

**Summary Minutes of the United States Environmental Protection Agency (U.S. EPA)
Science Advisory Board (SAB) Research Budget Work Group Meeting¹
March 3-4, 2011**

Date and Time: March 3, 2011, 1:00 p.m. to 6:00 p.m.; March 4, 2011, 9:00 a.m. - 4:00 p.m. Eastern Time

Location: Four Points by Sheraton, 1201 K Street, NW, Washington, DC

Purpose: to provide comments on the FY 2012 President's Budget Request for EPA's Office of Research and Development.

SAB Work Group Members:

SAB Work group Members

Dr. Jerald Schnoor	Dr. James Mihelcic
Dr. Claudia Benitez-Nelson	Dr. Christine Moe
Dr. Terry Daniel	Dr. Keith H. Moo-Young
Dr. George Daston (by telephone)	Dr. Eileen Murphy
Dr. Costel Denson	Dr. Kenneth Olden
Dr. Nancy Kim	Dr. Duncan Patten
Dr. Kai Lee (by telephone)	Dr. Paige Tolbert
Dr. Cecil Lue-Hing	Dr. Thomas Wallsten
Dr. Floyd Malveaux	Dr. Thomas Zoeller

Other SAB Members

Dr. Deborah Swackhamer (by telephone)

EPA presenters and representatives

Ms. Carol Terris, Deputy Director, EPA Office of the Chief Financial Officer, Office of Budget
Dr. Paul Anastas, Assistant Administrator, Office of Research and Development (ORD)
Dr. Kevin Teichman, Deputy Assistant Administrator for Science, ORD
Mr. Jay Benforado, ORD Senior Advisor for Innovation
Dr. Daniel Costa, ORD
Dr. Jennifer Orme-Zavaleta, ORD
Dr. Rick Linthurst, ORD
Dr. Robert Kavlock, ORD
Ms. Rebecca Clark, ORD
Dr. Gregory Sayles, ORD
Dr. Albert McGartland, National Center for Environmental Economics (NCEE)

SAB Staff Office Participants

Dr. Angela Nugent, Designated Federal Officer (DFO)
Dr. Vanessa Vu, Director

Meeting Summary March 3-4, 2011:

The meeting was announced in the Federal Register² and discussion at the meeting generally followed the issues and timing as presented in the agenda.³ There were no oral public comments on March 4, 2011 and no written public comments provided to the work group.

Convene the meeting

Dr. Angela Nugent, SAB DFO, convened the advisory meeting and welcomed the group. She noted that no written public comments had been received and that there had been no requests for oral public comment. Dr. Vanessa Vu, SAB Staff Office Director, expressed appreciation for members' preparations for the meeting and for involvement. She thanked Ms. Stacey Katz and Gail Robarge of ORD for coordinating planning of the meeting with the DFO.

Purpose of meeting and review of the agenda

Dr. Jerald Schnoor, the SAB Chair, welcomed SAB work group members. He stated that the goal of the meeting was to provide comments on the President's requested FY 2012 budget that he could develop as draft testimony for the SAB Chair's consideration by Sunday, March 6th. He also noted that he would work with the DFO to format these comments into a draft report that would be provided to work group members on March 11th for their concurrence so that a work group report could be sent to the chartered SAB the next week for discussion at the March 22-23, 2011 face-to-face meeting of the chartered SAB.

FY 2012 President's Budget Request for EPA - Overview presentation⁴ and discussion

Ms. Carol Terris, Deputy Director, EPA Office of the Chief Financial Officer, Office of Budget provided an overview of the President's FY 2012 request for EPA, compared to the FY 2010 enacted budget. She noted that the President had requested an overall reduction of 13% for EPA, compared to FY 2010 enacted levels, and that overall funding for Science and Technology had declined by 2.6%.

Following her presentation, SAB members asked several questions. In response, Ms. Terris noted that the Office of the Chief Financial Officer expects that future efficiencies may result from initial investment in ORD's current transdisciplinary efforts.

FY 2012 President's Budget Request for the Office of Research and Development and ORD Innovations - Background/overview presentations and discussion

Dr. Paul Anastas, Assistant Administrator, Office of Research and Development (ORD) provided an overview⁵ of the President's budget request for ORD. Although the budget request for FY 2012 indicates a 2% reduction compared to FY 2010 funding, EPA's investment in science continues the President's commitment to science as the foundation of environmental protection. He summarized significant recent ORD research accomplishments, noted ORD's role in supporting EPA Program and Regional Offices in achieving EPA's strategic goals, and described a new integrated ORD budget structure to meet 21st century environmental challenges

that he described as “broad in scope, deep in complexity and widespread in their impacts.” He noted that the restructuring responded to SAB advice that ORD pursue systems thinking to address systems problems and to orient research to problem solving. ORD has pursued this restructuring working with EPA as a whole to identify research that advances EPA’s strategic goals. ORD has re-structured 12 of its previously-defined research programs into four programs (Air, Climate & Energy; Safe and Sustainable Water Resources; Sustainable and Healthy Communities; and Chemical Safety for Sustainability), aligned with the EPA Strategic Goals (Taking Action on Climate Change and Improving Air Quality; Protecting America’s Waters; Cleaning Up Communities and Advancing Sustainable Development; and Ensuring the Safety of Chemicals and Preventing Pollution). ORD also proposes to maintain a Human Health Risk Assessment Program and a Homeland Security Research Program.

Dr. Kevin Teichman, Deputy Assistant Administrator for Science, ORD, provided an overview of historical trends in science funding. The FY 2012 President’s Budget requests \$584.1 million for ORD, a decrease of \$12.6 million from the 2010 enacted budget. He noted that the budget redirects funds to in priority areas including endocrine disrupting chemicals, green chemistry, green infrastructure, computational toxicology, air monitoring, drinking water, and STEM fellowships, and that extramural STAR grants and the fellowship program have been significantly increased.

Dr. Jay Benforado, ORD Senior Advisor for Innovation, provided an overview of ORD’s recent innovation activities⁶. ORD defines innovation as the development and adoption of new ways of solving environmental problems and creating opportunities. He briefly described ORD’s Pathfinder Innovation Projects; internal tools for collaboration; and open source innovation efforts.

SAB members followed the presentations with questions. Several SAB members asked how ORD is implementing past SAB recommendations about social and behavioral research that can help change behavior at the household or community levels. One SAB member noted that ORD’s new innovation awards are primarily technology-based and do not involve social science. Dr. Anastas responded that ORD must “get to the heart of the social and behavioral sciences” to orient around sustainability, societal and economic change. He has considered a major STAR grant around social and behavioral science, but instead decided that social science needs to be “infused throughout everything we do.” ORD will need a strategy of tapping into that expertise where it exists and bringing it into research and also will need to think about the slower process of changing current its workforce. One example is the area of cook stoves. EPA is working with the Department of State to invest in social and behavioral aspects of the problem that will facilitate use of new technologies. Through the Department of State, EPA has leveraged one billion dollars in philanthropic and private sector contributions. Dr. Teichman responded that the Sustainable and Healthy Communities Program is considering the social context of sustainability in different regions of the country. SAB members commented that building social science capacity within the Agency requires intellectual leadership as well as policy leadership. There are many opportunities, where a small amount of investment in the social sciences could have a major impact on environmental problem solving (e.g., ways to use social and decision sciences to streamline requirements, lower cost burden on regulated community, and regulate more cost-effectively).

SAB members noted the importance of benefit analyses, such as the recently released study of the costs and benefits of the Clean Air Act, which have the power to recast debate about the significance of research investments linked to Clean Air. Dr. Anastas agreed that ORD must strengthen the communications component of its work so EPA's research will have impact.

When an SAB member asked how EPA defines sustainability, Dr. Anastas responded by briefly describing an National Research Council (NRC) study underway to operationalize the term for the Agency. He compared this effort, undertaken at the request of Administrator Lisa Jackson as EPA celebrated its 40th anniversary, with the initiative of previous Administrator William Ruckelshaus, who asked the National Academy of Sciences to operationalize the concept of risk in the 1980's. He noted that the current NRC sustainability study was scheduled for completion in the summer of 2011.

Another question pertained to how EPA decided to allocate cuts across intramural and extramural programs. Dr. Teichman noted that although the President's requested budget indicated an overall reduction for FY 2012, an increase in grant funding resulted partly from a cut in ORD's total number of Full Time Equivalent (FTE) employees, accomplished through attrition, and partly through reductions in intramural funding. He encouraged the SAB work group to evaluate the planned accomplishments to be described by ORD National Program Directors in terms of the resources for intramural and extramural programs in each of their areas.

Yet another question pertained to consultation and collaboration with other federal Agencies as EPA helps develop the budget for future fiscal years. Dr. Anastas responded that EPA engages with other federal agencies through a variety of mechanisms, including the national Science and Technology Council, inter-agency committees, and through interactions with the Office of Management and Budget, which coordinates budget planning across federal agencies.

An SAB member asked whether ORD had a human resource development plan to help existing ORD personnel adapt effectively to the new research structure. Dr. Teichman responded that ORD is an applied research organization and has invested in the past in human resource development plans, but currently has no workforce planning initiative in place.

Dr. Schnoor concluded the discussion period with a comment about innovation and the potentially valuable tool of human health forecasting. EPA could make use of streaming data related to National Ambient Air Quality Standards and Hazardous Air Pollutants to forecast human health impacts. Dr. Benforado agreed that such a possibility would be useful to EPA and a potential area for ORD activity.

Overview presentations

Air/Climate/Energy

Dr. Daniel Costa, ORD, provided an overview of the Air/Climate/Energy (ACE) research program.⁷ After Dr. Costa's presentation, SAB work group members asked several questions. In response, Dr. Costa noted that ACE research will involve simulation, including development

of new models and wind tunnels. EPA will continue funding research on children's environmental health under the Sustainable and Healthy Community Research program. The ACE program had closed out several completed research areas (e.g., mercury, the 2010 biofuels report to congress) but will focus on monitoring, an increasingly important research area.

Safe and Sustainable Water Resources

Dr. Jennifer Orme-Zavaleta, ORD, provided an overview of the Safe and Sustainable Water Resources (SSWR) research program.⁸ After Dr. Orme-Zavaleta's presentation, SAB work group members asked several questions. In response, Dr. Orme-Zavaleta responded that ORD is working on a research strategy related to nonpoint source control that should be ready for ORD review by June. She committed to providing the work group with a clarification of the focus on "green infrastructure" in ORD's SSWR program, whether it included both the natural environmental and urban systems.

Sustainable and Healthy Communities

Dr. Rick Linthurst, ORD, provided an overview of the Sustainable and Healthy Communities (SHC) research program.⁹ After Dr. Linthurst's presentation, SAB work group members asked several questions. In response, Dr. Linthurst responded that ORD will need to make resources available in the future to help communities understand that ecosystem services are real. Because ORD does not currently have that capability, he will "bring experts in" on a consulting basis, as he did for ORD's ecosystem services research program. One of the deliverables of the research program will be tools to help communities and decision makers understand where they can obtain the greatest benefit from reducing risk and increasing community sustainability. He acknowledged that ORD would benefit from expertise in decision science. He noted the need for the SHC program to build on future SSWR research. Dr. Linthurst projected that ORD will develop action plans for the SHC research area in April for discussion by the SAB in June.

Economics and Decision Science

Dr. Albert McGartland, NCEE Director, provided a brief overview of the Office of Policy's Economics and Decision Science research program.¹⁰ He acknowledged that the name was currently a misnomer, because the NCEE program did not currently sponsor Decision Science research. He noted a steep drop in the number of in-house Ph.D. economists in NCEE over the past 10 years and sketched out the few planned activities (2 planned STAR grants, workshops, and dissertation support fellowships) that NCEE planned to sponsor in FY2012. SAB members expressed concern that EPA should increase its investment in decision science.

Chemical Safety for Sustainability

Dr. Robert Kavlock, ORD, provided an overview of the Chemical Safety for Sustainability (CSS) research program.¹¹ After Dr. Kavlock's presentation, SAB work group members asked several questions. In response, Dr. Kavlock responded that research on toxicity pathways, undertaken at a systems level, can help EPA make "first principle guesses" about

mixtures and cumulative effects. He acknowledged that EPA does not plan to use high throughput screening for every biological pathway, but instead for “as much as we can,” focusing on cell-to-cell interactions that can be used to sort toxicity information. High throughput screening was used to assess the toxicity of dispersants used in the 2010 Gulf Oil Spill. He also acknowledged that EPA does not plan to conduct large epidemiology studies, which are very expensive.

Human Health Risk Assessment

Ms. Rebecca Clark, ORD, provided an overview of ORD’s Human Health Risk Assessment (HHRA) program.¹² After Ms. Clark’s presentation, SAB work group members asked several questions. In response she noted that her program will over time increasingly use human health research outputs from the CSS program. The priority for IRIS assessments is set through a process of assessing program and regional needs. She noted that the HHRA program has begun to take steps to evaluate mixtures through its work on poly-aromatic hydrocarbons, phthalates, and the Integrated Science Assessments to support the secondary National Ambient Air Quality Standard assessment for oxides of nitrogen and sulfur oxides.

Homeland Security Research

Dr. Gregory Sayles, ORD, provided an overview of ORD’s Homeland Security Research (HSR) program.¹³ After Dr. Sayles’ presentation, SAB work group members asked several questions. Dr. Sayles responded that reductions in the President’s requested budget reflected the maturation of several HSR research programs, whose products will be made available to regions, states, and local governments. He acknowledged that successful communication with local responders is key to adoption of such programs. He described how HSR scientists interact with scientists in other federal agencies at multiple levels: from White House work groups to informal collaborations. There is a standing work group to coordinate with scientists in the Department of Homeland Security and Department of Defense. He acknowledged that the HSR program is limited by budget in exploring ways to design infrastructure to be resilient to manmade or natural disaster and climate change. He noted a natural fit between the SSWR and HSR research programs related to water security. As HSR science products are completed, there must be a mechanism to transition these products for use in the private sector.

Preparations for second day

Dr. Schnoor asked work group members to coordinate in the subgroups designed on the agenda and to send draft text or draft bullets to the DFO for discussion on March 4th.

The public meeting recessed at 6:00 p.m.

Friday, March 4, 2011

The Designated Federal Officer reconvened the public meeting at 9:00 a.m.

Charge to Work Group

Dr. Jerald Schnoor asked the work group to respond to the following key questions developed by him with the DFO and Chair of the chartered SAB to help organize the SAB response for each of the seven research areas:

1. How well will the requested budget permit EPA to advance its strategic research directions and meet EPA priorities?
2. Are the changes since the FY 2010 enacted budget and EPA's research budget trends appropriate, taking into consideration overall resources, FTEs, intramural and extramural resources?
3. Are there well defined objectives/work products for next year's budget? Can these be accomplished with the given resources?
4. Are there pivotal, "game changing" investments that can advance the science?
5. Are there investments that will serve multiple program or multiple priority needs?

Work Group Discussion

The Chair asked the DFO to project the draft text developed by work group members on a screen so work group members could develop a preliminary draft response. Work group members discussed the highlights of the draft text and the DFO edited the document to reflect the flow of the conversation (see attachment A for the draft highlights of the workgroup preliminary responses to charge questions). Additional questions and issues were raised related to each of the seven research areas, as described below, and ORD National Program Managers and Dr. Kevin Teichman were available to field questions from work group members.

Air/Climate/Energy Research Budget

- ORD clarified that the mercury research program being phased out was not a large program. ORD was divesting from mercury because of other priorities.
- ORD planned to divest from CMAQ modeling. It planned to focus instead on leveraging climate modeling with air quality modeling.
- ORD is only in the "embryonic phase" of evaluating social and economic factors related to vulnerability from climate change. The Clean Air Centers are piloting this question and EPA will use the STAR program to explore this issue, since EPA does not have immediate expertise in house.
- ORD is exploring the possible linkage of adaptation to air pollution, as well as climate change (e.g., decision making in response to air quality information)
- ORD's cook stove research has implications both internationally and within the United States, especially on Native American reservations.

Safe and Sustainable Water Resources

- ORD's current green infrastructure research is related to built environments, such as engineered natural systems (i.e., rain gardens, riparian corridors). ORD plans to expand this more broadly to watersheds in the future.

- SSWR planned studies on green infrastructure will need to be coordinated closely with ecosystem services research on wetlands under the SHC research program.
- ORD worked closely with EPA's Office of Water to identify mature research products related to Beach Safety that can be phased out. ORD met its commitment to conduct epidemiology studies (2007-2008). Resources will be needed to maximize what ORD has learned from specimens collected. ORD will be working with the Centers for Disease Control in making the best use of this "vital capability."
- ORD is concluding work on control of pathogens in drinking water and considering future work in this area. ORD is exploring research on groups of pathogens and technologies for addressing these groups.
- SSWR is coordinating with the CSS program to develop new research approaches to support decisions EPA must make related to the Chemical Contaminant List.
- ORD is coordinating with the U.S. Geological Survey, the Army Corps of Engineers and the Committee on Environment and Natural Resources to address research needs related to water scarcity, energy, and agriculture. There are many needs to study the relationships between wastewater, water quantity, agriculture, and energy, and the SSWR program must coordinate with the SHC research program.
- ORD is working with OW to explore the needs for future research to control microbial pollutants in drinking water.
- ORD is likely to expand research in the future to include a broader understanding of wastewater as a resource, rather than a waste, and to explore different definitions of water quality for different types of waters.

Sustainable and Healthy Communities

- It will take time for ORD to integrate all the components of previous research programs into a unified SHC program.
- SHC offers an important opportunity to test the concept of integrated transdisciplinary research
- ORD will need to train scientists for SHC work
- ORD will need to define more clearly what a community-based program should provide. The ORD interim National Program Director is taking a "first principles approach" and will build on his experiences with the ecosystem services research program

Chemical Safety for Sustainability

- For the CSS program, "sustainability" relates to recycling, green chemistry, lifecycle assessment, and identification of chemical characteristics that influence fate and transport.
- CSS is looking to possibly expand the Title 42 positions in the program, if EPA's Title 42 cap expands.

Human Health Risk Assessment

- ORD’s plan for the next fiscal year is to conduct innovative and traditional assessments in tandem. In the long term, ORD hopes to use innovative CSS products to generate an increased number of health assessments more quickly.
- ORD recognizes that investments will be necessary to communicate with the public about the use of CSS tools for risk assessment

Homeland Security Research

- ORD’s planned research for FY 2012 involves data collection, i.e., targeted work on anthrax, radiological threats, and water systems.
- ORD is exploring open source options for developing and maintaining software products. This approach may be useful for HSR-developed software.

Discussion of draft summary comments

Dr. Kevin Teichman provided a few remarks, noting the work group support for the new budget structure and their appreciation that, in tandem with the FY 2012 budget, ORD had developed “a whole new way of thinking about research.” He noted that ORD will be providing much greater detail to the SAB in June 2011 about research action plans, themes, timelines, and planned initial accomplishments.

Dr. Jerald Schnoor thanked work group members for their active participation. He asked them to revise their preliminary work group responses (Attachment A) in light of the work group discussion and provide revised text to him and the DFO by the end of the day, so that they could help the SAB Chair develop written testimony for the House Science, Space, and Technology Committee by March 8, 2011 and integrate text into a draft report for work group members’ review by March 11, 2011.

The Designated Federal Officer adjourned the meeting at 3:15 p.m.

Respectfully Submitted:

/S/

Dr. Angela Nugent
SAB DFO

Certified as True:

/S/

Dr. Jerald Schnoor
SAB Work Group 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: Preliminary work group responses to key questions

Air, Climate, and Energy;

1. How well will the requested budget permit EPA to advance its strategic research directions and meet EPA priorities?

ORD research on Air, Climate and Energy (ACE) is slated to decrease by \$3.4 million dollars from \$111.4 million in 2010 (enacted budget) to \$108 million in the President's 2012 proposed budget – a decline of about 3 %. Relative to other budget cuts, this is modest, and it indicates that certain research programs like biofuels (\$2.2 M) and mercury-in-air regulations (\$2.4 M) are completed and are no longer in the budget. But there are cuts in resources to the Clean Air Research Program for source receptor and dose-effect research that investigate human exposure to air pollutants and resulting health effects in Detroit and elsewhere (\$ 150 K) which is a high priority, and also cuts in research on the effects of climate change on estuaries (\$625 K). Funds for the modeling and development of State Implementation Strategies will be reduced (\$ 762 K) and SBIR programs (\$247 K) which would have met the priorities of the Agency and created jobs. Overall, CERES (2011) estimates that the National Ambient Air Quality Standards alone will result in the creation of 1.5 million jobs over the next five years. The country needs clean energy and jobs.

2. Are the changes since the FY 2010 enacted budget and EPA's research budget trends appropriate, taking into consideration overall resources, FTEs, intramural and extramural resources?

There is not enough detail to say with certainty whether the budget trends are appropriate. Certainly ACE should be a priority for the agency. Although air quality has gotten much better over the decades as a result of EPA research, monitoring, and enforcement, fine particulate matter and ozone are responsible for a large fraction of the human health effects in the U.S. each year caused by pollution, and OMB estimates that the benefits of air pollution regulations far exceed their costs. In addition, climate change and energy choices are among the most important issues looming before the country, and they should be made an extremely high priority for EPA to research the most cost-effective, job-creating, policies possible to ensure our safe energy future. Climate change mitigation is roughly without change in the President's 2012 budget compared to the 2010 enacted budget, but it should be a high priority for more funding on both mitigation *and* adaptation.

3. Are there well defined objectives/work products for next year's budget? Can these be accomplished with the given resources?

Yes, there are well defined objectives and expected accomplishments for the 2012 budget year. We don't know exactly the stage of each of those investments. Furthermore, there are certain objectives that seem to be missing. For example, Theme 3, Bullet 2: *Develop integrated approaches to assess how social and economic factors affect vulnerability to air pollution and climate change.* We didn't hear anything about social and economic research to address this item. Research is needed in how to encourage *behavior* that sustains and improves the

environment, such as driving habits, recycling, reducing carbon footprints, which are small investments with big returns.

4. Are there pivotal, “game changing” investments that can advance the science?

Yes, there are initiatives to research and implement a whole, new air monitoring network using the latest breakthroughs in technology which promise to be much more cost-effective and enlightening for mixtures of air pollutants. The Near Road/ NEXUS program promises important new information on road-side exposures, an important human health and environmental justice issue. However, we recommend that the Agency implement another game-changing investment in the social sciences as they relate to behavior. By a small investment in behavioral science, EPA ORD could research how to accomplish regulatory goals much less expensively with alternate incentives other than enforcement actions. There should be an entire new research effort in alternate means to attain improvements in air quality and greenhouse gas emissions without the traditional command-and-control options and enforcement actions. This would revolutionize the way we protect humans and the environment and may prove popular with citizens, business, and Congress alike.

5. Are there investments that will serve multiple program or multiple priority needs?

ACE is already a realignment that makes much sense and brings together ORD programs with tremendous synergy. There are many cross-cutting issues between ACE and the other research areas as well: atmospheric nitrogen deposition to watersheds, social and behavioral science on changing climate and water resources, and the energy-water nexus just to name a few. We can't have clean energy resources in the future without water availability, and we can't create clean water by desalination or water reuse if we don't have abundant energy supplies.

One of the model projects for which we applaud ORD is the cook stove project. Two MOUs were recently signed with the Peace Corps to expand the use of safe cook stoves in developing countries. However, it may be possible to collaborate and use the expertise of 60 universities who have Peace Corps M.S. training programs to involve graduate students both before and after their service to expand greatly the efficacy of this program.

Safe and Sustainable Water Resources;
Recommendations:

- We wish to commend the Safe and Sustainable Water Resources (SSWR) Program for their dynamic research activities over the past year. The realignment of research themes from separate Drinking Water and Water Quality programs into Integrated Water Resources and Water Infrastructure will increase efficiency and foster transformative research that focuses on entire watersheds from ecological to human perspectives.
- We applaud the realignment and integration process that has been undertaken by the agency. It is clear that by implementing this alignment and integration that the Agency is

responding to recent recommendations and suggestions of the SAB and other external advisory groups.

- The proposed SSWR 2012 research program is generally appropriate and we believe that great strides will be made in the coming year towards meeting the proposed research goals.
- Specifically, we are very supportive of the \$6.0M increase to develop innovative new tools and information research in the development of green water infrastructure, especially in the face of nationally restricted financial resources. However, we do have several concerns regarding whether specific foci and if funding is sufficient to meet a broader based perspective. In 2012, SSWR appears to generally focus on urban systems, specifically the management of stormwater. This is too narrow.
 - First and foremost, given the tight integration of larger watersheds with urban water resources (as sources of water and downstream end members), larger watersheds need to be explicitly studied. Only in this manner, can specific program goals that focus on innovative solutions to reducing and managing groups of chemicals and pathogens, and nitrogen and phosphorus pollution, be obtained.
 - We also note that the new paradigm in wastewater management is to view it not as a waste, but as a resource that can provide water, nutrients, and energy to meet social, economic, and environment needs. This paradigm fits within ORD's focus of sustainability and a systems approach as this ties management of wastewater with issues that include food production, land use, water quality, and energy production. It also provides opportunities to advance science in understanding of direct and indirect energy use in public infrastructure as well as understanding of the risk associated with use of nonpotable water. There is also a strong social/behavioral component to this type of research. We recommend that ORD's budget demonstrate a leadership role in this effort to assist the many water/wastewater utilities in the Nation make critical advances in these areas.
- We are very supportive of the \$4.2M increase in funding to assess the potential public health and environmental risks associated with hydraulic fracturing. The combination of three retrospective analyses and two new case studies will provide critical knowledge on the large scale impacts of these processes from an ecological and human health perspective. While the funding is sufficient for this fiscal year, we want to encourage the SSWR program to ensure that new case studies are conducted that expand on the knowledge gained from this initial program in future years and proposed funding levels for 2012 are likely insufficient.
- We understand the \$2M reduction in the Beaches Program. However, these studies are still critical and we would like to caution the program to provide a phased reduction approach that maintains the high quality research and management guidelines that has already come out of this research.

Misc. Notes

1) Not clear how “green infrastructure” is defined

- Urban infrastructure (eg. Drinking water distribution systems? Sewerage systems? Treatment plants?) vs. watershed-level (eg. drinking water source protection and watershed system (eg. NYC watershed?)
- Storm water management ??
 - Developing innovative sustainable solutions to aging water infrastructure....
 - Developing new approaches for evaluating and managing groups of chood and emciasl and pathogens?
 - Develop new and innovative approaches for redugin and managing Na nd P pollution.

2) Hydraulic fracturing study

Proposing 5-10 “case studies” for \$4.2 million and +5.0 FTEs (according to Budget Narrative pg. 14)

- What is the time frame for this activity?
- Does this mean only 5 FTEs working on this or 5 FTEs in addition to an existing team working on this?
- Does this involve drilling test wells? collecting and testing samples for multiple compounds? hydrogeologic modeling? conducting risk assessment? Is there existing data?
- Our gut reaction is that 10 case studies will clearly not be possible at this funding level.
- Will this effort be in collaboration with other federal or state agencies?

3) Beach Development and reduction? 2 Million

It is not clear how the Agency/ORD decides when their “immediate needs are met” (eg. Beaches Studies) or that “tools have been sufficiently developed” and no further research is needed.

How are the Regional and Program Offices involved in these decisions about when the research goals have been met and the project can be disinvested? Are these the “clients” for these tools and scientific products?

Are the water utilities considered “clients” for the tools and scientific products?

Sustainable and Healthy Communities;

1. How well will the strategic budget permit EPA to advance its strategic research direction and meet priorities?

- Sustainable and healthy communities aims to develop an integrated systems approach to find solutions for decision makers and stakeholders.
- The strategic budget reduces Programs in advanced monitoring, superfund, and ecosystem mapping.
- It increases funding for STAR Fellowship program to 14 million, which is a Presidential STEM initiative.
- The total budget is reduced by 21 million.
- core areas:
- 1. Pilot on urban communities
- 2. Human health protection
- 3. Barriers to community sustainability. (SAB reviewed)
- 4. Performance measures
- Strategic outcomes are provided however there needs to be a better mapping between outcomes and FTE and budget

2. Are changes in last years budget and EPA's research budget appropriate taking into consideration overall resources?

- FTE reduces by 25.3. Budget reduces by 21.1 million, 14 M in ecosystem services, children's health centers, oil spills, advance monitoring and Superfund
- 17 million reduction in s&T
- Significant reduction (3.6 million) of superfund and RCRA, ecosystem research? A: Yes
- This reduction will impact the OSWER future Programs? A: Yes
- No specific were given on the work that will be discontinued
- Does Reduced s&T dollar will mean less research? Yes
- No detail on extramural funding other than fellowships given
- Modeling, especially ecosystem services, being greatly reduced, critical to integrating disciplines for solving community problems
- Are programs consolidated, have they reached their endpoint? A: No, in ecosystem services, adapt research to needs of communities; in land context; move existing studies in new direction

3. Are there well defined objectives and is possible to do it in the budget?

- Point to conceptual origins in ORD's work on ecosystem services. Ecosystem service an important concept SAB has explored and supported
- Objectives integrated research to address specific health and environmental needs of local communities through realignment of following
 1. Fellowships

- 2. Human health
 - 3. Sustainability
 - 4. Land protection
 - 5. pesticides
 - new core areas:
 - 1. Pilot on urban communities
 - 2. Human health protection
 - 3. Barriers to community sustainability. (SAB review)
 - 4. Performance measures
 - Objectives are reasonable globally but the specific detail is missing
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 - No timeline provided for work products
 - Multiyear investments were not detailed
4. Are pivotal game changing investment defined?
- Identification of barriers to community sustainability may be game changing
 - Tools may be developed for local decision makers and stakeholders
 - May increase EJ equitable solutions by taking general modeling approaches and conducting pilot projects
 - These programs may need multiyear investment
 - STAR funding will positively impact the future of the workforce and is an investment in innovation
 - Life stage susceptibility is important at both ends of the life cycle; this susceptibility should be addressed in the 2012 projected accomplishments
 - Cumulative risk assessments become important as projects consider interactions among human health, ecosystems as well as economic, sociological and nonchemical stressors.
 - As project investigate interactions among human health, chemical stressors, etc. there is need to explore the epigenetic effects that can potentially result in transgenerational changes
 - Need for investment in evaluating this research area as testbed for ITR - to test concept and measure impact
 -
5. Are there investments that serve multiple Programs?
- CFERST adaptation
 - Technical guidance for EJ
 - Green infrastructure
 - Non invasive methods for mold and asthma
 - Decision framework for communities
 - EPA has an opportunity to develop transdisciplinary research through the consolidation however more detail needs to be provided on Outcomes, objectives, FTE realignment, and budget

Chemical Safety and Sustainability;

1. *How well will the requested budget allow EPA to advance its strategic research directions and meet EPA priorities?*

The budget for this program appears justified and should allow the program to achieve its goals as they are outlined by the program director.

It is important to recognize and congratulate EPA on the ambition of the realignment and the forward-looking approach the Agency is taking. These changes will allow the Agency to streamline its work and be more effective in achieving public health and environmental protection.

2. *Are the changes since the FY 2010 enacted budget and EPA's research budget trends appropriate, taking into consideration overall resources, FTEs, intramural and extramural resources?*

The changes in proposed budget relative to FY 2010 appear to be fully cognizant of the overall resources, FTEs and intramural/extramural resources. The agency has needed to develop more robust transdisciplinary research directions, and the articulation of the ORD's realignment is a good step in this direction. It leverages the talents and expertise of existing ORD staff to go beyond individual disciplines. The staff are well trained to conduct excellent research. By realigning these scientists to work with each other toward common new research goals, the Agency will be able to successfully implement the goal of true multi-disciplinary research. The Agency should take the time to ensure that staff scientists are formally developed as this program progresses and that they are brought on board this new initiative. Clearly, this research capacity is important for the success of the realignment.

3. *Are there well-defined objectives/work products for next year's budget? Can these be accomplished with the given resources?*

The specific objectives for next year's budget period could be better defined. This is a new program consolidating the strengths and assets of numerous former programs, so it is understandable that there are ambiguities in the presentation of specific objectives and the specific timeline for these goals. Some research areas appear overly broad, such as "Targeted high priority needs". The program is taking on former programs that identified focused and useful activities (i.e., computational toxicology, pesticides, endocrine disrupting chemicals, etc.), yet the new research areas appear unfocused and too vague. Therefore, it is very difficult to assess whether the objectives can be accomplished with the given resources given how broad the areas are. However, the broad objectives do represent Agency steps toward conducting more transdisciplinary research.

This program appears to be very forward-looking and visionary. If given more resources, it appears that it could lead EPA in a number of other areas, including improved ecological risk assessment through modeling and simulation, improved exposure assessment (a critical need as EPA moves forward with more routine aggregate exposure and cumulative risk assessments),

and computational approaches to green chemistry. Consider allotting more funding to allow these areas to be modernized.

4. *Are there pivotal, “game changing” investments that can advance the science?*

The program has the potential to make game-changing contributions in predictive toxicology and in decreasing uncertainty in risk assessment through the use of state-of-the-art screening methods and computational approaches.

Of all the new program areas, this one has the most potential to accomplish game-changing objectives. These include: 1) development of approaches to assess multiple contaminant exposures; 2) reducing the use of animal models to assess toxicity and relying more on predictive models; 3) develop tools that can be used in the medical field to further our understanding of individualized medicine.

The program has been very creative in accessing data sources (e.g., data on discontinued pharmaceuticals) at no cost to the Agency.

The program could serve as a model for the rest of EPA R&D in the use of computer modeling and simulation as a first step, rather than empirical testing

By combining the endocrine disrupter screening program with the computational toxicology program, there is a significant opportunity for the former to be modernized and provide much more valuable information for decision-making.

Placing the NextGen risk assessment program in the Chemical Safety and Sustainability program makes sense in that it will allow more seamless transfer of basic science into risk assessment methodology; however, special attention will be required to ensure that the methodology is being carried over into practice, as this is still within the purview of the Human Health Risk Assessment program.

There was concern that there is no pro-active initiative to develop ways of employing high through-put data into hazard or risk assessment. This is a significant weakness.

Combining multiple programs under CSS makes sense from a green chemistry standpoint, but there was not a lot of emphasis on life-cycle assessment in this program. If it's there, EPA should emphasize it more.

5. *Are there investments that will serve multiple program and multiple priority needs?*

Much of the work in this program will serve other programs and other priority needs. One could make the argument that this program will generate information that will be required across programs within the Agency and across different federal agencies.

Health and environmental implications of nanotechnology appeared throughout the presentations today and was included for this program area as well. However, NIH and other federal programs are actively and heavily funding the development of nanotechnology for commercialization of products. The budget appropriated to evaluating the health and environmental impacts of

nanotechnology is not sufficient for EPA to stay out in front of this technology development. Is there any attempt for EPA to work together with other funding agents to reconcile the federal government's priority to develop and commercialize nanotechnology with the need to assess the impacts of nanotechnology on human health and the environment? The dollar amounts to develop nanotechnology dwarf the dollar amounts to assess its impacts.

Human Health Risk Assessment

1. *How well will the requested budget allow EPA to advance its strategic research directions and meet EPA priorities?*

Inasmuch as the 2012 budget represents only a slight reduction (about \$600,000) relative to the 2010 enacted budget, the EPA appears to be in reasonable shape to maintain its strategic research and meet its top priorities. The increase in FTEs by 13 also appears to be appropriate – presumably many of these will be EPA scientists with specialized risk assessment training. However, the IRIS reviews in progress are ambitious and the Agency will be required to manage these reviews carefully. Moreover, it will be challenging for the Agency to incorporate new information – and new types of information resulting from Tox21 program – into IRIS and other assessments.

2. *Are the changes since the FY 2010 enacted budget and EPA's research budget trends appropriate, taking into consideration overall resources, FTEs, intramural and extramural resources?*

It is difficult to imagine how the Agency will avoid being in the position in a few years in which areas of modernization within the Agency are offset by the lag in the ability to use modern science to protect public and environmental health. So, the budget changes since 2010 do not appear to be sufficient for innovation and modernization of risk assessment for the Agency.

As EPA moves from risk management paradigm to sustainability paradigm, increased resources are needed.

3. *Are there well-defined objectives/work products for next year's budget? Can these be accomplished with the given resources?*

The objectives/work products for the next year were well articulated and it appears that the goals as outlined can be accomplished with the given resources, as they were in 2010 and 2011.

4. *Are there pivotal, "game changing" investments that can advance the science?*

Integrating Tox21 data into risk assessment will require investments that will be essential to modernize our ability to predict human and environmental health risks. Who makes these investments?

The multi-pollutant, cumulative risk approach is a potential paradigm shift in how we assess chemical risks. Perhaps the ambient air pollution multi-pollutant science assessment under way could be considered a pilot for multi-pollutant assessments?

5. *Are there investments that will serve multiple program and multiple priority needs?*

The HHRA inherently serves multiple program needs. The IRIS assessments clearly link to all the other integrated ORD programs. The IRIS assessments are used by basic science programs as well as regulatory programs not just in EPA but in other agencies and by states as well. This program is a shared federal resource.

The ISAs are extremely important to the NAAQS reviews and thus are integrally related to the ACE program.

There are strong potential linkages to the CSS program – the HHRA program will clearly need to work with CSS to use the CSS output appropriately and maximally.

Homeland Security.

1. How well with the requested budget permit EPA to meet proposed 2012 research activities and advance its strategic research directions and meet EPA priorities?

This program sits within an individual program with a very well defined mission. The Center for Homeland Security was initially charge to quickly develop and deliver products quickly, with the plan that the Homeland Security Research Center would be sunset after three years. However, it has been very positively received within the Agency and by the users of its products. Therefore, EPA has supported maintaining its effort because of this recognizes its value. Over half of the \$24.684 million request is directed towards monitoring and decontamination after a chemical, biological, or radiological release, including response to wide area anthrax attack. The safe buildings program was zeroed out for the proposed 2012 budget. Remaining funds of \$9.047 million are allocated to an “other” category.

The program activities related to developing contamination approaches to wide areas is limited because of budget restrictions that only allow for smaller pilot level tests which limit application to evaluation decontamination over much larger spatial scales. The efforts are focused on evaluating single agent releases and no budget is provided to address release of mixtures. This is in line thought with other EPA activities in evaluating exposure to single chemicals.

Though the Center for Homeland Security’s products are used and respected by other groups within ORD, There appears to be little allotted for deployment of more resilient infrastructure that could still function in case of a release.

It is important that the Homeland Security program see EPA’s regional and program offices as clients for its water related research. It would also be helpful to clarify the basis for EPA’s conclusion that the Water Security Initiative (WSI) is maturing so that its budget can now be reduced. Does the HS Program consider water utilities to be clients for its real-time water monitoring and decision-making tools and products? If so, how does the Program communicate with the water utilities on their needs for these tools and their experience would these tools? Why should the new real-time modeling and decision tools be privatized? Do they need further development before they can be disseminated? EPANET is public domain software. Why not use this model for the new tools developed by the HS Program?

2. Are the changes since the 2010 budget and EPA's research budget trends appropriate, taking into consideration overall resources, FTEs, intramural and extramural resources?

A 75% reduction in methods development for analyses of chemical, biological and radiological warfare agents is a huge reduction in a single program. The changes since the 2010 budget may be appropriate as several programs within the Center for Homeland Security are mature. We caution however, that many of the proposed 2012 activities are related to data collection that in this case are resource intensive activities, especially given the nature of potential releases.

3. Are there well defined objectives/work projects for next year's budget? Can these be accomplished with the given resources?

The Objectives appear to be very broad and we felt there was inadequate information on the research tasks that are going to be performed to achieve these objectives. For example, for "developing microbial risk assessment methodologies" - is the need really to develop methods? Or develop more data that could be used in these risk assessments. The Center has a record of developing and releasing materials in a timely manner that are well respected within and outside the Agency. The program has plans to disseminate water security related products to its users at the State and local level. Many of the 2012 activities are related to data collection efforts which are resource intensive in terms of this particular research area.

4. Are there pivotal "game changing" investments that can advance the science?

There do not appear to be investments aimed at a better understanding of the factors that shape the resilience of infrastructure and communities that have experienced the disruptions associated with attack or natural disaster. The disaster-response research community has investigated this question from a social science perspective, and it would make sense for the Homeland Security staff to engage with that group of research scholars and the governmental and nongovernmental entities making use of their findings. ORD efforts in this area could benefit

5. Are there investments that will serve multiple program or multiple priority needs?

The majority of proposed research activities are directed to monitoring and decontamination after a chemical, biological, or radiological release. EPA makes a significant contribution to the nation's ability to respond to natural disaster and unconventional warfare, because of the Agency's expertise in identifying and handling toxic substances in environmental media. Within the Agency's and ORD's emphasis on sustainability, we believe the organizing theme of the homeland security activities should be resilience in the face of sudden disruptions. This would meet multiple agency needs and also provide opportunities for some game changing investments.

It is relevant to note that some dimensions of resilience are rooted in social capital and landscape-level environmental design. Social capital is a measure of the capacity of a human community to mobilize under surprising and stressful conditions, drawing upon relationships that were not developed with emergency response in mind. Stable, sustainable human communities are more likely to possess social capital that can add to resilience. The ecosystems providing

essential services to people, such as water supply, food distribution networks, and the capacity to cleanse polluted air, also contribute to resilience after sudden disruption.

Strengthening social capital and adding to the resilience of ecosystem services are tasks that are not conventionally included in “homeland security,” but their essential role in social and environmental policy should be taken into account when targeted expenditures are sharply reduced, as is proposed.

EPA could make some game changing investments in this area that would cross over to other programs (such as water reclamation/reuse) if they added resilient infrastructure to this area. This would allow EPA to study the deployment of infrastructure in a decentralized or centralized manner, which will impact design and operation and performance, but also draws in issues of evaluating new technology, which is integrated with issues of individual, household, and community behavior, along with policy initiatives. The recent example of the Christchurch earthquake provides a great example related to dependence in centralized water and sanitation provision.

ORD stated their Water Security Initiative (WSI) is maturing and some aspects of the research program are reduced (please explain second bullet on page 66 of the 71page narrative). Besides issues we discussed above related to resiliency, the water security initiative can serve other research needs related to optimal deployment of water reclamation/reuse facilities, monitoring of distribution systems, and water quality issues associated with sprawl and the debate versus providing treatment in a centralized or decentralized manner.

Economics and Decision Science

Sustainability is a challenge grounded in the human dimensions of a coupled human and natural system: humans are the driving force of environmental changes both good and bad, and human institutions and behavior will have to change if a transition toward a sustainable economy is to be achieved. It is accordingly striking that EPA’s budget accords so little explicit attention to research on the human elements of coupled systems. Economics remains a stepchild of EPA, and decision sciences has become a foundling. The fragments of social science research continue to be exposed to the harsh winds of a declining budget. A long-term dataset, the Pollution Abatement Cost and Expenditure survey series, is a casualty of these cuts, limiting our ability to understand the economic implications of environmental regulation; this is a serious loss because of the length of time needed to collect data on industries making long-term capital investments in response to globalization and national economic shifts, as well as environmental regulations. NCEE retains a function as an internal consultant group, available for studies in the Office of Policy and elsewhere within the Agency. This is a potentially important function, not only for EPA’s immediate responsibilities, but as a way to maintain awareness within EPA of the perspectives and utility of understanding the human dimensions of environmental problems. Yet social science has no explicit place within the four national program areas around which ORD is being reorganized. We appreciate the understanding displayed by Assistant Administrator Anastas about the need for social science as a cross-cutting theme, but that understanding needs to be translated into a durable institutional presence in the Agency if the human dimensions of sustainability are to become a permanent part of EPA’s approach.

The neglect of social science is a problem of long standing, on which the SAB has commented repeatedly through the years. A time of politically frightening budget deficits is not a moment for a sweeping vision of investment in the social sciences. But people and the institutions that shape human behavior-including markets and informal norms, as well as the regulations and laws that fall within EPA's legal responsibility-are central to sustainability. The nation can't get there from here without engaging with those dimensions.

Answers to questions

1. How well will the requested budget permit EPA to advance its strategic directions and meet EPA priorities?

It appears that the total budget devoted to EDS is \$1M (plus an additional \$0.4M for NCEE) with a total of 3+ FTEs. This is barely enough to keep the Center and the program alive, much less to advance strategic directions.

2. Are the changes since the FY 2010 enacted budget and EPA's research trends appropriate, taking into consideration overall resources, FTEs, intramural and extramural resources?

The FY12 EDS budget represents a 17% decrease from the FY10 level of \$1.2M. Recognizing that budgets must decrease, we nevertheless think that the EDS budget should have moved in the other direction. Economic and especially decision sciences cut across the Agency's goals, yet the budget marginalizes them. This strikes us as misguided, because relatively small investments in these areas can provide large benefits.

3. Are there well defined objectives/work products for next year's budget? Can these be accomplished with the given resources?

It appears that efforts will be directed towards children's health protection and water valuation, but only two projects seem to be well defined, both under water valuation. These are modeling cost-effective nutrient management options for the Chesapeake Bay and modeling welfare impacts of ocean acidification.

We understand that the very limited budget makes it difficult to accomplish very much, and these few projects may be sensible, given that they address problems that cut broadly across the Agency.

4. Are there pivotal, "game changing" investments that can advance the science?

In a word, no. The budget is too small to be game changing in any sense. We applaud the fact that NCEE is directing a substantial portion of its limited funds to external grants, especially for graduate student research, as this is a good way to leverage resources and to bring new economists into environmental research. However, there is little evidence that this program can similarly affect the other social, behavioral and decision sciences. We deplore the elimination of decision sciences from the portfolio. It is apparent in the Agency's strategic plan that the decision sciences, and more generally the

- behavioral and social sciences, should be playing increasing roles in EPA's portfolio of research activities. They are mentioned throughout, but receive no funding.
5. Are there investments that will serve multiple programs or multiple priority needs?

In a sense the entire budget serves multiple programs.

An added comment beyond responses to the five questions: EDS was moved from ORD to NCEE in 2008. It seems that within these three years, the DS was dropped from EDS and we think that this is a mistake. We urge consideration of bringing the decision sciences back into ORD and expanding its mandate to include the behavioral and social sciences more broadly as an explicit research enterprise. This need not be a new program, but can be accomplished effectively by treating it as a cross cutting strategy.

Specifically, looking at the Agency's FY 2011-2015 Strategic Plan, which focuses on five strategic goals and five cross-cutting strategies, we propose that a sixth cross-cutting strategy be added and funded in the future. This strategy would be:

- Working to encourage behavior and facilitate decision making that sustains and improves the environment.

Two examples of the activities that would be encompassed by this strategy are

- Develop models and methods for engaging communities in dialogs to help identify and define human health and environmental protection goals and to help communities construct desired future conditions.
- Do or support the research necessary to encourage environmentally-friendly behaviors, such as altering driving habits, increasing recycling, making better use of energy labeling in purchasing decisions, investing in home insulation, adopting smart electricity meters, and more.

Research in these areas is inexpensive relative to the costs involved in much of the physical and biological sciences. Therefore, relatively modest investments in this cross-cutting domain could have large payoffs down the road.

Two overall policy recommendations

1. FOR ORD: We urge consideration of bringing the decision sciences back into ORD and expanding its mandate to include the behavioral and social sciences more broadly as an explicit research enterprise. This need not be a new program, but can be accomplished effectively by treating it as a cross cutting strategy. This recommendation seems especially pertinent in that each of the four research programs has acknowledged sets of issues in the decision, behavioral, and social sciences, ranging from decision analysis/structuring to risk communication to behavior change and beyond; yet none seem to have devoted any resources to it.

Two examples of the activities that would be encompassed by this strategy are

- Develop models and methods for engaging communities in dialogs to help identify and define human health and environmental protection goals and to help communities construct desired future conditions.

- Do or support the research necessary to encourage environmentally-friendly behaviors, such as altering driving habits, increasing recycling, making better use of energy labeling in purchasing decisions, investing in home insulation, adopting smart electricity meters, and more. Research in these areas is inexpensive relative to the costs involved in much of the physical and biological sciences. Therefore, relatively modest investments in this cross-cutting domain could have large payoffs down the road.

2. FOR THE AGENCY: Looking at the Agency's FY 2011-2015 Strategic Plan, which focuses on five strategic goals and five cross-cutting strategies, we propose that a sixth cross-cutting strategy be added and funded in the future. This strategy would be:

- Working to encourage behavior and facilitate decision making that sustains and improves the environment.

By including this strategy, EPA will focus attention and, perhaps, modest resources in this direction. Among the benefits of adding this cross-cutting strategy, in addition to facilitating relevant scientific advances and problem-solving, will be to attract decision, behavioral, and social scientists to work on environmental issues.

Members of the public attending the public meeting:

Sally Darney (by telephone)

Ann Vega (by telephone)

Materials Cited

The following meeting materials are available on the SAB Web site, <http://www.epa.gov/sab>, at the page for the [March 3-4, 2011 meeting](http://www.epa.gov/sab):
<http://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/73b87d4726595023852577ff005be5bc!OpenDocument&Date=2011-03-03>

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- ¹ Roster, SAB Research Budget Work Group Members
 - ² Federal Register Notice Announcing the Meeting
 - ³ Agenda
 - ⁴ FY 2012 President's Budget (Presentation by Carol Terris).
 - ⁵ FY 2012 President's Budget Request for the Office of Research and Development - Presentation to the Science Advisory Board by Paul Anastas and Kevin Teichman
 - ⁶ Update on Innovation in ORD - Presentation by Jay Benforado
 - ⁷ Air Climate & Energy - Presentation by Dan Costa
 - ⁸ Safe and Sustainable Water Resources - Presentation by Jennifer Orme-Zavaleta
 - ⁹ Sustainable and Healthy Communities - Presentation by Rick Linthurst.
 - ¹⁰ Economics and Decision Sciences Presentation from the National Center for Environmental Economics
 - ¹¹ Chemical Safety for Sustainability: EPA Research to Meet 21st-Century Needs - Presentation by Robert Kavlock
 - ¹² ORD Human Health Risk Assessment (HHRA) Program - Presentation by Becki Clark
 - ¹³ Homeland Security Research Program - Presentation by Gregory Sayles