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) June 29-30, 2011

Date and Time: June 29, 2011, 8:30 a.m. to 5:00 p.m.; June 30, 2011, 9:00 a.m. - 4:00 p.m. Eastern Time

Location: Embassy Suites Hotel, 201 Harrison Oaks Blvd, Cary, North Carolina

Purpose: To hold discussions with EPA regarding the Office of Research and Development's (ORD's) new strategic directions for research.

SAB and BOSC Members:

SAB Members

Dr. Deborah Swackhamer, Chair
Dr. Timothy Buckley
Dr. Patricia Buffler
Dr. Ingrid Burke
Dr. Thomas Burke
Dr. Terry Daniel
Dr. Costel Denson
Dr. David Dzombak
Dr. Taylor Eighmy
Dr. Madhu Khanna
Dr. Nancy Kim
Dr. Kai Lee
Dr. Cecil Lue-Hing
Dr. L.D. McMullen
Dr. Judith Meyer
Dr. H. Keith Moo-Young
Dr. Eileen Murphy
Dr. Duncan Patten
Dr. Stephen Polasky
Dr. Arden Pope
Dr. Stephen Roberts
Dr. Amanda Rodewald
Dr. James Sanders
Dr. Jerald Schnoor
Dr. Kathleen Segerson
Dr. Barton (Buzz) Thompson
Dr. John Vena
Dr. Roberts Watts
Dr. Thomas Zoeller
Dr. Thomas Wallsten (by phone)

Members of the BOSC

Dr. Martin Philbert, Chair
Dr. Kenneth Olden, Vice Chair
Dr. Susan Cozzens
Dr. Kenneth Demerjian
Dr. Lisa Dilling
Dr. Henry Falk
Dr. Charles Haas (by phone)
Dr. Earthea Nance
Dr. Diane Pataki
Dr. Dennis Paustenbach
Dr. Barry Ryan
Dr. Rosemarie Szostak
Dr. John Therakan
Dr. Thomas Russell
Dr. Katherine von Stackleberg
Ms. Marie Zuikov

Liaisons to the SAB:
Dr. James Johnson

SAB Panel Member:
Dr. Howard Melnick

EPA presenters:

Dr. Paul Anastas, Assistant Administrator, Office of Research and Development (ORD)
Dr. Kevin Teichman, Deputy Assistant Administrator for Science, ORD
Dr. Peter Preuss, Chief Innovation Officer, ORD

DFOs:

Dr. Angela Nugent, SAB Staff Office, Designated Federal Officer for the Chartered SAB
Mr. Greg Susanke, ORD, Designated Federal Officer for the BOSC
Dr. Thomas Armitage, SAB Staff Office, Designated Federal Officer for the Sustainable and Health Communities Breakout Group
Mr. Thomas Carpenter, 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 and Human Health Risk Assessment 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 June 29 2011:

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 first 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 the Office of Research and Development 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.

Goals and agenda for the meeting

Dr. Deborah Swackhamer, the SAB Chair, welcomed the group. She noted the importance of the joint SAB/BOSC meeting at a formative time in the development of ORD's research programs. She asked SAB and BOSC to seize the unique opportunity to provide strategic advice to ORD as

it develops six new integrated research programs. She briefly reviewed the agenda and introduced the ORD speakers for the plenary session.

ORD's Strategic Research Directions –Opening Remarks

Dr. Paul Anastas, ORD Assistant Administrator, spoke briefly and provided a slide presentation.[6] He expressed appreciation for the extraordinary meeting of the SAB and BOSC at an "extraordinary time at EPA." He described how the EPA Administrator had turned to ORD for the science needed to understand such priority issues as hydraulic fracturing and mountaintop mining. He described the EPA Administrator's emphasis on sustainability as a new focus for EPA and her vision in commissioning a new National Research Council study on "Making Sustainability Operational in EPA," due in July. He reminded SAB and BOSC members of the Administrator's analogy comparing the difference between risk assessment and sustainability approaches to the difference between treating a disease and pursing wellness. Solving twenty-first century environmental problems requires a deep understanding of those problems and an ability to translate problem identification and understanding into information that can empower solutions. He noted that EPA must redefine reductionist science and traditional risk management paradigms in ways that can help understand and address community risk, aggregate risk, and population risk. ORD is looking for advice on advancing these strategic directions, including how to meet the challenge for ORD's workforce, how research planning processes should change and how ORD should evaluate its research programs.

Update on planning and implementation

Dr. Kevin Teichman, Deputy Assistant Administrator for Science, ORD, provided a presentation entitled "Science for EPA's Future: Innovative Thinking, Creative Solutions."[7] He observed that strategic change in ORD calls for a balance of vision and implementation. He briefly described ORD's role; ORD's current resources; recent exemplary ORD accomplishments; the twenty-first century environmental challenges facing EPA that require ORD attention; ORD's efforts to adopt an integrated transdisciplinary research; recent efforts to restructure ORD research plans to align with EPA's strategic goals into four major research areas and two cross-cutting research programs, and an overarching schematic describing a systems approach to sustainability (Figure 1 below). He described the charge questions for the National Research Council "Green Book" focusing on implementing sustainability at EPA; major challenges facing ORD research; integration of the behavioral and social sciences in EPA's work; and ORD innovation efforts. He concluded his remarks by listing ORD's charge questions for the SAB and the BOSC and reminding his audience of the ten major accomplishments identified by the Aspen Institute for EPA's fortieth anniversary. He asked SAB and BOSC members to help ORD identify the science that will be needed to support sustainability and the environmental protection achievements that might be celebrated at EPA's fiftieth anniversary.

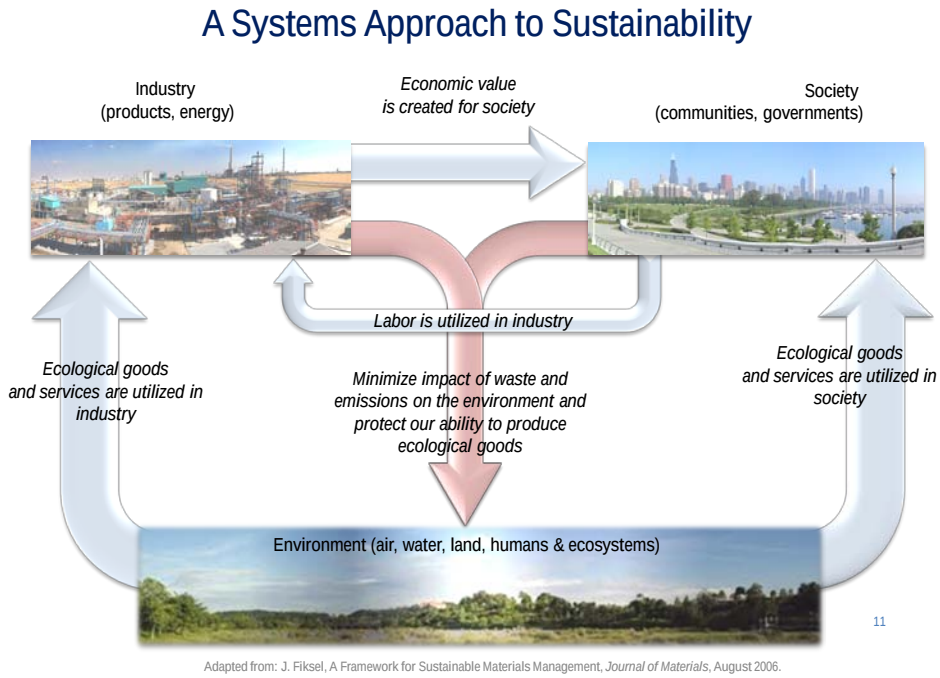

Figure 1

ORD Innovation

Dr. Peter Preuss, Chief Innovation Officer, ORD, provided an overview of ORD's recent innovation efforts.[8] He asked for SAB and BOSC recommendations to improves ORD's innovation strategy, which has four major elements: 1) supporting innovation at the bench; 2) transdisciplinary research; 3) use of open innovation to broaden network of environmental problem solvers; and 4) showcasing research that exemplifies the principles in Paul Anastas' "path forward" vision. He provided examples of ORD's recent "Pathfinder Projects;" examples of ORD's use of an open source platform to seek a method for measuring acrolein; and a template for identifying signature projects using the following criteria: sustainability, innovation, transdisciplinary research, significance of problem addressed, systems thinking research alignment, EPA mission/client, quick start, market drivers, and existence of a champion. He noted that ORD is seeking signature projects in each of ORD's four major research areas and has plans to continue and expand the "Pathfinder Project" awards in FY 2012.

Follow-up Questions for ORD Presenters during the Plenary Session

The SAB Chair moderated a question and answer session after the ORD speakers concluded their presentations. One advisor asked how ORD will ensure it has the workforce (number of employees and correct disciplines) with the appropriate training and support to engage in integrated transdisciplinary research. He asked about ORD's strategy for workforce development and incentives. Dr. Anastas responded that the ORD Executive Council had met on June 28, 2011 to discuss how to support, "incentivize" and "grow staff." ORD is considering a variety of mechanisms, including direct hiring and other tools to develop an agile workforce capable of dealing with evolving science and evolving environmental challenges

Another committee member noted the risks of ORD's approach at a time when the federal budget is likely to be shrinking and pressures on EPA are strong. He described the experience of a San Francisco utility, City Gas & Electric, which had experienced a "disastrous" gas pipeline explosion. As a result, the utility faced public pressure to move away from sustainability programs and policies and back to engineering "nuts and bolts." He asked how ORD is planning to deal with similar tensions at a risky time. Dr. Anastas responded that ORD's transformation process must build a resilient organization, able to deal with change.

An advisor asked whether ORD planned to involve industry in its plans to collaborate with outside organizations. Many firms are investing in sustainable technologies. Drs. Preuss and Anastas agreed that EPA must understand where the "big breakthroughs are happening." In addition, if environmental technologies are not practical or economically viable, they are not sustainable.

Another advisor asked how sustainability relates to EPA's authority and whether EPA will need sustainability metrics different from risk metrics. Dr. Anastas responded that sustainability will require EPA to think in a new way, rather than just adopt new metrics. EPA must consider how it can achieve desired environmental goals we want along *as well as* consider how to avoid undesirable consequences. The key challenge is how to "frame the questions right." The challenge is not about displacing risk. Considerations of risk will need to be complemented with considerations of sustainability.

Advisors asked how ORD intended to organize its structure to support its six new research programs. They asked how the decision-making structure, budget, and personnel will be organized and how laboratories and centers will work together. Dr. Teichman responded that ORD is trying to create a "balanced matrix" that will provide a true balance between Laboratory and Center Directors and National Program Directors (NPDs). NPDs work with Laboratory and Center Directors and regional and program staff. They identify needs and then look to see how laboratories and centers can meet those needs. Where there's a mismatch, ORD will address the issue. Where ORD does not have the needed expertise, it will explore whether the National Center for Environmental Research can supplement ORD's intramural resources with research conducted through grants. The NPDs hold a weekly meeting to address these issues.

An advisor commended ORD for fostering greater communication and collaboration across its research programs. He expressed concern, however, for research activities that may have been eliminated by ORD's new structure (e.g., ecosystem services). He asked whether some programs were being reduced below "the capacity they should have." Dr. Anastas responded that the new program should allow all needed research programs to exist. Dr. Teichman asked the SAB and BOSC to inform them if significant research is missing and to identify, as well, activities that may not be needed and should be dropped. He noted that the Sustainable and Healthy Communities program was meant to include the ecosystem services research program. Research on hydraulic fracturing is an example of collaboration between the Air, Climate and Energy Program and the Safe and Sustainable Water Resources Program.

A member asked about the role of the precautionary principle in ORD's restructured programs. She expressed the view that precaution is "fundamental to sustainability." Dr. Anastas responded that the systems approach requires researchers to look at the "inherent nature" of environmental problems and ask "what is it intrinsically that cause adverse consequences?" Researchers must try to understand systems to provide scientific information that may help prevent those adverse consequences.

Dr. Martin Philbert concluded the discussion with a few thoughts. He acknowledged the importance of the overarching themes discussed, and asked SAB and BOSC members to think in terms of the big picture but to remember that EPA must still have the basic science needed to make mundane decisions. He asked members to discuss how ORD should strike a balance between pragmatism and "disruptive innovation", and between continual incremental improvement and catalysis. He asked them to identify the areas where innovation makes the most sense, where it can suggest "elegantly simple solutions" or evidence based management issues. He spoke of the need for a flexible framework that provides opportunity for innovation and permits EPA to meet its obligations.

Instructions to the Breakout Groups

Dr. Deborah Swackhamer provided some guidance for the breakout groups meeting to discuss ORD's six research programs. She noted that the agenda was designed to provide maximum time for SAB and BOSC deliberations in small groups and that members assigned to breakout groups had been expected to review ORD's briefing and background material prior to the meeting. Following an SAB and BOSC request in March, ORD provided on June 14, 2011 online briefing presentations with audio enhancement . These presentations outlined the six newly realigned research areas in lieu of presentations at the meeting.[9] ORD also provided research frameworks[10] and some other background material[11] for breakout group members to review before the meeting.

She noted that there were four breakout groups, and that two groups contained both a major ORD research program and a related cross-cutting ORD research program (i.e., Human Health Risk Assessment, and Homeland Security). She noted that the breakout groups each included SAB and BOSC members and each had a designated facilitator and rapporteur, as well as a DFO to support the group.[12] She noted that ORD, Program and Regional staff would be participating in the breakout groups as resources for the discussions, should SAB and BOSC members have questions about ORD research programs or Program and Regional science needs.

She asked each breakout group to address the charge questions posed by ORD for each research program assigned for group discussion. She identified the charge questions:

a. To what extent do the draft research frameworks describe EPA's National Program and Regional Offices strategic science priorities? How well do ORD's research programs align with those priorities? If resources allow, what are areas for increased emphasis? If resources decline, what areas might be appropriate for decreased emphasis?
b. How can ORD enhance coordination among its research programs, and better ensure that they complement one another?

c. How well do ORD's proposed research directions reflect its commitment to sustainably protecting human health and the environment?
d. How do the six programs fit together as an integrated environmental research strategy, charged with informing decisions on the nation's most-critical environmental issues? Are these programs positioned to address the nation's highest priority, emerging environmental issues in the coming years?
e. Based on Board members' familiarity with efforts in the broader scientific community, how well do ORD's research programs appear to catalyze and complement environmental science programs elsewhere? What suggestions do the members have for how EPA's research programs could improve upon their leveraging with those of others?
f. How does the SAB/BOSC view ORD's activities in stimulating innovative research and what other suggestions would the SAB/BOSC have to promote innovation in EPA research?

She informed the group that the agenda also allowed for time on June 30, 2011, to discuss cross cutting issues including emerging environmental issues and social, behavioral and decision sciences. She noted that Drs. Kenneth Olsen and Jerald Schnoor will provide brief remarks on June 30, 2011, and that Dr. Terry Daniel had asked for an opportunity to speak briefly about ORD research and the social, behavioral, and decision sciences before the breakout discussions began. Dr. Daniel described his pre-meeting work with a SAB-BOSC group (Drs. Dilling, Doering, Hammitt, Khanna, Lee, Nance, Polasky, Segerson, Thompson, Von Stackleberg and Wallsten, and Ms. Zhuikov) to highlight SAB and BOSC past efforts to advance ORD research in the social, behavioral, and decision sciences.[13] He noted that they had developed four additional questions to augment ORD's formal charge questions for discussion in the breakout groups and for plenary discussion on June 30, 2011:

1. What specific roles should social, behavioral and decision sciences fill in meeting science/decision support responsibilities relevant to the realigned ORD research programs (i.e., what might SBD scientists do)?
2. What specific sub-disciplines/fields of SBD sciences might best meet identified research and decision support needs?
3. Where might individuals having the relevant types of training, experience and expertise be found (e.g., what types of academic programs, research organizations, etc)?
4. How might SBD sciences best be organized and supported within the EPA/ORD research and development programs and systems?

After the Plenary session concluded, the four breakout groups (Breakout Group on Air, Climate, and Energy; Breakout Group on Safe and Sustainable Water Resources and Homeland Security; Breakout Group on Sustainable and Healthy Communities; and the Breakout Group on Chemical Safety for Sustainability and Human Health Risk Assessment) met from 10:45 a.m. to 5:30 p.m.

Meeting Summary June 30, 2011:

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. Jerald Schnoor, rapporteur for the Breakout Group on Air, Climate, and Energy (ACE), thanked his group and acknowledged Dr. Katherine von Stackelberg as facilitator. He provided a slide presentation summarizing the group's deliberations and responses to charge questions.[14] He noted that the ACE research themes are: 1) assess impacts on human and ecosystem exposures and effects for air pollutants and climate change at all scales; 2) prevent and reduce emissions by providing data and models for atmosphere that are cost effective and innovative multipollutant; and 3) respond to changes in climate and air quality (adaptation).

In addition to addressing ORD's six charge questions, the ACE breakout group made several general observations. They noted a fundamental disconnect between sustainability as a paradigm for driving research and the legislative mandates of the Clean Air Act and asked how EPA will integrate the two, especially in lean budget times. They recommended a few suggestions to spark innovative approaches. They observed that Air Quality Monitoring has been a major ORD strength in the past and ORD has a unique opportunity to develop sensors and reporting networks. In the past, EPA has primarily conducted monitoring for the sake of compliance. EPA may reap benefits if monitoring is designed to support decision-making and hypothesis testing also. The breakout group also observed that biofuels is one area where EPA has a mandate to prepare an annual report to Congress on green house gas effects. The lack of legislative authority, however, could free ORD to provide research of a more creative and innovative nature. His group did not address the use of social, behavioral and decision sciences as separate questions, but emphasized their importance in responses to ORD's charge questions.

After Dr. Schnoor's presentation, breakout group members provided additional comments. One member spoke of the importance of ORD focus on adaptation to climate change and consideration of potential adverse impacts of different adaptation measures. He also noted the importance of social science research on climate change perceptions. People lack a mental framework for evaluating future impacts and it may be useful to engage social science in helping people understand future climate change effects. Another member noted that the ACE vision statement did not mention sustainability, though it is a focus of ORD research overall. Yet another member emphasized the importance of maintaining "predecessor programs" on which EPA depends, while investing in new research directions. He commended ORD management for working through this with "intelligence and energy."

After the workgroup's remarks concluded, other advisors provided comments and questions. One member asked whether the ACE program's multi-pollutant focus was solely a long-term effort or whether there were near-term activities. The National Program Director explained that ORD began multi-pollutant work in 2004. Research on near-roadway exposures and impacts has been framed in that context and research related to individual National Ambient Air Quality Standards are "being rolled into a multi-pollutant context" where possible. The member suggested that the

ACE research framework be revised to highlight that some multi-pollutant efforts were underway.

One member asked about the group's response to part of question "a" (i.e., If resources allow, what are areas for increased emphasis? If resources decline, what areas might be appropriate for decreased emphasis?). Dr Schnoor had noted that the ACE breakout suggested that ORD should " aim…ORD research in such a way as to decrease the cost of regulations to the regulated community." A breakout group member suggested that ORD can help EPA change the paradigm for regulations by identifying sustainable alternatives. ORD can help identify benefits to help inform decisions by identifying sustainable alternatives. ORD can expand its current portfolio by helping identify and understand decision options.

Another member asked about the work group's comment on the "importance of linking policy and science knowledge. Combining policy with science is itself a new way of doing EPA's business and it is an area of research in and of itself." Dr. Schnoor responded that the intersection of science and policy could be a distinct ACE research area. Another group member added that this topic has been a lively focus of research for the past ten years and that the Intergovernmental Program on Climate Change had fostered research on the relationship of policy to science that could be useful to ORD. Yet another member added that leaders in other science areas, such as the Congress of Epidemiology, have published reports on translating science into policy and regulations.

Other members provided additional comments. One member emphasized the need to clarify use of the terms "sustainability" and "sustainable solutions." Another member asked ORD to highlight its interactions with the well-funded Department of Energy (DOE) biomass programs. She suggested such collaboration across Agency lines offered potential for transdisciplinary work. Other members emphasized the importance of inter-agency coordination, given EPA's limited climate change mandate and related research budget. Given the important role of DOE, one member emphasized the importance of involving that Agency in ORD's program formulation for the ACE program.

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

Dr. David Dzombak, rapporteur for the Breakout Group on Safe and Sustainable Water Resources (SSWR) and Homeland Security (HS), thanked his group and acknowledged Dr. James Sanders as facilitator. He provided a slide presentation summarizing the group's deliberations and responses to charge questions.[15] His group explicitly addressed both ORD's charge questions and the separate set of questions related to ORD and the social, behavioral, and decision sciences. One overarching comment of the group was that integration of EPA's drinking water and water quality research programs is a very positive development and will provide important new synergies, e.g., with respect to water treatment technologies relevant to drinking water, wastewater, and storm water; evaluation of microbial risks; and evaluation of aquifer storage and recovery for water supply. The group noted that the HS research program is not as far along in developing its framework as SSWR program. Dr. Dzombak also remarked that the breakout group was impressed with the level of coordination within the SSWR program and its

efforts to coordinate within ORD and with EPA program and regional offices and outside EPA. The group commended the SSWR program for beginning to address water quantity issues and exploring the linkages between water quantity and water quality. The Group suggested the importance of coordination with other agencies (e.g., U.S. Department of Energy, U.S. Department of Agriculture) on this subject and the need for new approaches to make inter-agency collaboration more substantive, more long-lasting, and less *ad-hoc*.

After Dr. Dzombak's presentation, one breakout group member provided additional comments. She emphasized that sustainability requires developing and sustaining natural ecosystem processes. To do that effectively, EPA needs to understand functional indicators and must plan research focused on ecosystem processes and functions. Australia and the European Union are leaders in this area. ORD should expand its coordination beyond the federal government internationally to collaborate internationally with leading research organizations.

After the breakout group members' remarks concluded, other advisors provided comments and questions. One advisor asked whether the SSWR framework showed evidence of synergies between Drinking Water research and Clean Water Act Research. Dr. Dzombak responded that the framework shows many examples of integration and synergies. It reflects an understanding of watersheds as integrated systems and sources of drinking water. Drinking water research is integrated with research on nutrients. And the framework gives attention to the relationship of water quantity to water quality. The breakout group was enthusiastic about the linkages and found the framework very well developed and well supported.

An advisor asked whether the SSWR definition of sustainability was consistent across all ORD programs. He noted the importance of consistency across ORD programs for communication of environmental issues to decision makers. He also noted that social and behavioral science is needed in the areas of communicating environmental issues to decision makers and the public.

Another advisor supported the breakout group's recommendation that ORD expand innovation awards beyond Pathfinder Innovation Projects.

ORD managers then provided comment on the breakout group's report and plenary discussion. Dr. Teichman noted a sentiment that ORD refer to its major research programs as six programs, not as four program areas plus four cross-cutting areas. He agreed with this change. He also asked for SAB and BOSC ideas for how to represent ORD's sustainability efforts graphically and how to diagram the relationship between different programs. He also welcomed suggestions for how ORD could access external expertise in the social sciences and develop that capability internally. He agreed that the integrated transdisciplinary research approach requires ORD to bring policy and research together in problem formulation. He emphasized the importance of ORD's conducting usable research, research necessary for the risk management decisions at hand. He also voiced caution that policy decisions involve other considerations than science and cited the Bipartisan Policy Center 2009 report as helpful guidance in this area.

Dr. Preuss asked the SAB to provide specific guidance on how ORD can improve its efforts to coordinate or collaborate with cross Agency groups. In regard to the breakout group's recommendation that ORD establish a group of futurists focused on emerging issues, he noted

that he is trying instead to encourage people to focus on their "desired future state," and "what can we do to achieve it," rather than focusing on simply identifying future environmental problems. In regard to social science, he asked the SAB to articulate what an ORD group would do in the area of social sciences. Specific recommendations will be needed if ORD is to develop this area as a core function.

In response to an advisor's question about whether "anything was lost" in the development of the SSWR program, Dr. Teichman responded that he believes ORD will be able to accomplish more with the new structure. The SSWR National Program Director noted that EPA's Office of Ground Water and Drinking Water was concerned about losing drinking water research deliverables in the context of a larger drinking water area. The National Program Director is making an effort to highlight public health topics in the SSWR framework so that all parts of EPA's Office of Water can see their needs met.

Safe and Healthy Communities Breakout Group Report

Dr. Kathleen Segerson, rapporteur for the Breakout Group on Sustainable and Health Communities (SHC), thanked her group and acknowledged Dr. Kenneth Olden as facilitator. She provided a slide presentation summarizing the group's deliberations and responses to charge questions.[16] Dr. Segerson began with general comments from the group, which applauded the integration of research under the overarching theme of sustainability, which was previously a very small research program in ORD, The breakout group viewed the SHC research program as visionary, an exciting new research area with the potential to catalyze support for EPA through community-based outreach and interaction.

The group suggested that ORD should clarify whether it envisioned the program as an over-arching program that other programs feed into, as depicted in the slide provided by the SHC National Program Manager (Figure 2 below) or as a research program co-equal with other programs, as illustrated in the presentation provided by Dr. Kevin Teichman. (Figure 3 below). ORD should communicate more clearly whether SHC research is the center and driver of ORD research or an ORD research program with distinct characteristics (i.e., focus on local/community level rather than national concerns; broader holistic systems perspective; focus on stakeholder participation and collaboration).

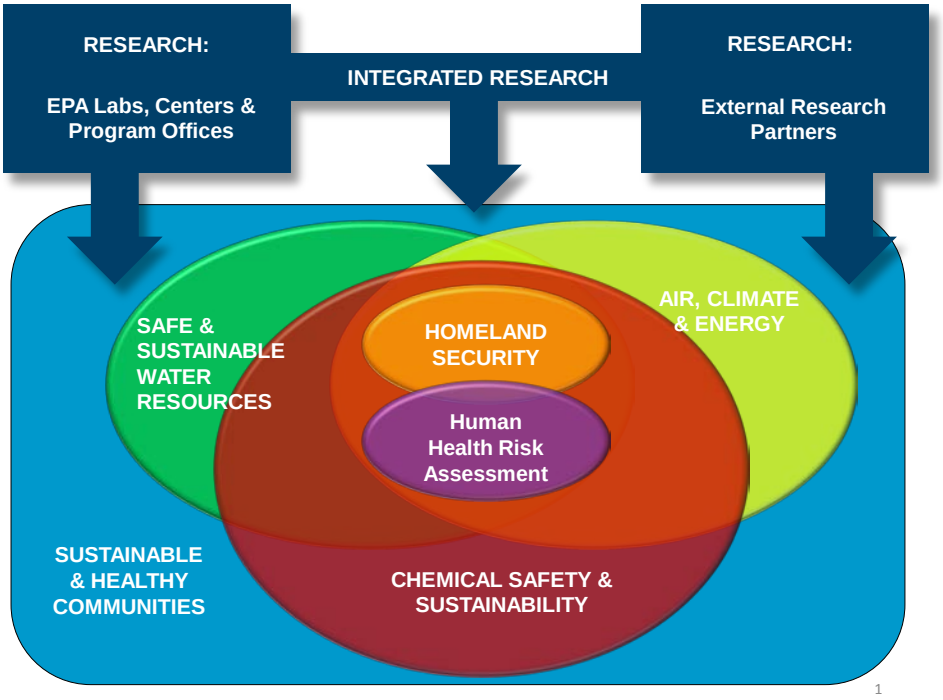

Figure 2 – Slide from SHC National Program Manager's Presentation

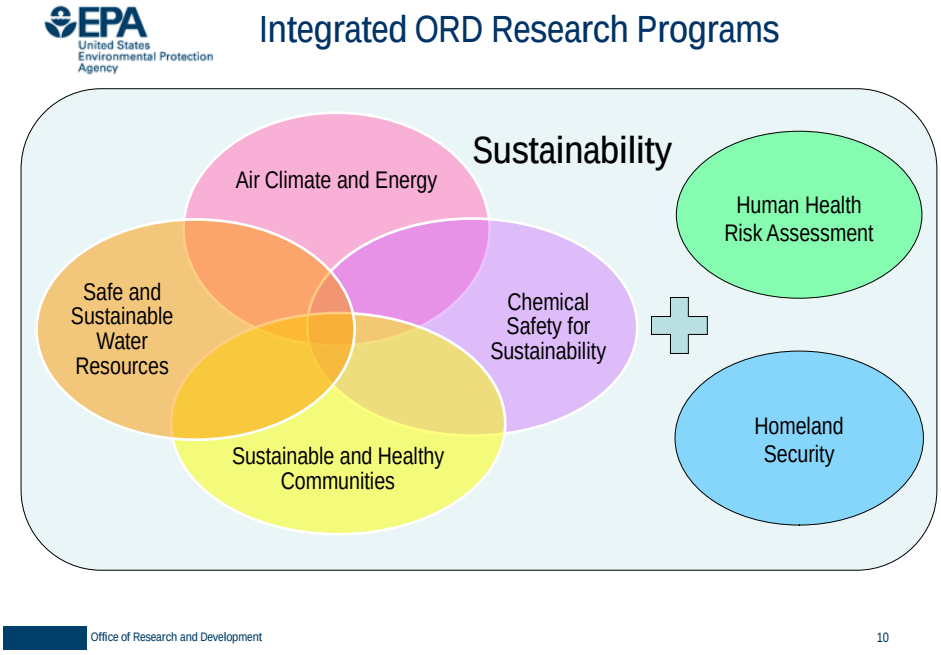

Figure 3 – Slide from Kevin Teichman's Presentation

Dr. Segerson reported that the group voiced concerns, however, despite its support for the program, over its ambitious scope and the resources and time needed to make it work. The group was concerned that ORD does not have the expertise needed for the participatory, community-based work required. The group called for greater clarity over how communities and community

objectives would be defined and how community objectives aligned with national objectives. There was a need for ORD to better articulate its role in providing assistance to communities; to indicate how the three SHC themes were inter-related and would be integrated; and to address whether the minimal budget provided for the most innovative theme, "Solutions for Sustainable Communities," could be achieved with only 10% of the SHC budget. The group also emphasized the importance of ecosystem research as part of the SHC program and voiced concern that ecological research, as well as the science necessary to understand ecosystem services and benefits, could be under-funded and under-emphasized in the proposed research structure.

Dr. Segerson summarized briefly the group's response to ORD charge questions and their response to additional questions regarding social, behavioral and decision sciences in ORD.

After Dr. Segerson's presentation, breakout group members provided additional comments. One advisor noted that the Department of Defense has a strategic environmental research and development program that offers another opportunity for collaboration for ORD. Yet another advisor stated strongly that "sustainability" needs to be defined. It is not clear whether sustainability research will make research on ecological processes and ecosystem services a priority. Another member highlighted a theme in the group's discussion: a healthy and sustainable community requires attention to children's health. Members agreed that ORD should develop a definition of a healthy and sustainable community.

After the workgroup's remarks concluded, other advisors provided comments and questions. One member noted that the group had identified types of social, behavioral, and decision sciences needed for the SHC program but had not included sciences that focus on institutions. He suggested that history, geography, and political science should be included to help the SHC program identify institutional opportunities and institutional constraints.

Another advisor emphasized the importance of strengthening ORD research on ecosystem services and exploring the link between ecosystems and public health. EPA has a unique role to play in protecting ecosystems. On a related point, he asked whether ORD has identified the proper indicators to develop a scientifically credible *Report on the Environment.* He spoke of the need for a research program that would identify the proper questions to ask, especially regarding the health of terrestrial ecosystems.

An advisor noted the difference between ecosystem structure, function and health as compared with ecosystem services. There is a need for research to translate between these different domains. The SHC framework should more clearly identify where ORD should prioritize is efforts, whether in basic research on ecological structure and functions or in the translation to ecological services. Another advisor emphasized the importance of clarifying this role, because ecological research affects other ORD research programs in major ways.

Yet another member asked about a conclusion from the breakout group, which noted that ORD could reach out more effectively to other organizations pursuing ecosystem services research. A breakout group member responded that he has seen little ORD involvement in a recent United Kingdom study on the value of ecosystem services or cutting-edge international programs on ecosystem change. More coordination with leading international researchers is needed.

The discussion concluded with comments on several other points. One advisor spoke of the importance of the *Report on the Environment* organizing information by ecosystem services. Dr. Peter Preuss responded that most all of information in the *Report on the Environment* came from outside EPA. Another advisor noted an emphasis in the SHC discussion on community involvement in exposure monitoring. She expressed concern about samples being taken without a good sampling plan. A workgroup member responded by stressing the importance of protocols for communities to follow and the successes demonstrated in gathering monitoring data at the community level.

Chemical Safety for Sustainability and Human Health Risk Assessment Breakout Group reports

Dr. R. Thomas Zoeller, rapporteur for the Breakout Group on Chemical Safety for Sustainability (CSS) and Human Health Risk Assessment (HHRA), thanked his group and acknowledged Dr. Barry Ryan as facilitator. He provided a slide presentation summarizing the group's deliberations and responses to charge questions.[17]

His presentation focused immediately on the group's response to the ORD charge questions. The group's primary response to the CSS and HSRA frameworks were that the documents reflect intense effort but were too theoretical. ORD should clarify what is meant by the term "sustainable," related sustainability terms, and terms such as "inherency." In a related point, he mentioned that the group found that CSS framework did not clearly explain how the program would achieve its desired outcome and encouraged EPA to set a clearly defined concept of "sustainability" as the goal and not the means by which chemical safety is achieved.

After Dr. Zoeller's presentation, breakout group members provided additional comments. One member reiterated the importance of a succinct definition of sustainability for ORD to communicate with the public and especially with industry. Another member emphasized the critical importance of the HHRA program, because it involves high profile EPA science that is often the focus of controversy between adversarial interest groups. If this program were to fail or not be improved, EPA would suffer a loss of credibility. In addition, environmental science would suffer more broadly. University research is looking for a stimulus to help generate the new research needed for human health risk assessment and states are losing funding for environmental research. There is a critical importance in making the contribution of green chemistry real and tangible in human health risk assessment. Another group member underscored the importance of EPA support for extramural research at a time when universities and research institutions are not investing in developing environmental research because of budget shortages.

SAB and BOSC members then discussed the appropriate percentage of ORD's research portfolio that should be innovative and cross cutting. One advisor noted that Universities typically only invest ten percent of their portfolio in such categories. One member responded that the criteria should be the expected impact on public health and the environment. The National Institute of Environmental Health Sciences takes this approach. Other members expressed the view that innovation can best be focused on long term problems to "prevent future large train wrecks."

Another member saw that potential of innovation can involve an old idea approached innovatively. In his view, the culture of innovation should be pervasive. The group agreed that, in any case, successful innovation must result in usable information for EPA.

After the SAB-BOSC discussion concluded, Dr. Teichman thanked rapporteurs and facilitators and provided his comments on the breakout groups' reports on the SHC, CSS, and HHRA programs. He acknowledged the complexity and unique nature of the SHC program, thereby deserving a "two-headed arrow" to indicate it as a driver for other ORD research programs and a user of the results of the other research programs. He confirmed the statement of the SHC breakout group that EPA's ecosystem research budget has declined over time. He noted that ORD has relied on the Brudtland Commission's definition of sustainability, i.e., "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." He acknowledged the need to use a consistent definition across ORD programs, while allowing each to internalize it appropriately within the context of its work and create operational definitions.

Dr. Teichman noted the critical comments received regarding the CSS framework document. ORD will take note of the SAB-BOSC feedback as it revises the research framework. He also noted comments on the HHRA program that addressed controversy and adversarial relationships He welcomed instead a vision of an improved, collaborative process for development of hazard and risk assessments.

Dr. Peter Preuss made some comments on the SAB-BOSC discussion of innovation. He defines innovation as "a great idea put to use." He expressed concern about their discussion of the "risk of failure." He noted that many companies invest in innovation have metrics for success. Some companies use the metric that 30% of profits need to be generated from ideas developed in the last three years. Such a metric focuses on putting new ideas to use and getting new markets for them. In his view, innovation needs to be measured by their positive impacts.

He viewed community research as the "great tidal wave" revolutionizing environmental science. There are "Apps" that can change environmental research and EPA can be a pioneer. He asked SAB and BOSC members to "imagine a future where school children use detectors in science class. Information about their environmental exposures gets uploaded. They get a picture of all the exposures they have to a particular chemical, in classrooms, neighborhoods, homes, and communities. Environmental justice communities could use these monitors." He said that EPA keeps "getting questions about more fence-line monitoring, but the future is here with personal monitoring." Community-based science is tremendously powerful. Monitoring at the community level must be done intelligently and is possible.

Cross-cutting issues

Social, behavioral and decision sciences

Dr. Terry Daniel briefly highlighted the rich responses provided by breakout groups to the additional questions about social, behavioral, and decision sciences and their potential use in

ORD's restructured research programs. He committed to working with the DFO to consolidate these responses for the SAB-BOSC report.

In response to a question from the SAB Chair, Dr. Daniel noted that in some cases ORD can draw on existing literature to help address EPA issues, but there are also important research gaps that trained social, behavioral, or decision scientists will need to engage. Another advisor noted that increasingly, scientists have interdisciplinary training in social science and other technical fields. Experts with this interdisciplinary background can be especially useful for this research.

An SAB member noted the broad consensus in the group concerning the importance of social sciences to ORD's new environmental research programs. Even though most advisors are chemists, engineers, biologists, or human health scientists, they strongly and consistently agree that ORD use social sciences to make their research programs more effective.

Emerging environmental issues

Dr. Swackhamer introduced the next two speakers, Dr. Kenneth Olden and Dr. Jerald Schnoor, who had agreed to provide some perspective on emerging environmental issues, since ORD's charge question (d) contained the subquestion "Are (ORD's research) programs positioned to address the nation's highest priority, emerging environmental issues in the coming years?"

Dr. Olden provided some remarks based on his recent article in the journal *Health Affairs* (Olden, K. N Freudenberg, J. Dowd, and A.E. Shields. 2011. "Discovering How Environmental Exposures Alter Genes Could Lead To New Treatments For Chronic Illnesses." *Health Affairs*. 30. pp. 833-841.) He described how emerging research demonstrates that diet, pollution, and other environmental triggers can alter both the function and expression of human genes and lead to a heightened disease risk. These environment-gene interactions can cause so-called epigenetic changes in gene expression—patterns of which genes are switched "on" or "off"—that may account for the rising mortality from chronic diseases in industrialized nations. He spoke of a need for a new transdisciplinary approach to public health that would examine how environmental exposures, both physical and social, influence gene expression and a person's susceptibility to chronic disease. Such research could lead to new ways to prevent and treat such illnesses.

Dr. Olden commented that "Genetics loads the gun but the environment pulls the trigger," causing chronic disease. One member asked if the environment is the trigger and the epigenome is an indicator, shouldn't research be focused on the environmental stressors affecting the genome? He suggested that it would be a high priority to monitor such environmental change.

Another member asked how EPA could take a systems approach to disease prevention that would include epigenetics. Dr. Olden responded that EPA is proposing a transdisciplinary, integrated approach. This approach could address multiple endpoints of concern, identify epigenetic markers for then, and then link results to stressors. Stressors may be environmental or the result of personal behavior. Social science can help identify and address many of these stressors.

Dr. Jerald Schnoor provided a slide presentation on emerging environmental issues.[18] He noted that twenty-first century environmental problems are at larger scale (regional to global) than those addressed successfully by EPA in the past and involve many areas without solid legislative jurisdiction (e.g., agricultural runoff, land use and climate change, energy choices). He named key drivers of environmental change: population growth and demographic shifts, land use change, and energy sources. He described emerging and intensifying environmental issues that result: air quality deterioration from climate change; threats to coast water ecosystems; contamination from urban storm waters; terrestrial ecosystem degradation; effects of climate change on oceans, fisheries, and coral reefs; and likely increased demands for risk and exposure assessments for chemicals such as dioxin, chromium, arsenic, and bisphenyl-A. In the face of these environmental issues there have been no major legislative mandates since 1996, except for a judicial extension of EPA's authority in the area of climate change.

Dr. Schnoor suggested that the emerging issues and EPA's legislative context called for increased investment in social, behavioral, and decision science to address environmental stressors and change behavior. He described opportunities offered by "Environomics" to develop understanding of environmental phenomena through enhanced monitoring, technologies for understanding data-rich environments, data mining, and data simulation. He envisioned new opportunities for EPA to understand the environment and pair this enhanced understanding with chemical forecasting that can be useful for predicting public health and environmental impacts. He stressed the importance of new, creative, and innovative approaches for preventing and addressing the causes of Gulf hypoxia and averting water quantity and water quality problems likely to arise from exploitation of groundwater resources. He envisioned a future where EPA could work with the "exposome" (i.e., all cumulative risks to people) and match this information with genetic and epigenetic profiles to understand and manage environmental risks.

After Dr. Schnoor's presentation, SAB and BOSC members provided comments and questions. Members were impressed with Dr. Schnoor's description of population pressures on world resources, especially water resources. One member noted, however, that there has been a demographic transition in developing countries, which have experienced a declining rate of population growth from the 1960's. He noted a potential decline in energy intensity and decline in the consumption of some materials, such as paper. He suggested that ORD and EPA could envision a sustainability goal that would help national populations down transitional paths to reduce energy consumption and towards "de-materialization." Populations in California and Arizona have successfully responded to the need to economize use of water.

A member asked Dr. Schnoor for his vision for EPA's research on emerging environmental issues. She asked: " what should be the unique contribution of EPA's research?" Dr. Schnoor responded that ORD research should support EPA's mission and could make a critical difference for addressing twenty-first century environmental problems by investing in forecasting.

Another member suggested that ORD should conduct research that focuses on optimal, sustainable types of urban forms, e.g., types of buildings, transportation systems, and green space. Although solutions would vary regionally and the environmental problems Dr. Schnoor described were daunting, potential solutions could be advanced by research.

Yet another member asked about resiliency and how it related to the concept of sustainability and whether it offered a better or different model for environmental protection. Dr. Schnoor responded that resiliency is defined as the ability to withstand a perturbation. The concept of resiliency is built into environmental design for urban infrastructure. Another member commented that the eight states around the Great Lakes are beginning to collaborate to manage a limited water supply. This collaboration reflects an emerging awareness of the importance of resiliency.

Dr. Teichman provided comments that concluded the discussion. He thanked SAB and BOSC members and expressed appreciation that they supported ORD's bold efforts to restructure its research programs at a time of budget cut backs. ORD's focus on sustainability needs to be complemented by a clearer definition of the term. He expressed a desire to prepare a "Sustainability 101 Course" for all ORD staff. He noted that the National Research Council Study expected this summer was intended to help operationalize the concept of sustainability across EPA.

Action Items/Next Steps

Dr. Deborah Swackhamer thanked the presenters, rapporteurs, facilitators, and breakout group members. She noted that the SAB and BOSC DFOs will draft a report based on the presentations and meeting discussions and work with the SAB and BOSC Chairs to prepare a draft for SAB and BOSC discussion during a public teleconference.

She thanked participants for the successful meeting and expressed appreciation for ORD and EPA staff involvement.

The DFOs adjourned the meeting at 4:00 p.m.

Respectfully Submitted:

/Signed/

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Dr. Angela Nugent
SAB DFO

/Signed/

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Mr. Greg Susanke
BOSC DFO

Certified as True:

/Signed/

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Dr. Deborah Swackhamer
SAB Chair

/Signed/

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Dr. Martin Philbert
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 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.

Members of the public attending the public meeting:

Andrew Almeter, EPA
Stan Barone, EPA
Amy Battaglia, EPA
Carl Blackman, EPA
David Bylsma, EPA
Rebecca Clarke, EPA
Dan Costa, EPA
Llael Cox, EPA
Kevin Crofton, EPA
Alva Daniels, EPA
Sally Darney, EPA
David Dix, EPA
Bob Dyer, EPA
Stephen Edwards, EPA
Elaine Wright, Univ of Penn
Marina Evans, EPA
Gabby Fekete, EPA
Steven Foster, EPA
Frank Priuciotta, EPA
Jonathan Garber, EPA
Jay Garland, EPA
Alice Gilliland, EPA
Alan Hecht, EPA
Jon Herrmann, EPA
Ross Highsmith, EPA
Howard Mielke, Tulane Univ
Jenny Hopkinson, Inside EPA
Elaine Cohen Hubal, EPA
Bryan Hubbell, EPA
Scott Jenkins, EPA
David G. Jewett, EPA
Marjorie Jones, EPA
Lek Kadeli, EPA
Stacey Katz, EPA
Bob Kavlata, EPA
Sue Kimbrough, EPA
David Kryak, EPA
C W Lee, EPA
Carol Lenox, EPA
Rick Linthurst, EPA
Danelle Lobdell, EPA
Bob MacPhail, EPA
Debrah Mangis, EPA
Mark Mason, EPA

Melissa McCullough, EPA
Mike McDonald, EPA
Douglas Mckinney, EPA
Charlene McQueen, EPA
Andy Miller, EPA
Mark Miller, EPA
Ardra Morgan, EPA
Michael Mortan, EPA
Jeff Morris, EPA
Lucas Neas, EPA
Chuck Noss, EPA
Jennifer Orme-Zavaleta, EPA
Phil Oshida, EPA
Russell D. Owen, EPA
Haluk ozkaynak, EPA
Maya Pachnowski, EPA
Ines Pagan, EPA
Dale Pahl, EPA
Michele Palmer, EPA
Brenda Rashleigh, EPA
Mary Reiley, EPA
Gail Robarge, EPA
Jefferey Ross, EPA
Bill Russo, EPA
Jason Sacks, EPA
Kathryn Saterson, EPA
Gregory Saylor, EPA
Seema Schappelle, EPA
Laurel Schultz, EPA
Anne Sergeant, EPA
Richard Shores, EPA
Betsy Smith, EPA
Holly Stallworth, EPA
John Stoddard, EPA
Kevin Teichman, EPA
John Thomas, EPA
Kent Thomas, EPA
Alan Vette, EPA
Randy Waite, EPA
Barb Walton, EPA
Tim Watkins, EPA
Michael Werno, EPA
Kaye Whitfield, EPA
Holly Wilson, EPA
Charles Wood, EPA
Hal Zenick, EPA

Materials Cited

The following meeting materials are available on the SAB Web site, http://www.epa.gov/sab, at the page for the June 29-30, 2011 meeting: http://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/794564e427071dfa8525780f00656e32!OpenDocument&Date=2011-06-29

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[1] Agenda
[2] Roster of SAB members
[3] Roster of BOSC Members
[4] Federal Register Notice Announcing the Meeting
[5] Comment from Comments from Valerie Nelson, Water Alliance, June 28, 2011
[6] Paul Anastas' Presentation
[7] Kevin Teichman's Presentation
[8] Peter Preuss' Presentation
[9] Links to ORD presentations with audio - research strategy overview and introductions to ORD's six newly realigned research areas. ORD presentations also available in Powerpoint format:

- Presentation to the Science Advisory Board and the Board of Scientific Counselors Premeeting Presentation Powerpoint Slides by Kevin Teichman.
- Air Climate & Energy Air Climate & Energy Presentation Powerpoint Slides by Dan Costa
- Chemical Safety for Sustainability: EPA Research to Meet 21st-Century Needs Powepoint Presentation Slides by Robert Kavlock
- Homeland Security Research Program Powerpoint Presentation Slides by Gregory Sayles
- Human Health Risk Assessment (HHRA) Program Powerpoint Presentation Slides by Becki Clark
- Safe and Sustainable Water Resources Powerpoint Presentation by Jennifer Orme-Zavaleta
- Sustainable and Healthy Communities Presentation Powerpoint Slides by Rick Linthurst

[10] ORD Research Frameworks:

- Air, Climate, and Energy Framework for EPA's Research Program, June 14, 2011
- Framework for an EPA Chemical Safety for Sustainability Research Program, 1 June 2011
- Framework for an EPA Safe and Sustainable Water Resources Research Program June 14, 2011ORD Research Framework
- Homeland Security Research Program Research Framework Draft: June 2, 2011
- Human Health Risk Assessment (HHRA) Research and Assessment Framework, June 15, 2011
- Sustainable and Healthy Communities Research Program Draft Research Framework June 15, 2011

[11] Chemical Safety for Sustainability: Research Action Plan, DRAFT v.1.
[12] Breakout Group Assignments as of June 28, 2011

[13] SAB and BOSC advice on expanding ORD capabilities in the social, behavioral and decision sciences to meet identified research and decisions support needs at EPA
[14] Report from breakout group on "Air, Climate, and Energy" research framework
[15] Report from breakout group on "Safe and Sustainable Water Resources" and "Homeland Security" research frameworks
[16] Report from breakout group on "Safe and Healthy Communities" research framework
[17] Report from breakout group on "Chemical Safety for Sustainability" and "Human Health Risk Assessment" research frameworks
[18] Presentation by Jerald Schnoor on Emerging Environmental Issues as part of SAB/BOSC discussion including Ken Olden on that topic