

**Additional Preliminary Comments received after July 6, 2012, 12:00 p.m.
for the July 10-11, 2012 SAB/BOSC Meeting**

List of comments received

Comments from Dr. Terry Daniel.....	2
Comments from Dr. H. Keith Moo-Young.....	7
Comments from Dr. James Opaluch.....	17
Comments from Dr. Jonathan Samet	21
Comments from Dr. James Sanders.....	24
Comments from Dr. Peter Thorne	25

Comments from Dr. Terry Daniel

The Strategic Research Plan for the SHC Research Program is exciting and well written. The core focus on sustainability is consistent and the definition of sustainability within the program is clear and nicely operationalized by the TRIO approach to assessments and modeling. The relationships (and interrelationships) to the other research programs is very clearly presented and appropriately highlighted.

The SHC program is unabashedly devoted to “translational” science motivated by the very practical needs of EPA offices and regions and of the communities and stakeholders the Agency serves. In this context there is strong emphasis on bringing the best science to bear to identify and understand pressing environmental management problems and on developing and transferring innovative technologies and tools so that client communities and stakeholders can affect sustainable solutions. This approach is a much needed advance from risk-based models that too often have been restricted to singular threats in singular environmental media.

The SHC program is a poster child for the dramatic transformation of ORD research that has been carried out under difficult economic and political circumstances. There is much left to be done and threats external and internal to EPA and ORD could yet derail this important effort. But it is a valiant effort that deserves to succeed, to the benefit of the country and the planet.

Some specific comments and suggestions are organized below under the themes and topics presented in the Summary Tables of Outputs and Outcomes presented at the end of the report.

Theme 1. Data and Tools to Support Sustainable Community Decisions

Topic 1.1 Decision and Information Science

Outcomes: Outputs created under this theme will help EPA and its partners to better understand the scientific, economic, and social dimensions of community sustainability issues, leading to more effective environmental decision-making.

Framing Sustainable Decisions and Enhancing Collaboration

Community typologies to guide future community selection for collaborative FY2013 research and tool development

[It is appropriate for EPA and SHC goals that biological setting (ecosystems) is the first dimension for classification of communities, but the constituents and characterizations for this dimension have to anticipate and be compatible with the social and demographic factors that must also be incorporated. Together the biological and social factors must interact to define the ecosystem services factor. Most importantly, defining/classifying ecosystems goods and services requires that the “values/needs/wants” that distinguish communities be linked effectively to the capacities and capabilities of their associated ecosystems.]

Collection of tools and processes for community decision analysis	FY201 4
Compilation of best practices for community and stakeholder engagement	FY201 4

[These tools/practices need to be “state of the (decision) science.” Meetings and listening sessions are an important part of this process, but more structured and more guided methods will be required to attain consistent and valid representations of community values, needs/wants and understandings of relevant ecological, economic and governmental/legal capabilities and constraints (in a sustainability context), as well as the conflicts and synergies these impose on TRIO goals. Talking to and listening carefully to the talk of communities will not be sufficient.]

The Communication and Community Engagement Plan will describe the activities, processes and timeline where ORD will collaborate with EPA, HUD, and DOT community based programs and our partners including universities to systematically and more effectively identify community issues, develop and deliver science products, and develop networks for building capacity in communities to empower communities for better decision-making. 2

[This process should include some initial formal applications of value construction, facilitated deliberation, multi-criterion and other modern decision science methods early in the design and development of communication tools and processes, including determination of stakeholders’ concerns about the communication/decision making processes per se.]

Topic 1. 2 Assessing Community Sustainability

Outcome: Outputs created in this theme area will form the foundation for a toolkit of innovative, non-mandatory solutions to varied and complex sustainability problems.

Existing and New Tools (models, methods, frame works, etc)

Inventory of relevant community sustainability tools and peer review evaluation of effectiveness and accessibility of existing tools FY2012

[Some assessment of community understanding/acceptance of these tools should also be included—including variations in communities’ understandings of the parameters of sustainability (viz. time, space and equity dimensions, for example).]

Providing Indicators and Indices to Assess, Track, and Inform Community Sustainability

Updated guidance document and inventory of available sustainability and performance indicators in a searchable database; Prototype completion of web tool for searching database FY2013

[As noted above, there needs to be frequent and effective interaction with stakeholders/communities regarding selection, definition, measurement and reporting of indicators, as well as the features and functions of the web-based tools for accessing an using them.]

Theme 2. Forecasting and Assessing Ecological and Community Health

Topic 2. 1 Quantifying Production and Valuation of Ecosystem Goods and Services for Sustainable Communities

Outcomes: Outputs created under this topic will provide federal agencies with consistent, effective, and broadly applicable information on the distribution of ecosystem service benefits, as well as how this distribution changes based on land use, transportation, housing and infrastructure choices, and materials management.

[It should be more explicit under this theme that characteristics of the “client community” are at least as variable and as important (viz. EGS and their values/vulnerabilities) as characteristics of the target ecosystems. This is a critical point to make as you develop models, metrics and indicators for EGS—the needs and wants of potential client communities must explicitly be included! That is, one cannot map the distribution of EGS independent of the characteristics of the underlying “client” communities. An EGS map is necessarily derived from an overlay of community type x relevant ecosystem characteristics.]

Methods for estimating the transferability of ecological production, ecosystem goods and service production, and benefit functions across landscapes, and regions and to unmonitored locations FY2015

[Including transferability across client-community classes.]

Community-based EGS Research for Representative Communities

Incorporation of EGS production and benefit functions in specific decision-making contexts and forecast of intended and unintended consequences of different decision options FY2014

[Include feedback effects of community responses to the EGS and to relevant community characteristics.]

An accessible compilation of existing ecological production functions and benefit functions (models relating management options to changes in the timing, spatial distribution and quantity of a variety of ecological endpoints, and the social benefits of ecological goods and services derived from those ecological endpoints), with an assessment of critical missing data FY2014

[Special and specific attention should be paid to the effects/interactions of community characteristics.]

Topic 2. 2 Improving Human Health and Well-being for Community Sustainability

Outcomes: EPA will have better data regarding factors contributing to disease, as well as the ability of the built and natural environment to enhance health outcomes.

Enhancing Community Public Health

Identification of the most prevalent environmental public health conditions in communities resulting in disparities in health and well-being between communities or populations for use in targeting and prioritizing research and generation of risk management methods FY2014

[Include some assessments of community/public awareness and appreciation of the identified health issues/risks in each of the tasks under this topic.]

Theme 3. Near-term Approaches for Sustainable Solutions

Topic 3. 1 Contaminated Sites

Outcomes: Outputs created under this theme will improve assessment, response, and remediation of ground water contaminants, sediment contaminants, vapor intrusion, fuel spills, and oil spills.

[No comments.]

Topic 3. 2 Materials Management and Sustainable Technologies

Outcomes: Outputs created under this topic will enable EPA to provide definitive guidance and more flexible options for handling waste disposal and materials.

Assessment of the state-of-the-practice in the beneficial reuse of materials to minimize waste disposal Collaboration with the States to assist in developing reuse options and with the private sectors in assessing technologies/processes

FY201

5

[There would seem to be important opportunities to use behavioral sciences to encourage, educated and otherwise persuaded users (consumers and industry) to use and reuse products/materials in ways that reduce waste in the first place, as well as altering waste streams toward those more easily and effectively addressed by reuse technologies/processes. As written, this topic seems unnecessarily limited to technological fixes.]

Topic 3. 3 Integrated Management of Reactive Nitrogen

Outcomes: Outputs under this topic will contribute to a comprehensive analysis of the nitrogen cascade and its effects on the environment.

[As in 3.2 above, social/behavioral science should provide sound approaches for getting farmers and others (along with their associated systems/institutions) who affect the nitrogen cascade to alter behaviors and practices toward greater sustainability.]

Topic 3. 4 EPA's Report on the Environment

Outcomes: The ROE, developed through a collaborative Agency-wide effort, is the EPA's most complete and reliable source of information on the status of the environment and trends over time.

[Will the web-based ROE offer readers/users the opportunity to model what if scenarios so that the interactions among indicators (and underlying processes) can be more easily seen in more realistic, concrete situations likely to be of interest to different stakeholders/publics?]

Topic 3. 5 Innovation and Technology to Foster Sustainability

[This is another place where social, behavioral and decision sciences should play a role—perhaps each student project (and guidance/advice to communities) could include a SBD science component.]

Theme 4. Integrated Solutions for Sustainable Outcomes

Topic 4.1 Community Decision Sector Analysis

Outcomes: The research produced under this topic will provide EPA and communities with greater flexibility in developing sustainable practices for materials/waste management, transportation alternatives, and the built and natural environment.

[In each of the synthesis report areas individual and social assumptions, expectations and preferences play important roles in determining what policies and practices can be successful. Relevant social/behavioral science should be included in each of the synthesis documents and in the recommendations, guidance and tools for management practice.]

Topic 4. 2 Integrated Approaches to Sustain the Built and Natural Environment and the Communities they Support

Outcomes: The outputs developed under this theme will improve analysis of linkages between community sectors, enhancing community sustainability.

Topic 4. 3 STAR Fellowships

Fellowships

Completed fellowships contribute toward a workforce ready to innovate and Annual implement trans-disciplinary approaches to a more sustainable future.

[Can you spell SBD science?]

btw--

I have recently become aware of the IBM Intelligent Cities program, which seems to offer an excellent opportunity for collaboration or at least consultation viz. getting EGS and other SHC goals incorporated or at least made compatible with the IBM systems are being adopted in some communities, and are likely to be extended to many others. At the very least, SHC should see what can be learned from IBM's efforts in this area.

Comments from Dr. H. Keith Moo-Young

I. DRAFT SAB/BOSC CHARGE QUESTIONS FOR EACH BREAKOUT GROUP

1. FIRST YEAR PROGRESS

The Strategic Research Action Plans were developed during 2011, with the benefit of SAB and BOSC advice [*Office of Research and Development (ORD) New Strategic Research Directions: A Joint Report of the Science Advisory Board (SAB) and ORD Board of Scientific Councilors (BOSC)*]. (EPA-SAB-12-001)].

Charge Question: How are the ORD research programs progressing in the first year of implementation?

ORD research programs are in the beginning stages of implementing the new strategic research direction. Very little information was provided prior to July 3 on the progress of the programs. It would be extremely helpful to provide updates and a synopsis of the progress. It is anticipated that in the July 10-11 meeting with the SAB/BOSC that the progress of the program will be elucidated.

Are the research activities planned for FY 13 and future years appropriate for answering the science questions in the Strategic Research Action Plan?

After reviewing the Strategic research action plan, the research activities strive to answer the science questions. Many of the deliverable are task based which many solve a particular problem which addresses some of the concerns in the strategic plan. However, with shrinking federal resources, it is extremely encouraging to see the long range planning for the strategic plan. One of the major questions is how will the resources be allocated in the future to assure that the major outcomes will be achieved in the desired timeframe.

2. SUSTAINABILITY

The SAB and BOSC concluded in the October 21, 2011 report that "...ORD's research frameworks can advance EPA's adoption of sustainability as a core principle by more consistently and clearly describing where and how ORD research relates to sustainability."

Charge Question: How are ORD programs contributing to sustainability through their research plans and activities?

ORD has made a significant effort to integrate sustainability throughout their research plans. Through consolidation of existing programs and strategic alignment of research themes, ORD should be commended for taking on this task. They have done an outstanding job of integration of sustainability.

What advice does the SAB and BOSC have for each research program about advancing sustainability in future research?

After reading the plans for integrating sustainability into future research plans, EPA ORD has done a very good job of striving to advance sustainability. One thing that could enhance their efforts would be to invest in the development of future human resources through increasing fellowship opportunities such as AAAS fellows and STAR fellowships. As expertise in the ORD continues to retire over the next five years, it would be advantageous for EPA to increase the number of new post docs, Ph.D. students, and M.S. students who can assist in developing the new research programs that advance sustainability.

3. BALANCING IMMEDIATE PROGRAM NEEDS AND EMERGING ISSUES

Meeting program and regional needs is a primary objective of ORD research. The highest priority needs of the programs tend to be those that are most immediate. Another important role for ORD is to anticipate the future scientific needs of the programs and regions, areas of research that tend to get less support from the EPA partners. Anticipating emerging issues and investing in innovative approaches that could lead to more sustainable, less expensive or timely solutions often requires longer term and potentially higher risk research. The Strategic Research Action Plans strike a balance in addressing current priorities and future science needs; however, new emerging issues will likely arise that are not currently anticipated.

Charge Question: As we consider science for the future, while budgets continue to shrink, how should ORD balance its commitments in the Strategic Research Action Plan with the need to advance science on emerging issues?

In R and D management, typically you would develop a portfolio of projects and then determine the competitive position vs the competitive impact. This is typically called the portfolio analysis. Technologies and products would be categorized as base, key or pacing, and the competitive position would be rated from weak to dominant. Another way to determine the type of projects would be to align the research projects from basic, applied, advanced technology development, demonstration/validation, manufacturing development, or management support. As a result of doing this analysis, ORD can then determine how they are spending their dollars for the various types of R&D projects. To facilitate sustainability leadership, ORD must spend its dollars wisely to continue to conduct groundbreaking research. Thus, having an analytical mechanism of determining how to balance emerging issues with pacing research and development projects is mission critical.

4. PROGRAM SPECIFIC QUESTIONS

Air, Climate and Energy Charge Question:

To create an integrated program, research in ACE is organized in three Themes: 1) Assess Impacts, 2) Prevent and Reduce Emissions, and 3) Respond to Changes in Climate and Air Quality. Research related to energy and environment is not a specific focus, but is most prevalent in Theme 2. Relevant topics include research on near-road air pollution, multi-pollutant research, and greenhouse gas impacts.

- How do we bring together research on biofuels, oil and gas measurement methods, combustion related pollutant effects and modeling/decision

support tools into a coherent whole to address the environmental effects of energy production and use?

I am assuming that the environmental effects of energy production and use are related to air and climate change. My suggestion to EPA would be to conduct a literature study of the research on these topics. Next, they should synthesize this literature review to determine the gaps in research. I think the ultimate goal for EPA as it relates to climate and air would be to integrate this into a risk assessment framework. This may be an excellent project for a STAR Fellow or AAAS Fellow.

EPA may consider developing a partnership with IPIECA. IPIECA is the global oil and gas industry association for environmental and social issues. IPIECA was formed in 1974 following the launch of the [United Nations Environment Programme](#) (UNEP). IPIECA is the only global association involving both the upstream and downstream oil and gas industry on environmental and social issues. IPIECA's membership covers over half of the world's oil production. IPIECA is the industry's principal channel of communication with the [United Nations](#).

Safe and Sustainable Water Resources Charge Questions:

• ORD has integrated programmatic research, with EPA Program Office input, to begin developing a strategic nutrient management plan for the nation with the intent of accomplishing the SAB's recommended goal to reduce reactive nitrogen by 25 percent. Are there research gaps that would impede accomplishing this goal? (for example, should we be looking at green infrastructure for removing nutrients as well as for controlling storm water?)

The major challenge to strategic management of reactive nitrogen is the politics of implementation. The key driver for strategic management of reactive nitrogen will be the development of national policy which can be implemented at the local level. Because of the complexity of the contributing sources to the reactive nitrogen problem, ORD will need the program offices to work directly with the policy office to develop and pass national legislation which will curtail the current practices and develop sustainable solutions.

One suggestion for ORD is to develop a network of national test beds where they strive to develop collaborations from major source producers on a regional basis to reduce the nitrogen loads. This could be done through the creation of regional applied R/D centers who would leverage their locations to monitor and assess. A partnership with the Agriculture Extension and the Department of Agriculture may be one way to disseminate best practices and develop a mechanism to change the practices in the industry.

• To better accomplish our goal of using a variety of approaches to address stormwater issues, should EPA also consider incorporating natural infrastructure into research on constructed green and gray infrastructure?

Yes, EPA should incorporate natural infrastructure into research on constructed green and gray infrastructure where it is applicable. Natural infrastructure will provide the following benefits to the potential solution:

- creates a framework for environmental decisions
- provides predictability and certainty
- helps reduce opposition to development and conservation
- leverages and maximizes the return on public and private investments in conservation and restoration
- is scientifically defensible.

Sustainable and Healthy Communities Charge Questions:

• The Sustainable and Healthy Communities Research Program incorporated a number of diverse research elements (e.g., ecosystem goods and services, human health outcomes, waste and contaminant remediation, environmental indicators) in building a research program focused on supporting community decision-making. **The SHC Strategic Research Action Plan aims to provide science-based research and tools to assist communities in evaluating their decisions from a sustainability perspective. What advice can the SAB/BOSC provide to help ensure this research and these tools will most effectively support communities in doing so?**

The best advice that I can give to ORD is to involve the stakeholders upfront and often in the development and implementation of the tools to support sustainable communities. Though EPA is seeking to develop a generic tool, these community based support tools must be flexible to meet the needs of a variety of communities.

• The SHC's fourth theme investigates sustainability practices within four high priority decision sectors identified during SHC community listening sessions. These sectors are: transportation, land use, buildings and infrastructure, and waste and materials management. There are three primary goals: to assess opportunities for communities to achieve greater synergies from practices within a given sector and across multiple sectors; to provide methods to more comprehensively account for these practices in terms of their social, economic, and environmental outcomes; and to collaboratively apply and refine these findings in partnership with specific communities (e.g., Durham, NC). Does the Committee agree that this fourth theme provides a useful way to integrate research within SHC? If so, what are the most important implementation questions that ORD must address?

I concur with the fourth theme to investigate sustainability practices may provide a useful way to integrate research with in SHC. The most important implementation questions include the following:

1. How are sustainable communities impacted by the transportation infrastructure including types of options such as road types, connectivity, public transportation?

2. How do the four sectors defined interconnect in decision making that promotes sustainable and health communities?
3. Can a systems engineering approach and life cycle analysis be conducted to link the energy, waste and water flow of a sustainable community?
- 4.

- Does the Committee feel that SHC has the appropriate balance of breadth and depth in its design?

This is difficult to answer given that the program is still in its infancy. SCH is extremely broad in its scope. EPA has tried to narrow down the focus of the program into obtainable products to mark progress over the years. EPA should strive to develop regional partnerships with state and local agencies and universities to expand the breadth of knowledge, increase the visibility and impact and develop a linked network of research partners to sustain this effort. An example of this approach could be the Agriculture Research Extensions at Land Grant Universities.

If out year budgets continue to shrink, what areas should SHC maintain as the primary areas of focus?

In my opinion, EPA needs to prioritize the short, medium and long range research plan and develop an R&D portfolio analysis to determine where their research efforts will provide the greatest bang for the buck. To accomplish this lofty goal for SHC, ORD needs to create partnerships. Increasing its efforts to fund STAR Fellowships and AAAS Fellows may be a lower cost way to accomplish its goals through partnering organizations.

Theme 1, 2, and 3 are requirements for theme 4. So, theme 4 could be put on the back burner and limited funding could focus on theme 1-3 if funding were reduced.

Can the committee recommend areas that SHC should invest in if budgets increase?
Theme 4 should receive enhanced funding since it will bring about greater integration.

Chemical Safety for Sustainability Charge Questions:

- Is the CSS program well positioned to support EPA needs in the three key areas of endocrine disrupting chemicals, nanotechnology, and computational toxicology research?

Yes. It seems that the CSS program is well positioned to support the three key areas. In reading the plan for CSS, more detail may be required to better analyze if these three key areas are being addressed.

CSS objectives of creating tools to inform, developing faster screen methods, providing scientific tools to assess risk, develop assessment approaches for specific decisions, and life cycle impact position the three key areas well for better integration.

- How well has the exposure component of the CSS research program progressed since its inception?

It is difficult to comment since there were no updates provided at the time of writing this review. However, I look forward to the meeting in NC to see the progress.

Human Health Risk Assessment Charge Questions:

- The HHRA research program is committed to modernizing methods to evaluate the health effects of pollutants, consistent with advice of the SAB/BOSC and National Academy of Sciences. What aspects of the hazard and dose-response assessments produced by the HHRA research program are most likely to benefit from the application of state-of-the-art data streams and methods (e.g., in vitro toxicity testing results, gene expression profiling data, bioinformatics and QSAR modeling)?

In the 21st century, the new genomic technologies will greatly improve the accuracy of risk assessment allowing identification of sensitive subpopulations at-risk, and ultimately resulting in a personalized risk profile for each individual based on their genetic composition. State of the art data streams and methods will produce major benefits to the dose response assessments of hazards. I am not an expert in risk assessment, so I am not familiar with the various nuisances required for the risk assessment framework. However, improving the quality of data streams and methods of data collection can only enhance the modeling techniques utilized.

Additionally, what approaches can be envisioned to enhance risk managers' understanding, use and acceptance of these new methods?

To improve the risk manager's understanding, use and acceptance of new methods, ORD will need to conduct training and develop guidance documents. The development of a national training course has been utilized by OSWER for many hazardous waste management processes.

- In the 2010 mid-cycle progress review of the HHRA program the Board of Scientific Counselors noted that "IRIS assessments and ISAs are among the most heavily peer reviewed documents provided by scientists anywhere." How can the HHRA research program efficiently obtain robust peer reviews that contribute to the scientific integrity of assessments without impacting the timely provision of documents with public health value?

HHRA can utilize a peer review process similar to the peer reviewed literature. They could identify a group of reviewers, and have the reviewers comment on specific questions. This process can be done via the internet. In addition, they could potentially utilize an open innovation peer review process, where results, data, and analysis are put on line for comment and feedback from the community.

Additionally, can the SAB/BOSC provide advice on the appropriate overall balance of peer review of individual products versus other recommended scientific capacity building activities

Homeland Security Charge Question:

The HSRP has conducted research primary to support EPA's homeland security mission, i.e., response to acts of terrorism. In 2011, the SAB and BOSC stated that "the program should consider expanding research and capabilities in relation to natural disasters..." What advice (e.g., strategic, tactical, structural) can the SAB give to guide the program toward this broader role?

Natural disasters are an appropriate area where human health risk may be compromised. Hurricanes, tsunami's, floods, earthquakes, etc. all may pose potential human health risk, stress existing water, wastewater infrastructure, and potentially can pose significant potential hazardous and solid waste repositories. A natural disaster homeland security research plan must be developed around the potential risks which could occur.

Strategy: Develop the capability to assess the human health risk of natural disasters such as wildfires, floods, hurricanes, tsunami's, tornadoes and earthquakes, and determine the environmental restoration and recovery that can be man induced. The strategic framework could be to divide the natural disasters by medium: Land, water, air/wind, fire.

Each potential natural disaster will have different tactics. Land based natural disasters include earthquakes and landslides. EPA could partner with the USGS to develop the framework for human health risk and response to land based natural disasters.

Water based natural disasters include hurricanes, tsunami's, floods, and lightning storms. EPA may want to partner with NOAA, NASA and other federal agencies that study and monitor hurricanes.

Air based natural disasters include tornadoes. EPA may want to partner with NOAA and other federal agencies to develop the framework for human health risk and response to land based natural disasters

II. DRAFT CHARGE QUESTIONS FOR GENERAL ORD/PLENARY SESSION**1. INTEGRATION ACROSS PROGRAMS**

By their very nature, environmental issues are cross-disciplinary. Pollutants move and change across air, land, water and species. Energy, health, environmental justice and ecology are cross cutting topics. To organize research that is so intertwined requires a structure. By realigning its program from 16 distinct research topics to six related programs, ORD has made it a priority to eliminate stove-piped research and foster integrated, transdisciplinary research.

In the first year of implementation, the National Program Directors are in the early stages of managing each research program, while also taking steps to integrate across the six programs. This requires a balance of formally organizing and integrating research that relates to multiple programs, without creating additional, separate research programs.

While there are numerous topics that involve integration, ORD has selected five examples to present as case studies for the SAB and BOSC to consider. These five integrated topics reflect a range of dimensions including:

- topics that ORD has just begun to integrate and others that are further developed

- topics germane to every research program and others more narrowly focused among two or three
 - topics that are more immediately client-driven and others that are longer term
- Integrated Topics:
- Nitrogen
 - Global Climate Change
 - Children's Health/Environmental Justice
 - Applying new chemical assessment approaches in human health risk assessment
 - Endocrine-mediated Dose-Response

Charge Question: Based on the presentation of five integrated topics, what advice can the SAB and BOSC provide to help ORD succeed in integrating research across the ORD programs?

Successful integration of research topics across ORD will require a commitment of leadership and the financial resources to facilitate the research. Each topic is timely and will require the certain amount of manpower to facilitate new research and development products. This is definitely the right approach. However, the funding must be sustainable to foster the type of trans-disciplinary changes in the research culture.

How can different approaches to integration help us achieve our research goals? EPA ORD can repackage these five topics as Grand Challenges. The could then realign existing budgets and have national program directors commit resources and funding of FTE, space and equipment to assisting in a national scale effort to solve these challenges. This needs to be a multiyear commitment. Second, I would encourage the development of national test beds partnering state and local agencies with universities to develop team of regional partners to develop a scalable model.

2. INNOVATION

The Path Forward principles that guide ORD's realigned research program emphasize pursuing innovative, ground-breaking research. To address increasingly complex and expensive environmental problems, innovative solutions are needed.

Charge Question: How can ORD's initial innovation activities be improved to ensure continued and long term benefits for EPA?

ORD should be commended on its efforts to foster innovation. To improve the framework, ORD may want to develop a set of "Grand Challenges" for the agency which can be used to guide the research community. In addition, development of teams and large scale research groups would also enhance the R/D framework.

Are there useful experiences and lessons from other research organizations about managing innovation?

The Skandia Navigator applies a balance sheet approach to link the human and structural capital underlying organizational competencies to financial and economic outcomes related to strategic objectives and goals. The Navigator describes the firm's total intellectual capital using two composite metrics:

- The intellectual capital value is a composite of investment measures that reflects the firm's commitment to the future and its potential for innovation and growth.
- The intellectual capital efficiency index is a composite of monetary and nonmonetary indicators that reflects the firm's current position and the direction and velocity of inn

<http://www.athenaalliance.org/pdf/MeasuringInnovationandIntangibles-STPI-BEA.pdf>

What guidance can the SAB and BOSC provide for ORD in developing metrics that would be most effective in assessing the success of our innovation efforts?

Innovation metrics can include the following metrics:

1. Publications
2. Patents
3. Guidance documents
4. Presentations
5. Partnerships
6. Interagency partnerships
7. Workgroups
8. R&D dollars
9. Solutions/problems solved
10. Citations
11. Post-doc
12. Ph.D. students funded
13. New hires resulting
14. Awards
15. Developing interagency teams
16. Information and communications technology infrastructure
17. Production materials
18. Production machinery and facilities

The Skandia Navigator applies a balance sheet approach to link the human and structural capital underlying organizational competencies to financial and economic outcomes related to strategic objectives and goals. The Navigator describes the firm's total intellectual capital using two composite metrics:

- The intellectual capital value is a composite of investment measures that reflects the firm's commitment to the future and its potential for innovation and growth.

- The intellectual capital efficiency index is a composite of monetary and nonmonetary indicators that reflects the firm's current position and the direction and velocity of innovation and growth.

Comments from Dr. James Opaluch

I enjoyed reading the ORD Strategy Research Action Plans. ORD has obviously placed a lot of thoughtful effort in developing these plans. Yet much of the material is difficult to assess at this early stage. Below I provide what I hope is a set of useful comments for improving the process.

Charge Question 1: How are the ORD research programs progressing in the first year of implementation? Are the research activities planned for FY 13 and future years appropriate for answering the science questions in the Strategic Research Action Plan?

I focus here on progress made on the Safe and Sustainable Water Resources (SSWR) program area. The EPA materials describe a Strategic Research Action Plan, and have implemented research based on that plan. The plan outlines 2 general research themes, 3 science questions for Theme 1 and 4 science questions for theme 2, and a number of specific projects.

The ORD materials list 16 key products for FY 2012, and link products to science questions. The 16 listed projects are linked to questions 1, 2 5 and 7. The materials describe illustrative outputs, products and outcomes for the two themes. But these do not seem to be directly mapped to the science questions in the materials that were provided. In some cases, the mapping is obvious, in other cases it is not so obvious. But looking more broadly, it appears that at least some of the projects were ongoing, and linked to most closely related science questions after the fact, rather than being designed to be responsive to the science questions. This may partly be due to the fact that the organizational structure is new, and the may be a “legacy” effect to some of the projects.

Without being able to read reports on each of these projects, it is difficult to assess the extent to which the projects address the 7 science questions. But the titles of the reports do not seem like projects that were designed to address the key elements of each science question. Rather, a cursory glance at the project titles suggests that there was a series of existing projects, and there was an attempt made to link these ongoing projects to the science questions, rather than having studies that were designed to answer the science questions.

For example, Question 1 is “What factors are most significant and effective in ensuring the sustainability and integrity of water resources?” An additional explanatory paragraph describes this question as follows

“This research will focus on keystone factors that promote sustainable water resources, as well as the anthropogenic activities and natural contamination that threaten the sustainable quality and quantity of water resources.”

A project listed as responding to question 1 is a National Coastal Condition Assessment. Such Assessments are essential elements in environmental programs, but is more a matter of establishing a baseline, which is an essential foundation for progress, but does not identify factors that are most important and effective in ensuring sustainability and integrity of water resources.

Similarly, Q2 is “What approaches are most effective in minimizing ... environmental impacts ...” A descriptive paragraph states:

This research will describe current and future best and cost-effective management practices that minimize impacts to water resources. Research also will include the evaluation of contaminant risk.

An associated project listed as responsive to Q2 is an “Investigation into techniques to specifically detect viable organisms” Again, this project may provide useful techniques for EPA in meeting its mandates and may be related to Q2, but it does not seem to be a project that is designed specifically to be responsive to the key elements Q2.

Project 3 is also listed as responsive to Question 2. Project 3 is described as an update on a method to determine organic compounds in drinking water. This is again a method for assessing the state of water quality, but is not directly responsive to Question 2, which focuses on the methods that are most effective in minimizing impacts.

It is understandable that EPA is at the early stages in its new research program, and they have not yet had the opportunity to design new studies to answer the Science questions. Going forward, I recommend that ORD lay out more complete descriptions of the rationales underlying each of its science questions, similar to a series of White Papers. These White Papers would define the the essential elements and boundaries for each of the science questions, what is known, what important elements are not known. This would provide the basis for linking specific project to addressing the key unknown elements in each of the science questions.

Under Theme 1, the materials describe a set of “Illustrative Outputs/Products/Outcomes”. Example 1 is described as “Cost-effective nutrient pollution reduction strategies. EPA researchers are establishing safe nutrient levels in aquatic resources”. But the none of the descriptions below this example relate to cost-effectiveness, but rather focus purely on numeric criteria to prevent eutrophication and aquatic degradation. This is clearly an important activity, but it does not relate to cost-effective means for achieving these criteria.

A major impediment facing our nations achievement of environmental goals is opposition to environmental regulations due to the high cost of meeting environmental goals. And especially in the current state of the economy, it is important to achieve environmental goals without placing undue burden on the economy. Indeed, in many cases it is more the economic costs of improving the environment that serve as a barrier to achieving environmental goals, rather than technical feasibility. As a consequence, cost effectiveness is an important social imperative in protecting the environment, and should be a central concern to EPA’s design of regulations. At the same time, cost-effectiveness and low cost do not mean the same thing. Some regulations that are touted as “cost-effective” are really “low cost” precisely because they not *effective*. Hence, it is essential to design regulations that are both low cost *and* environmentally effective. This is not a simple task, and considerable research is essential in achieving this goal.

Indeed, it is difficult to determine the extent to which *any* social science research is being incorporated into Theme 1. of SSWR Perhaps ORD could hold a series of workshops to get input from the social science community on how to better incorporate social sciences into its research. Theme 2 includes an element on the use of economics tools, including water quality trading programs. However, it is difficult to judge how extensive this effort is to be.

Charge Question 2: How are ORD programs contributing to sustainability through their research plans and activities? What advice does the SAB and BOSC have for each research program about advancing sustainability in future research?

The research plans and activities appear to provide a good basis for contributing to sustainability, at least from the science and engineering side. It is difficult to assess how well the new organizational structure will actually contribute to sustainability until it has been used in practice for some time. Implementation is the key, and the new organizational structure and associated strategic plans have not yet had adequate time to prove themselves.

Although I have not had a chance to read all of the program strategic planning documents, I have not seen much emphasis on the Social Science side of the research. Human behavior and institutions are key elements to EPA mandates, and it will be difficult or impossible to be effective in advancing the goal of sustainability in the real world without a good understanding of the roles of human institutions and behavior. As a consequence, high quality social science (including economics) is an essential element to the success of advancing sustainability.

Collaborations with other Federal Agencies and with non-Federal and non-Governmental organizations is also an essential element of contributing to sustainability, especially given the shortage of funds available. Other federal agencies have closely associated mandates and programs, such as US Department of Agriculture, US Geological Survey and Department of Interior. Similarly, the states and local agencies, as well as non-governmental organizations have significant overlapping interests. Effective collaborations with these groups is very important in achieving sustainability. Indeed, we can be sure that EPA cannot achieve sustainable society. Among the documents that I have had the opportunity to review, there has been little specific discussion of collaborations outside of the Agency. I am pleased to see the recommendation for an inter-agency task force, in response to earlier SAB recommendations. But I would like to see this go further to identify how specific research questions and associated projects could link with closely related work in other agencies and outside the Federal government.

EPA has the opportunity to link with programs such as the Conservation Reserve Program. Coordinate with non-governmental entities such as World Resource Institute on programs like the on-line nutrient trading system, NutrientNet. Market-like institutions have great promise for achieving environmental goals without unduly affecting our prosperity and our standard of living. But careful design of market-like institutions is essential in order to be effective. And the most effective institutions usually combine elements of regulatory overview and market-like trades. We must learn from experience, and incorporate new ideas to create effective regulations.

Charge Question 3: As we consider science for the future, while budgets continue to shrink, how should ORD balance its commitments in the Strategic Research Action Plan with the need to advance science on emerging issues?

The balance between “fighting brushfires” and being proactive to future opportunities and challenges is always a tough one to balance. The Innovation Overview document provided by ORD outlines several promising avenues for fostering innovation. But organizational culture can also prove to be a serious impediment to innovation.

Program Specific Charge Questions: Safe and Sustainable Water Resources

ORD has integrated programmatic research, with EPA Program Office input, to begin developing a strategic nutrient management plan for the nation with the intent of accomplishing the SAB's recommended goal to reduce reactive nitrogen by 25 percent. Are there research gaps that would impede accomplishing this goal? (for example, should we be looking at green infrastructure for removing nutrients as well as for controlling storm water?)

- To better accomplish our goal of using a variety of approaches to address stormwater issues, should EPA also consider incorporating natural infrastructure into research on constructed green and gray infrastructure?

Co-benefits of particular actions may be essential in choosing among preferred alternatives to achieve water quality goals. For example, an equivalent level of nutrient reduction might be achieved by better managing fertilizer application or by providing green infrastructure, such as wetlands or riparian buffers. In addition to nutrient management, green infrastructure may also provide other ecosystem services, such as wildlife habitat, flood protection and aesthetic landscapes. It is essential that these co-benefits be considered in decision making. At the same time, it is challenging to develop methods to select among alternative management actions when each action may have a suite of collateral benefits (and/or costs). Wetlands might provide wildlife habitat, but may lead to the spread of mosquito-borne illnesses. It is challenging to quantify and then compare the full suite of beneficial and damaging effects of each potential action, especially since they are likely to be context specific. ORD research could be helpful in designing methodologies for doing so.

Comments from Dr. Jonathan Samet

GENERAL COMMENTS

These overview comments relate to the general topic of human health risk assessment, as typically defined and not as constrained by the Agency's four themes in the *Human Health Risk Assessment* Strategic Research Action Plan, 2012-2016. In the 2011 joint report to Administrator Jackson, a recommendation was made to make human health risk assessment (HHRA) one of the six major themes. This recommendation has now been followed. In part, this approach reflects the programmatic nature of several of the themes of HHRA, including the IRIS Program and the development of ISAs in support of the assessment of the NAAQS. The methodology of risk assessment is an element of Themes 3 and 4 and it is also prominent in the themes of *Chemical Safety for Sustainability* (CSS). Thus, the methods of risk assessment are mingled with the problems to which they are being applied. This mingling seems to have been problematic previously as the positioning of HHRA was considered; the current integrative diagram (Figure 4 in *EPA Research Program Overview 2012-2016* reflects this difficulty. Risk assessment itself (whether for human or environmental health) is a foundation for application and problem scoping and management and not a set that only overlaps with components of other sets as portrayed.

This positioning of risk assessment may have real implications, given the imperative for EPA to continually refine and enhance its risk assessment methodologies. Various reports, from the Agency, the National Research Council (NRC), and others, have urged refinements and even major changes to Agency approaches, as with the 2011 NRC report on the draft IRIS formaldehyde assessment. Across the six programs, risk assessment figures to varying degrees. Within CSS and HHRA, risk assessment methods are mentioned extensively. While cross-program integration is proposed, the relevant agendas within these two programs are largely separated and the basis for selecting outputs and giving them priority is not clear. Even within HHRA, there is not adequate connection and synergy. For example, transparent evidence synthesis is integral to both the IRIS Program and the development of the ISAs, but this connection is not made.

Additionally, HHRA, as for other programs, would benefit from the integration of social, behavioral, and decision scientists into the activities related to risk assessment methodology in support of decision-making. This recommendation from the prior review remains relevant.

DRAFT SAB/BOSC CHARGE QUESTIONS FOR EACH BREAKOUT GROUP

1. FIRST YEAR PROGRESS

The Strategic Research Action Plans were developed during 2011, with the benefit of SAB and BOSC advice [Office of Research and Development (ORD) New Strategic Research Directions: A Joint Report of the Science Advisory Board (SAB) and ORD Board of Scientific Councilors (BOSC). (EPA-SAB-12-001)]. Charge Question: How are the ORD research programs progressing in the first year of implementation? Are the research activities planned for FY 13 and future years appropriate for answering the science questions in the Strategic Research Action Plan?

Comments here about progress are limited by the limited timespan since the Strategic Research Action Plans were developed and implemented. The IRIS assessments and the ISAs have specific schedules and deliverables. The outputs for Themes 3 and 4 are scheduled for the future

with some TBD particularly for Theme 3. For the methodological outputs, the timelines should address the sequential and iterative nature of the processes by which methods, data resources, and related infrastructure are developed. For example, many of the items listed for “Theme 4—Modernizing Risk Assessment Methods” will undergo continued refinement through use. Do the output years refer to the time of initial testing or implementation into use? Some of the timelines seem overly optimistic, e.g., the availability of the “Bioinformatics Toolbox” in FY13, or perhaps this will be a library of existing methods and software?

With regard to the “science questions”, I note that the questions for Themes 1 and 2 do relate to matters of risk, while those for Themes 3 and refer to the provision of tools, methods, and applied analyses. For Themes 1 and 2, the science questions will not be “answered”, but EPA will need to have a sustained research strategy to assure that needed evidence is available for IRIS assessments and the development of ISAs.

2. SUSTAINABILITY

The SAB and BOSC concluded in the October 21, 2011 report that “...ORD’s research frameworks can advance EPA’s adoption of sustainability as a core principle by more consistently and clearly describing where and how ORD research relates to sustainability.”

Charge Question: How are ORD programs contributing to sustainability through their research plans and activities? What advice does the SAB and BOSC have for each research program about advancing sustainability in future research?

The ties of HHRA to sustainability are indirect rather than direct and sustainability receives little direct mention in the Strategic Research Action Plan. In fact, there is little specific discussion of sustainability, except for mention of other programs incorporating sustainability. The ties to sustainability might be made more explicit, particularly for Theme 3—which relates to communities.

3. BALANCING IMMEDIATE PROGRAM NEEDS AND EMERGING ISSUES

Meeting program and regional needs is a primary objective of ORD research. The highest priority needs of the programs tend to be those that are most immediate. Another important role for ORD is to anticipate the future scientific needs of the programs and regions, areas of research that tend to get less support from the EPA partners. Anticipating emerging issues and investing in innovative approaches that could lead to more sustainable, less expensive or timely solutions often requires longer term and potentially higher risk research. The Strategic Research Action Plans strike a balance in addressing current priorities and future science needs; however, new emerging issues will likely arise that are not currently anticipated. Charge Question: As we consider science for the future, while budgets continue to shrink, how should ORD balance its commitments in the Strategic Research Action Plan with the need to advance science on emerging issues?

This question is somewhat of an artifice, but does speak to the potentially realistic (and actual?) scenario of declining resources even as scientific challenges and opportunities mount. There is no doubt that the nature of the evidence to be considered in the IRIS assessments and in developing ISAs is changing and will increasingly draw on large scale data resources generated by high throughput testing and new, synthetic observational studies that are based in cohorts assembled from administrative data bases. EPA will need to be an active partner with the many other entities that are also building on these new opportunities. It will critical for EPA to maintain capacity to incorporate the latest lines of scientific investigation into its decision-making and to do so, it will need a cadre of researchers who can stay abreast of the possibilities.

HUMAN HEALTH RISK ASSESSMENT CHARGE QUESTIONS:

• *The HHRA research program is committed to modernizing methods to evaluate the health effects of pollutants, consistent with advice of the SAB/BOSC and National Academy of Sciences. What aspects of the hazard and dose-response assessments produced by the HHRA research program are most likely to benefit from the application of state-of-the-art data streams and methods (e.g., in vitro toxicity testing results, gene expression profiling data, bioinformatics and QSAR modeling)? Additionally, what approaches can be envisioned to enhance risk managers' understanding, use and acceptance of these new methods?*

This charge question is quite broad in its reach and not readily answered with specificity. It points to the many new sources of data that are relevant to risk and the complexities of integrating them into practice. The many options call for strategic planning to take advantage of ever-richer data sets. The Agency will need enhanced capacity in bioinformatics and in integrative modeling. As to which data stream should receive emphasis, there is no ready answer. Here, cross-talk across programs is needed.

The second component of this question, related to risk managers, also has no straightforward answer. Clearly, risk managers need to have information presented in ways that demarcate what is known from what is not known and that portray uncertainty in a useful way. This obvious statement applies, regardless of the underlying data used to characterize risk both qualitatively and quantitatively. Here, there is a topic for Agency research; how should evidence from these new lines of investigation be combined with evidence from "traditional" sources? The question is mis-phrased and efforts should be directed at the utility of these new data sources for decision-making and not at "risk managers' understanding, use, and acceptance." Isn't this an appropriate topic for investigation by decision-scientists?

• *In the 2010 mid-cycle progress review of the HHRA program the Board of Scientific Counselors noted that "IRIS assessments and ISAs are among the most heavily peer reviewed documents provided by scientists anywhere." How can the HHRA research program efficiently obtain robust peer reviews that contribute to the scientific integrity of assessments without impacting the timely provision of documents with public health value? Additionally, can the SAB/BOSC provide advice on the appropriate overall balance of peer review of individual products versus other recommended scientific capacity building activities?*

The Agency should have the overall goal of providing its assessments in a timely way. This goal has not always been met, particularly for the IRIS assessment and the past Criteria Documents. More recently, the Agency has been completing the peer review of the ISAs in a timely fashion, in part because of court-ordered deadlines. Additionally, the switch from the Criteria Document to the ISA format has led to more synthetic and transparent documents that can be more readily reviewed. Some of the IRIS assessments that have been tardy in being completed have been overly long and found to be deficient in various ways. The plans to change the process used to carry out the IRIS assessments should enhance peer review.

As to the specific mechanism of peer review, I do not have specific guidance at this point. Various approaches have been used and various entities have been involved. A tiered, screening strategy might be useful that is reflective of the underlying complexity of the assessment being reviewed. Regardless, "rigorous peer review" cannot be sacrificed to expediency. The suggestion that there is a trade-off between peer review and scientific capacity buildings seems artificial, lacking further explanation.

Comments from Dr. James Sanders

Break out group charge questions:

1. Progress during the first year appears to be appropriate. The program design looks sound. The research themes and priority science questions are all appropriate, and at this initial step, seem to cover the SSWR topic well. However, as discussed last year, the plans lack detail about the activities that are planned, and it is not possible to discern whether these unknown activities will lead to adequate progress on actually answering these priority science questions. The lack of detail was understandable last year, but I expected greater detail by now. For each topic discussed I would like to know what will be done, and how will those activities help resolve the topics.
2. I am not prepared to discuss the level of sustainability in the SSWR plan without further discussion.
3. As we have discussed many times over the past several years, the continued erosion of ORD funding is extremely troubling. The reorganization should help ORD provide services to the agency in the most efficient manner possible, but as noted, new and emerging needs will always arise, and the agency and ORD will have to rise to meet them. It is difficult to provide guidance on prioritizing the topics discussed in the SSWR plan, all are appropriate and needed. Without greater specificity on actual activities, the only advice that I can offer is to work to recognize when topics and questions have been resolved, and set them aside for the next most urgent topic.
4. Any responses on the specific charge questions (N reduction, natural infrastructure) will require further discussion.

Plenary Session charge questions:

1. The early work toward integration using cross-cutting topics is quite good. As discussed in 2011, such activities should lead to greater integration of agency staff and between ORD and the regional and national offices. Many suggestions were made in 2011 to encourage collaboration, and it is apparent that some have been considered and put into place. There may be other suggestions from the 2011 discussions that deserve further attention. In general, the fewer barriers to collaboration, the better.
2. The innovation programs that have been put into place appear to be working well. I am impressed at the level of interest, at least according to the large number of proposals that have been received. Since it should be okay for these projects to fail, given that they are risky, it is very difficult to measure "success". Certainly not by minimizing failure. Perhaps through the number of proposals submitted, the end products, publications and the like? The degree to which these proposals cut across traditional agency boundaries and offices should also be encouraged as a possible metric.

Comments from Dr. Peter Thorne

I. DRAFT SAB/BOSC CHARGE QUESTIONS FOR EACH BREAKOUT GROUP

Air, Climate and Energy Charge Questions

Question: How do we bring together research on biofuels, oil and gas measurement methods, combustion related pollutant effects and modeling/decision support tools into a coherent whole to address the environmental effects of energy production and use?

Answer: It would be useful to start with a systems concept using the carbon cycle integrating energy production and use and identifying points where there are emissions and where there is potential for carbon sequestration. The research in the areas mentioned in the question all fit within this paradigm and the connections and trade-offs can be mapped.

Question: How [is the ACE] research program progressing in the first year of implementation? Are the research activities planned for FY 13 and future years appropriate for answering the science questions in the Strategic Research Action Plan?

Answer: This is a bit difficult to judge based on the information provided which paints the programs with a broad brush. The Action Plan lacks specifics and the examples are too vague to answer this*. Of the 145 outputs listed, just 13 are FY2012 and these could be described in more detail to highlight the accomplishments of ORD thus far. I suspect that more detailed discussions will occur at the SAB/BOSC meeting.

*See for instance page 22, paragraph 1 which states the following: "An example is an analysis considering use of biofuels for transportation, including the evaluation of potential alternative strategies that may improve sustainable use of limited resources." What type of analysis? Which biofuels? What alternative strategies? Which limited resources?

Question: How [is the ACE] program contributing to sustainability through research plans and activities? What advice does the SAB and BOSC have for [the ACE] research program about advancing sustainability in future research?

Answer: The ACE program includes studies of GHG emission mitigation strategies and consequences of adaptation approaches. There is no mention of the role of agriculture in GHG emissions nor is there discussion of changing agricultural practices to reduce GHG emissions (e.g., changing industrialized livestock production practices to reduce methane release; or shifting toward ligno-cellulosic ethanol production which requires lower inputs of fossil fuels).

Question: As we consider science for the future, while budgets continue to shrink, how should ORD balance its commitments in the Strategic Research Action Plan with the need to advance science on emerging issues?

Answer: One suggestion is to put greater emphasis on studying new and emerging areas and sunset programs where the pace of discovery has slowed (or stopped) even if the pollutants under study are important toxicants.

II. DRAFT CHARGE QUESTIONS FOR GENERAL ORD/PLENARY SESSION

1. INTEGRATION ACROSS PROGRAMS

***Question:* Based on the presentation of five integrated topics, what advice can the SAB and BOSC provide to help ORD succeed in integrating research across the ORD programs? How can different approaches to integration help us achieve our research goals?**

Answer: I look forward to hearing the presentations on this topic to get a better sense of the methods EPA is employing to break down silos within the organization. It is hard to determine this from the narrative provided. With climate change research there are a number of promising examples that show interaction between ACE and SSWR.

2. INNOVATION

***Question:* How can ORD's initial innovation activities be improved to ensure continued and long term benefits for EPA? Are there useful experiences and lessons from other research organizations about managing innovation? What guidance can the SAB and BOSC provide for ORD in developing metrics that would be most effective in assessing the success of our innovation efforts?**

Answer: I appreciate the statement by Peter Preuss that, “Innovation is challenging for public-sector organizations because internal decision processes generally are not designed to foster creativity...”. Many organizations have tried to become more innovative by emulating the Bell Labs model – which is difficult to duplicate in this time and in the public sector. Perhaps ORD needs to develop a program that takes a small number of innovative thinkers and encourage wild ideas and experimentation while accepting that there will be failures but some successes. These investigators should be allowed to operate with minimal reporting requirements and enhanced programmatic flexibility.