk assessment research into the work of the agency. Dr. Vena responded that the role of the Forum was not made clear during the CSS presentations. Another group member mentioned that the

Forum deals with guidelines rather than research, and that another mechanism might be needed. An SAB member recommended that as more CSS tools and models are developed, it will be necessary to highlight uncertainty and data gaps and how they relate to risk assessment policies and use of CSS information in the assessments to be developed by the HHRA program. Drs. Vena and Samet responded that the HHRA breakout group supported the inclusion of new information right away in assessments to supplement existing, more traditional data. In response to a question regarding uncertainties that may be associated with the use of new data and delays in peer review related to these data, Dr. Samet emphasized that "good reports make for good, efficient peer review." Delays in peer review do not necessarily result from the uncertainties in an assessment; each new kind of information included in any assessments comes with gains and its own kinds of uncertainty. The HHRA needs to aim for clear exposition of the data considered and the agency's conclusions from these data. Dr. Vena noted that the SAB's Exposure and Human Health Committee was conducting a self-initiated activity related to the use of computational data for risk assessment. The report resulting from that SAB activity will look at this issue in more detail.

Safe and Sustainable Water Resources, Homeland Security Research Breakout Group Report

Dr. David Dzombak, rapporteur for the Breakout Group on Safe and Sustainable Water (SSWR), provided a summary of his group's discussion.[19] Dr. Kimberly Jones, facilitator for the group, provided some additional comments. She noted the importance of ORD's clarifying its research role *vis-à-vis* research in other federal agencies. Clarity on this point will help ORD prioritize its SSWR activities. Nimble leadership requires knowing the playing field. She also emphasized the importance of communicating about SSWR research to all communities, not just "stakeholders that speak the loudest," so that environmental justice concerns can be identified and addressed.

After the presentation was complete, other SAB and BOSC members made several comments. One member suggested that it might be helpful for ORD to "bring in an ethicist" to help with prioritization of research. Another member suggested that innovation for SSWR should reach beyond "widgets" to consider innovation in organizations, especially mixed social and technological innovation. Yet another member called for more tracking of impacts between stormwater and health. A member commended the Nitrogen innovation example for its roadmap showing how research activities are and could be integrated; development of roadmaps for other projects will facilitate and demonstrate integration.

Homeland Security Breakout Group Report

Dr. Jeffrey Griffiths, rapporteur for the Homeland Security Group, provided a summary of his group's discussion.[20] Dr. Keith Moo-Young, facilitator for the group, provided his additional comments. He noted that, while the breakout group supported an "all hazards approach," it encouraged ORD to proceed cautiously because of limited resources. The group advises a cautious first step that focuses on when and how science products generated by this program can be utilized more broadly.

After the presentation was complete, other SAB and BOSC members posed questions and made comments. One member cautioned the SAB against characterizing ORD's Homeland Security program as fully embracing sustainability or integrating across social, environmental, and economic concerns. Dr. Griffiths acknowledged that the program had focused on the "technological aspects of puzzle" and that other components are less developed, but that the Homeland Security program was sensitive to communication strategies that may be needed to complement the technical products developed. An SAB member noted that the Homeland Security program web page included information on metrics for community well-being. She suggested that there were additional opportunities for integration across ORD programs involving the Homeland Security program. Climate change might be characterized as "a slow emergency," and the Sustainable and Healthy Communities program might be renamed the Sustainable, Healthy and Secure Communities program with consideration of climate change as part of the portfolio. A member stated that since climate change will cause more natural disasters, the HSRP needs to work with the Federal Emergency Management Agency. Dr. Moo-young responded that the Homeland Security program works on a one-to-three year time scale, but that ORD is beginning to consider whether Homeland Security products intended for the near term have broader applicability than the intended purpose. One of the integration challenges is "integrating within ORD." The breakout group considers that intra-ORD integration will provide immediate opportunities for "cross-pollination." Dr. Griffiths noted that the Homeland Security program was established to respond the Homeland Security law of 1992 and specific provisions related to homeland security in water and air statutes. He and other members agreed that the program could benefit from thinking more broadly about emergencies, such as climate change, natural disasters, and chemical incidents.

Safe and Healthy Communities Breakout Group Report

Dr. Amanda Rodewald, rapporteur for the Safe and Healthy Communities (SHC) Breakout Group, provided a summary of her group's discussion.[21] Dr. Stephen Polasky, facilitator for the group followed with one major comment. He noted that the SHC program was tremendously ambitious and that ORD would "have to grow" to implement the program, but at the same time science questions need to be prioritized because of limited budgets. A group member added that it will be important for the program to define the appropriate scale of communities to be considered. This is important for the program overall and for products such as the National Atlas for Sustainability.

After the group's presentation was complete, other SAB and BOSC members posed questions and made comments. A member observed that three important science questions were missing. In theme 1, ORD should include "how do you structure community engagement so it can be inclusive and broadly representative." In theme 2, ORD should include a question to help communities with self assessment. In theme 3, ORD should consider how to provide communities most at risk with tools and data for self assessment for sustainability and ORD should address the validity EPA will give to community-based assessments. Dr. Polasky noted that the breakout group agreed that EPA could learn from others' experience on the first two points.

Additional comments followed. One member recommended that ORD consider the discussions of human and ecological interactions discussed in the following publication: Di Giulio, R.T. and W.H. Benson (eds.), 2002. *Interconnections Between Human Health and Ecological Integrity*. SETAC Press, Pensacola, FL. Another member suggested that the SHC program might provide communities with a structure for data collection and analysis that would be accepted by EPA scientists. He also recommended that the SHC strategic research action plan should also have a "translational plan" that could be understood by the lay public. A member noted that a typology of decisions on how communities make decisions would be useful.

Overarching Conclusions

The SAB Chair summarized the breakout group's reports and invited comment from SAB and BOSC members. She noted that there was general agreement that ORD has made remarkable progress down the "Path Forward," despite changes in leadership. There was general consensus that ORD has been highly responsive to previous advice from the SAB and to the 2011 SAB and BOSC report. The ACE, CSS SSWR and Homeland Security program are making good to very good progress. The HHRA and SHC programs are also making progress but have more to do in refining their vision and implementation strategy. All of the programs would benefit from defining sustainability more clearly for their programs. Although the definition of sustainability from the National Environmental Policy Act will work as a common definition, most breakout groups recommended that ORD explain more specifically what sustainability means to each program.

ORD's research in social, behavioral and decision sciences is weak. Sustainability cannot be the focus of ORD research if ORD research only involves "one leg of the sustainability stool." There needs to be continued focus in this area. She reminded ORD about the Appendix to the 2011 SAB-BOSC report as a starting point for future planning.

In addition to these general points, she noted a need to improve the strategic research action plans in several ways:

- Need to increase research emphasis on ecological risk;
- Need to include research on nonchemical stressors;
- Need for better communication of products and outputs and of findings and knowledge gained from research across ORD programs, across EPA and with other stakeholders;
- Need for roadmaps, similar to the Nitrogen integration example roadmap, for key projects; and
- Need to identify co-benefits for research activities to help establish priorities.

She concluded by congratulating Dr. Kavlock, the National Program Directors, and Directors of ORD Laboratories and Centers for their continued commitment to integrated transdisciplinary research and sustainability. She encouraged them to continue these efforts with the concept of "One Environment" as their touchstone.

Dr. Swackhamer invited Dr. Kavlock to provide comments. He thanked the SAB and the BOSC for their insights and the SAB and BOSC staff for their efforts in planning the meeting. He agreed that co-benefits could be better used for prioritizing science questions and that strategic

research action plans should be revised in two or three years to better characterize the science questions; better indicate the linkages between vision and projects and projects and clients and better define ORD's unique role. Better definition of the ORD role will help the office leverage its research with other parters' efforts. He committed to review the Appendix on social, behavioral, and decision sciences that was attached to the 2011 SAB-BOSC report and to take recommendations in this area seriously, because SAB and BOSC advice has been so consistent. Dr. Kavlock noted the need to work out metrics for sustainability and success overall and for innovation. He concurred with recommendations that "continuing learning for scientific staff" and continuing culture change are priorities. Translation and communication of ORD research to users will also be important. He will evaluate ORD's experience with the five integration examples and determine what could be applied to other research activities. He committed to reinvigorate the BOSC review process for each of ORD's six research program. Finally, he also encouraged the SAB and BOSC to find ways to "go paperless" for future meetings.

General discussion of integration and innovation

Members discussed a recommendation to encourage EPA to develop a social science plan to support sustainability at the Agency. They encouraged ORD to plan a workshop on this topic and work with SAB and BOSC members to identify possible attendees. This workshop should complement needs in ORD's strategic research action plans and take into account past ORD and BOSC advice. Another approach might be to examine ORD's five integrated projects and identify the needs for social, behavioral and decision sciences. One member cited the BOSC 2009 Decision Analysis Workshop as a possible model. Another model cited was a workshop on current concepts in toxicology that focused on decision-analytical tools related to both human health and ecological endpoints. ORD's Dr. Annie Jarabek was the lead for this effort. An SAB member cautioned that any recommendation for a workshop would require additional resources and any future SAB-BOSC report should take note of this need. Another member cautioned against forming "horizontal stovepipes" where a community of social, behavioral and decision scientists would become isolated from other ORD science.

The next topic for discussion was roadmaps for major ORD projects. Roadmaps may not be needed for all ORD projects, but would be useful for major projects. They would facilitate integration within ORD and EPA and with partners outside EPA. Another member noted that scientists trained in interdisciplinary programs could be especially useful in ORD's integration efforts.

SAB and BOSC members then discussed recommendations related to ORD's innovation program. Members supported an increased focus of innovation in areas where there was a clear program need, for example generation of toxicology data for chemicals lacking health assessment data or other key questions in ORD's research programs. Members supported increased innovation related to science topics other than "widgets." Members identified several models that ORD could example: public health implementation science, experience with the Gates Foundation; journals on implementation science; the World Bank; a recent history of Bell laboratories. In regard to metrics, members warned against evaluating innovation in terms of the quality of the research, in terms of a business model, or in terms of applying metrics to individual innovation projects rather than collectively. They also noted that ORD needs to have

realistic expectations regarding innovation success and implementation. Members briefly discussed several ideas related to encouraging an ORD culture of innovation. Since ORD has identified repeat high performers for Pathfinder Innovation Projects, it might be advantageous to co-locate them and engage them on especially hard problems, have them serve as liaisons to the NPDs, or have them serve as points of contact with other federal agencies. ORD might also convene workshops, discussions, roundtables and chat rooms to stimulate discussion and thinking about innovation. Members also recommended that ORD incorporate considerations related to innovation in its human resource plans to recruit new scientists.

Action Items/Next Steps

Dr. Deborah Swackhamer thanked the presenters, rapporteurs, facilitators, and breakout group members. She asked rapporteurs and facilitators to provide draft text for their breakout groups to the DFOs by July 27, 2012. She and Dr. von Stackelberg noted that the SAB and BOSC DFOs will work with them to draft a report based on the presentations. This draft will be the focus of SAB and BOSC discussion during a public teleconference in September.

The SAB and BOSC Chairs thanked participants for the successful meeting and expressed appreciation for ORD and EPA staff involvement.

The DFOs adjourned the meeting at 2:30 p.m.

Respectfully Submitted:

/Signed/

Dr. Angela Nugent
SAB DFO

/Signed/

Mr. Greg Susanke
BOSC DFO

Certified as True:

/Signed/

Dr. Deborah Swackhamer
SAB Chair

/Signed/

Dr. Katherine von Stackelberg
BOSC 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.

Attachment A: Members of the public attending the public meeting:

Andrew Almeter, EPA
Tina Bahadori, EPA
William Benson, EPA
Gail Bentkover, EPA
Will Boyes, EPA
Eletha Brady-Roberts, EPA
Tara Breauer, EPA
Lyle Burgoon, EPA
Kirkley Cain, EPA
Michele Conlon, EPA
Dan Costa, EPA
Kevin Crofton, EPA
Rebecca Daniels, EPA
Sally Darney, EPA
Robin Dennis, EPA
David Dix, EPA
Bob Dyer, EPA
Susan Euling, EPA
Becca Feeks, EPA
Lynn Flowers, EPA
Gary Foley, EPA
Jeffrey Frithsen, EPA
Heather Galada, EPA
Jonathan Garber, EPA
Andy Gillespie, EPA
Iris Goodman, EPA
Tara Greaver, EPA
Rick Greene, EPA
Sally Gutierrez, EPA
Alan Hecht, EPA
Jon Herrmann, EPA
Ross Highsmith,
Mark Higuchi, EPA
Virgina Houk, EPA
Elaine Hubal, EPA
Marcus Jackson, EPA
Scott Jenkins, EPA
David G. Jewett, EPA
Jim Johnson, EPA
Marjorie Jones, EPA
Steve Jordon, EPA
Peter Jutro, EPA
Lek Kadeli, EPA
Stacey Katz, EPA

Bob Kavlock, EPA
Tad Kleindienst, EPA
Thomas Knudson, EPA
David Kryak, EPA
Monica Linnenbrink, EPA
Elizabeth Lonoff, EPA
Michael Loughran, EPA
Rick Linthurst, EPA
Bob MacPhail, EPA
Mike McDonald
Charlene McQueen, EPA
Ann Miller, EPA
Mark Miller, EPA
Regan Murray, EPA
Chuck Noss, EPA
Kris Novak, EPA
Carlos Nunez, EPA
Angela Page, EPA
Tom Pierce, EPA
Damian Ramirez, EPA
Anne Rea, EPA
Mary Reiley, EPA
Carl Richards, ORD
Matt Richards, EPA
Gail Robarge, EPA
Eletha Roberts, EPA
John Rogers, EPA
Jeffery Ross, EPA
Mary Ross, EPA
Bill Russo, EPA
Shawn Ryon, EPA
Jason Sacks, EPA
Chris Saint, EPA
Ann Sergeant, EPA
Kathryn Saterson, EPA
Gregory Saylor, EPA
Phil Sayre, EPA
Laurel Schultz
Anne Sergeant, EPA
Seema Shappelle, EPA
Jane Simmons, EPA
Mya Sjogren, EPA
Michael Slimak, EPA
Betsy Smith, EPA
Holly Stallworth, EPA
John Stoddard, EPA

Nicholle Tulve, EPA
John Vandenberg, EPA
Suzanne van Drunick, EPA
Alan Vette, EPA
Andy Waite, EPA
Barb Walton, EPA
John Wambaugh, EPA
Tim Watkins, EPA
Joe Williams, EPA
Doug Wolf, EPA

Attachment B: Breakout Group Attendees

Air Climate and Energy Breakout Group

SAB and BOSC Breakout Group Members

David T.Allen, rapporteur
Ingrid Burke
Lisa Dilling
Madhu Khanna
Jerald Schnoor
Peter Thorne
Paige Tolbert, facilitator
Robert Watts

Designated Federal Officer: Holly Stallworth

Other attendees:

Phil Bushnell
Dan Carter
Robin Dennis
Robert Devlin
Mark Higuchi
Bob Judge
Tad Kleindienst
David Kryak
Carl Mazza
Andy Miller
Kris Novak
Mary Ross
Alan Vette
Randy Waite
Michael Werno

Chemical Safety for Sustainability Breakout Group

SAB and BOSC Breakout Group Members

George Alexeeff
Ed Carney- Rapporteur
Elaine Faustman- Facilitator
Eileen Murphy
Daniel Schlenk
Katherine von Stackelberg
Russell Thomas

Designated Federal Officer: Suhair Shallal

Other attendees:

Tina Bahadol
Tina Bahrtori
Gail Bentkover
Lyle Borgoon
Will Boyes
Ed Carney
Elaine Cohenthbal
Michele Conlon
David Dix
Peter P. Egeghy
Becca Feeks
Ross Highsmith
Marcus Jackson
Monica Linnenbrink
Michael Louhran
Mark Miller
Carl Richards
Gail Robarge
Phil Sayre
Linda Sheldon
Alan Vette
John Wambaugh
Joe Williams
Doug Wolf

Human Health Risk Assessment Breakout Group

SAB and BOSC Breakout Group Members

Michael Dourson
Henry Falk
Jonathan M.Samet, facilitator
Pamela Shubat
Gina Solomon
Daniel Stram
Rosemary Szostake
John Vena, rapporteur

Designated Federal Officer: Greg Susanke

Other attendees:

James Avery
Elizabeth Corona
Lynn Flowers
Kate Guyton
Thomas Knudsen
Elizabeth Lonoff
Ken Olden
Gail Robarge
John Vandenberg

Safe and Sustainable Water Resources

SAB and BOSC Breakout Group Members

Susan Cozzens
Otto C. Doering
David A. Dzombak, rapporteur
Kimberly L. Jones, facilitator
James Opaluch
James Sanders
Marie Zhuikov

Designated Federal Officer: Edward Hanlon

Other attendees:

Artie Chatalu, EPA
Ann Compton, EPA
Chris Faulkner, EPA
Gary Foley, EPA
Joseph Fiksel, EPA
Jeff Frithsen, EPA
Heather Galada, EPA
Alice Gilliland, EPA
Susan Glassmeyer, EPA
Tim Gleason, EPA
Rick Greene, EPA
Ann Grimm, EPA
Sally Gutierrez. EPA
Matt Heberling, EPA
Marjorie Jones, EPA
Steve Jordan, EPA
Stacey Katz, EPA
Mike McDonald, EPA
Walt Nelson, EPA
Chuck Ness, EPA
Angela Page, EPA
Anne Rea, EPA
Mary Reiley, EPA
Matt Richards, EPA
Nicole Shao, EPA
Jane Ellen Simmons, EPA
Suzanne Van Drunick, EPA
Hal Walker, EPA
Vickie Wilson, EPA
Phil Zahreddine. EPA

Homeland Security Breakout Group

SAB and BOSC Breakout Group Members

Costel Denson
Jeffrey K. Griffiths, rapporteur
Charles Haas,
Bernd Kahn,
Nancy K.Kim,
Cecil Lue-Hing,
H. Keith Moo-Young, facilitator

Designated Federal Officer: Thomas Brennan

Other attendees:

Hiba Ernst
Charles Haas,
John Hall
Jon Herrmann
Peter Juthro
Regan Murray
Shawn Ryan
Greg Sayles

Sustainable and Healthy Communities

SAB and BOSC Breakout Group Members

Joseph Arvai
Barbara L. Harper
Judith L. Meyer
Earthea Nance
Duncan Patten
Stephen Polasky, facilitator
Amanda Rodewald, rapporteur
Deborah L.Swackhamer

Designated Federal Officer: Angela Nugent

Other attendees:

Andrew Almeter
John Darling
Gary Foley
Andy Gillegen
Tara Greaver
Alan Hecht
Jim Johnson
Rick Linthurst
Carlos Nunez
Tom Pierce
Damian Ramirez
Bill Russo
Kathyn Saterson
Seema Schappelle
Nicolle Tulve
Barb Walton
Jing Zhang

Materials Cited

The following meeting materials are available on the SAB Web site, http://www.epa.gov/sab, at the page for the July 10-11, 2012 meeting: http://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/42912e0e0b1e749785257995005a9e0a!OpenDocument&Date=2012-07-10

[1] Agenda
[2] Roster of SAB members
[3] Roster of BOSC Members
[4] Federal Register Notice Announcing the Meeting, published June 18, 2012 (77 FR 36273-36274)
[5] Comment from Comments from Valerie Nelson, Water Alliance
[6] Charge for Implementation of ORD's New Strategic Directions
[7] Background information included:

ORD Strategic Research Action Plans: Air, Climate, and Energy; Strategic Research Action Plan 2012-2016, EPA 601/R-12/003; Chemical Safety for Sustainability; Strategic Research Action Plan 2012-2016, EPA 601/R-12/006; Homeland Security; Strategic Research Action Plan 2012-2016, Security, EPA 601/R-12/008; Human Health Risk Assessment; Strategic Research Action Plan 2012-2016, EPA 601/R-12/007; Safe and Sustainable Water Resources; Strategic Research Action Plan 2012-2016, EPA 601/R-12/004; Science for a Sustainable Future; EPA Research Program Overview 2012 – 2016, EPA 601/R-12/002; Sustainable and Healthy Communities; Strategic Research Action Plan 2012-2016, EPA 601/R-12/005

Overviews from ORD National Program Directors for each Breakout Group: Dan Costa Overview for the Air, Climate and Energy Program; Jonathan Herrmann Overview for the Homeland Security Research Program; Kenneth Olden Overview for the Human Health Risk Assessment (HHRA) Research Program; Michael Slimak Overview for the Sustainable and Healthy Communities Research Program; Suzanne van Drunick Overview for Safe and Sustainable Water; Tina Bahadori Overview, Implementing EPA's Chemical Safety for Sustainability Research Program

ORD Research Integration Factsheets: Applying New Chemical Assessment Approaches in Human Health Risk Assessment; Children's Health and Environmental Justice; Climate Change Research; Nitrogen; EPA's Nonmonotonic Dose Response Curve (NMDRC) Workplan

June 20, 2012 note from Peter Preuss, "ORD Innovation Moving Forward"

Biosketches: For Members of the SAB and SAB Liaisons; BOSC; and EPA Presenters

Preliminary Member Comments: Preliminary Comments as of 9:56 a.m. on July 6, 2012 (corrected); Additional Member Preliminary Comments as of July 9, 2012; Second Set of Additional Preliminary Comments

Tentative Breakout Group Assignments as of 07/02/12

[8] Robert Kavlock Presentation, July 2012 SAB/BOSC Meeting

[9] *Office of Research and Development (ORD) New Strategic Research Directions: A Joint Report of the Science Advisory Board (SAB) and ORD Board of Scientific Councilors (BOSC).* EPA-SAB-12-001 and the Administrator's Response
[10] C. Andrew Miller Presentation, Integration of Climate Research Across ORD
[11] Anne Rea Presentation, Cross-EPA Nitrogen Research & Policy Integration
[12] Sally Darney Presentation, Integrating Children's Health and Environmental Justice Research Across ORD:
Reducing risk while promoting equity and well-being
[13] Kate Guyton Presentation, Applying New Chemical Assessment Approaches in Human Health Risk Assessment .
[14] Douglas Wolf Presentation, Research Program Integration: Investigating Implications of Non-Monotonic Dose Response Curves (NMDRCs) .
[15] Peter Preuss Presentation, ORD Innovation
[16] Report from the Air, Climate and Energy Break-out Group
[17] Report from the Chemical Safety for Sustainability Breakout Group
[18] Report from the Human Health Risk Assessment Breakout Group.
[19] Report from the Safe and Sustainable Water Resources Breakout Group.
[20] Report from the Homeland Security Breakout Group.
[21] Report from the Sustainable and Healthy Communities Breakout Group