

**Summary Minutes of the United States Environmental Protection Agency (U.S. EPA)
Science Advisory Board (SAB) Meeting
April 23 – April 24, 2009**

Board Members: See Board Roster provided in Attachment A.

Date and Time: Thursday, April 23, 2009, 8:30 a.m. - 5:00 p.m.
Friday, April 24, 2009, 8:00 a.m. – 1:30 p.m.

Location: Westin Arlington Gateway
801 N. Glebe Road
Arlington, VA 22203

Purpose: The purpose of this meeting was to discuss the U.S. EPA strategic research plan for FY 2009-2015 and to discuss the SAB's plan for a special project for the EPA Administrator. The Agenda is in Attachment B and the *Federal Register* announcement of the meeting is in Attachment C.

SAB Participants:

Dr. Deborah L. Swackhamer, Chair	Dr. Stephen M. Roberts
Dr. John Balbus	Dr. Granger Morgan
Dr. Thomas Burke	Dr. Duncan Patten
Dr. James Bus	Mr. David Rejeski
Dr. Deborah Cory-Slechta	Dr. Joan Rose
Dr. Terry Daniel	Dr. James Sanders
Dr. Otto Doering	Dr. Jerald Schnoor
Dr. David A. Dzombak	Dr. Kathleen Segerson
Dr. John Giesy	Dr. Kristen Shrader-Frechette
Dr. Rogene Henderson	Dr. Thomas L. Theis
Dr. James H. Johnson	Dr. Robert Twiss
Dr. Bernd Kahn	Dr. Tom Wallsten
Dr. Melanie Marty (Liaison CHPAC)	Dr. Daniel Watts (Liaison)

Meeting Summary:

Discussion at the meeting generally followed the issues and timing as presented in the meeting agenda (Attachment B).

Thursday, April 23, 2009

1. Convene Meeting:

Mr. Thomas Miller, SAB DFO, convened the meeting and welcomed the group. He noted that the SAB complies with all Federal ethics and conflict of interest codes that apply to advisory groups having SGE members. Mr. Miller stated that the topics discussed at this

meeting were not specific party nor particular matters, and therefore did not pose ethical or conflict of interest issues. He remarked that one important component of the Federal Advisory Committee Act (FACA) is public access and participation, and that no members of the public had submitted written comments for the meeting nor had anyone requested time to make oral comments to the Board.

2. Director's Welcome

Dr. Vanessa Vu, the SAB Staff Office Director welcomed the members, and thanked the U.S. EPA and contractor staff. Dr. Vu noted that this meeting is a prelude to the upcoming SAB review of the ORD FY 2010 research budget. Members will be notified of the date for the Congressional Hearing concerning EPA's fiscal year (FY) 2010 budget if one is to be held.

3. Introduction of SAB Members & Meeting Purpose and Approach

Dr. Deborah Swackhamer, the SAB Chair, noted that the Board was to have conducted its annual review of the EPA research budget at this meeting but that the budget has been delayed this year. The Board will instead focus on continuing its interactions with EPA's Office of Research and Development (ORD) staff on its strategic vision for the EPA research program and the current research efforts. This will allow the two parties to continue that dialogue as well as to prepare ourselves for conducting the research budget review. Having updated information on the long-term vision for the program and the activities currently underway in accomplishing the envisioned program will give the Board a good foundation for the budget review once. We will schedule a teleconference meeting of the Board to conduct that review.

4. EPA Science Priorities: Dr. Pai-Yei Whung

Dr. Swackhamer introduced Dr. Pai-Yei Whung, EPA Chief Scientist, who discussed EPA's Science Policy Council science priorities project. In past years, it was a routine practice for the SAB to hear from each program office on their short- and long-term research, technology, and other support needs. We are reinstating that practice with the EPA Chief Scientist's discussion of the underlying science priorities that provide a part of the context for ORD's research and development program.

Dr. Whung stated that EPA Administrator Jackson identified several key Presidential values that will shape the Agency's activities. The first is that "Science must be the backbone for EPA programs." The Administrator earlier stated that, "The public health and environmental laws that Congress has enacted depend on rigorous adherence to the best available science. The President believes that when EPA addresses scientific issues, it should rely on the expert judgment of the Agency's career scientists and independent advisors. When scientific judgments are suppressed, misrepresented or distorted by political agendas, Americans can lose faith in their government to provide strong public health and environmental protection."

EPA's science portfolio includes research, applied science, technology, and the use of science for applications and decision-making. She then discussed the role of the EPA Office of the Science Advisor. OSA provides leadership in science and science policy to ensure the best use of science at the Agency. OSA promotes science integration using a number of institutional entities, including the:

- Science Policy Council (SPC) – integrates policies that guide the use of science by decision makers.
- Risk Assessment Forum (RAF) – promotes consensus on risk assessment issues and guidance.
- Program in Human Research Ethics (PHRE) – provides review and develops standards for scientific merit and ethics.
- Environmental Technology Initiative (ETI) – encourages sustainable technologies to solve environmental problems.
- EPA Group on Earth Observations (GEO) – supports the Global Earth Observation System of Systems and develops decision tools.
- Council for Regulatory Environmental Modeling (CREM) – promotes consistency among model developers and users.
- Forum on Environmental Measurements (FEM) – develops policies to guide the Agency's measurement community.

The SPC, composed of senior leadership from across EPA, addresses important science and science policy issues. The SPC recently established a Subcommittee for Science Priorities that is to create a corporate consensus on emerging and complex, multifaceted, cross-media and cross-Agency, interdisciplinary environmental problems, that would benefit from greater collective attention. This process will be updated from time to time and inform the action priorities set by the Administrator, the EPA Strategic Plan, and the programmatic and regulatory imperatives of the Agency. Specific criteria used to screen candidate issues include:

- Integrative: multi-media and multi-program implications
- Regulatory relevance
- Potential for high impact in terms of risk reduction
- Economic and societal benefit
- Scientific maturity, uncertainty, and technological feasibility
- Appropriateness for EPA to undertake given mission, role, and responsibilities
- Opportunity for leveraging resources
- Degree to which they are driven by specific environmental problems or by the development and application of analytical tools to support cross-media decision making.

The Subcommittee considered a set of candidate issues submitted by the SPC member organizations, and based on the prioritization criteria, agreed on four priority themes (now referred to as draft science priorities):

- Climate and Energy
- Environmental Contaminants
- Homeland Security and Emergency Response
- Modernization of Infrastructure

EPA is in the early stages of drafting a document to discuss the priorities in a consistent manner. The document will discuss how EPA's efforts on the issue will: (1) advance environmental science and technology, (2) inform policy decisions, and (3) create tools for implementation. The process is in its early stages.

The next steps in the Subcommittee's process include:

- Internal Agency/SPC approval.
- Discussion with the Administrator to obtain additional guidance.
- Stakeholder feedback.
- An Agency dialogue on the use of science priorities for actionable projects.

Once approved, the priorities will guide the development of actionable project by EPA.

SAB Questions and Comments:

- Members are interested in obtaining a final version of the priorities document itself.
- The list was prepared at the end of the previous administration. If issues that are not on the list emerge, what flexibility will there be to address them in the face of the already identified priorities? Dr. Whung noted that EPA always has the flexibility to identify and address such issues and that the existing priority list is dynamic and will evolve over time.
- Members asked if the existing science leadership had yet had an opportunity to meet with the new Administrator on science issues and priorities and learned that they have met with her on many issues including science priorities. These are longstanding issues, thus they are already a part of EPA's work and are already, at least partly, a part of current ORD, regional, and program office programs.
- There was a sense that getting stakeholder feedback at such a late point in the process might not be effective and likely would not lead to any changes in the prioritization. The point was acknowledged by Dr. Whung.
- EPA frequently does not link the issues it considers. Will this be done by the priorities project? Because the focus of this process is to bring the agency together, EPA intends to pursue linkages more explicitly as it develops "actionable items" that come from the prioritization process.
- Science is acknowledged as the "strong back" of EPA, however, it can also be the "eyes and ears" for EPA. The science community is often the group that recognizes new problems first. Science can help EPA see what is coming down the road.
- The importance of EPA having a multi-pollutant view seems to be gaining greater recognition. Dr. Whung agreed and noted that the Risk Assessment Forum is considering as an actionable item the notion of multi-pollutant – cumulative -- risk assessment.
- Working with others on climate change continues to be important. Dr. Whung noted that EPA is doing so in several ways. In some, EPA is the lead office and in others EPA offers support and it will continue to do so.
- The "environmental contaminants" priority seems broad. Does it include activities that address the new toxicology paradigm as well as the notion of risk-based prioritization? Both are included.

- The time seems to be ripe for some “back casting” at EPA – i.e., looking at what seems to work within the current institutional arrangements for collaboration, and what does not seem to work. This is not to suggest that EPA should reorganize; however, it could benefit from addressing the opportunities that now exist in the advent of new EPA leadership.
- EPA should consider innovative ways to conduct its science program.

5. Transforming ORD: Building a Successful Future: Dr. Larry Reiter

At the March 5, 2009 SAB teleconference meeting, Dr. Kevin Teichman, ORD’s DAA for Science, notified the Board of ORD’s “Transformation Initiative.” Dr. Reiter updated the SAB on ORD’s progress in developing this initiative. Dr. Reiter stated that ORD must undergo “transformation” because current and emerging problems require more ambitious research programs to:

- Consider differences in scale (spatial, temporal, economic)
- Transcend EPA regulatory structures, environmental media, scientific and engineering disciplines, and
- Be accommodated in both planning (cross-media) and implementation (integrated, multidisciplinary).

Current scientific needs outstrip resources available so ORD must:

- Not be a mile wide, and an inch deep;
- Be smarter in planning its research agenda so it can “target” the highest priority program/regional office needs (dialogue issue);
- Be more nimble in moving programs to address high-priority needs (implementation issue);
- Be effective – informing in the most useful way; and
- Leverage resources

ORD must partner with Program and Regional Offices, stakeholders, and practitioners, starting from problem definition thru to the use of research results, to achieve success. It must also fully employ its unique integrated, multidisciplinary capability to solve complex environmental issues and best fulfill its mission.

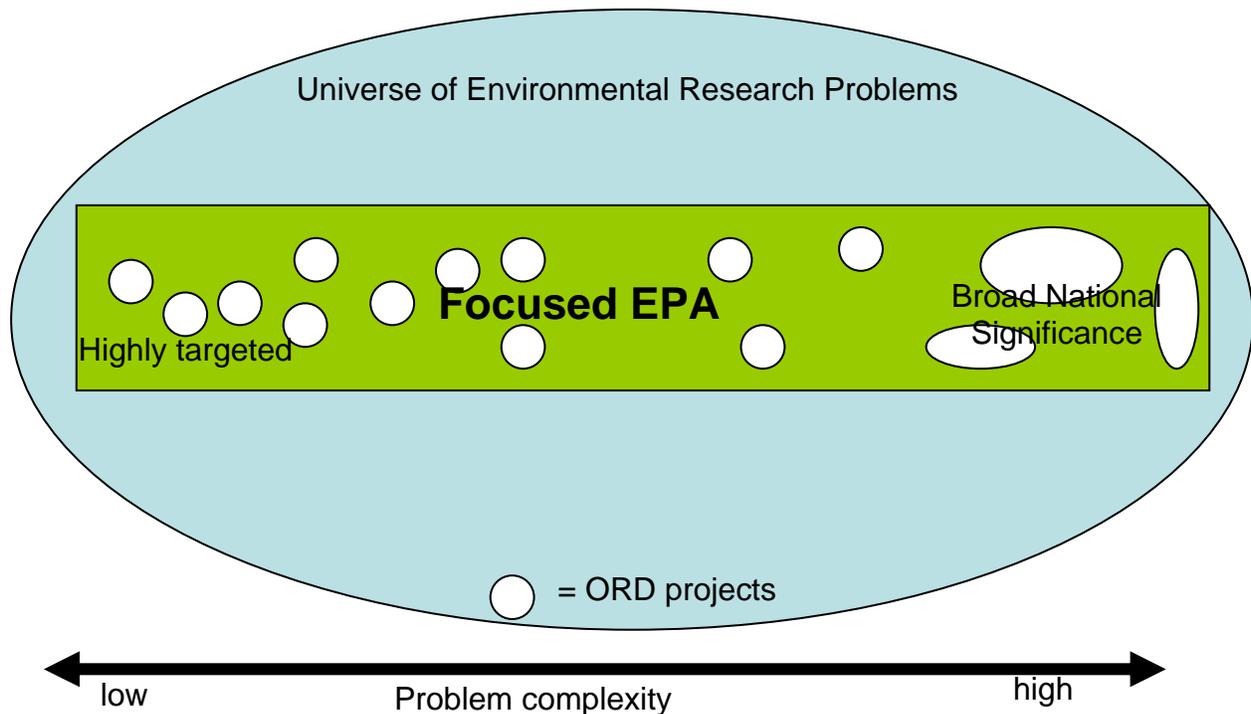
Building on its strengths, ORD will proceed on two fronts: One will be oriented to What we do. ORD must ensure that its research addresses the most important environmental problems facing the Agency and Nation as suggested by the SAB recently “... the Agency must undertake a larger program of research that goes beyond its immediate regulatory needs...” (SAB 2008).

The second front will consider “How we do it.” Here ORD will fully capitalize on its special ability to conduct integrated, multidisciplinary research to solve these problems.

Using several illustrations, Dr. Reiter showed EPA’s research needs within the context of their occurrence. First, within the full universe of problems, EPA’s needs were portrayed within the context of a “universe of problems” and along a line indicating complexity of the

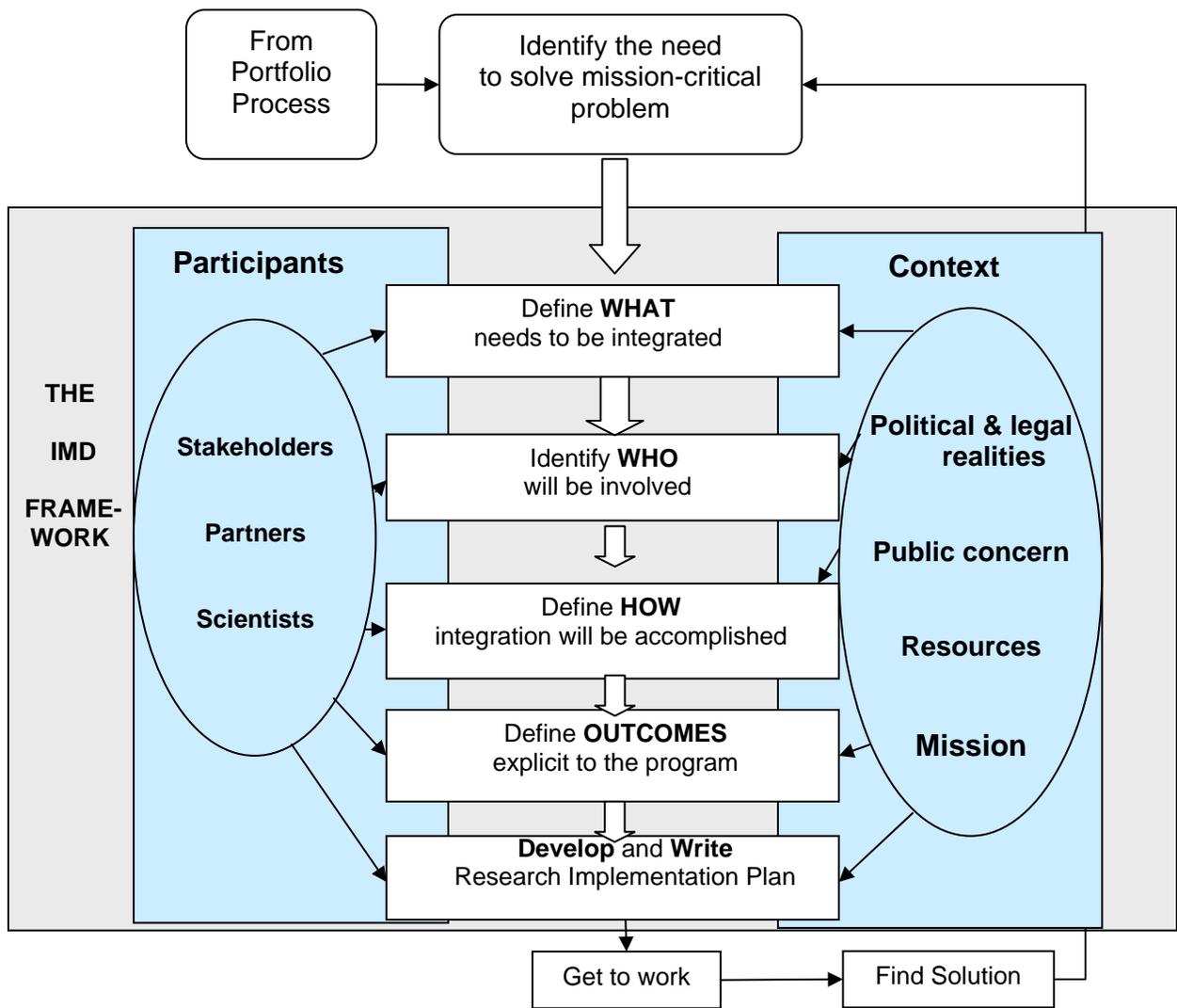
problem. Problems exist along a continuum of low complexity (and highly targeted) to those of high complexity that have broad national significance (e.g., climate change, water capacity, sustainability). He noted that ORD's current portfolio includes a few of the most complex problems. However, some of the research might not be as focused on EPA's near term needs as some would like. The future ORD portfolio will need to focus more on Agency research needs and tackle more of the big, and complex, environmental problems.

- ORD's future portfolio will:
- Focus on Agency research needs
 - Tackle some of the really big problems



Dr. Reiter noted that ORD's strength is in Integrated Multidisciplinary (IMD) research. IMD means: *Identifying and solving* environmental problems through the concerted application of multiple disciplines and partner *perspectives* during all phases of research planning, execution, and synthesis. *Identifying and solving problems* includes problem identification and bounding, research planning and implementation, and interpretation, communications and using results. *Perspectives*, include: disciplines, stakeholders, practitioners, etc. IMD is always appropriate for problems of broad national significance, and may be appropriate for research elsewhere on the portfolio continuum.

Dr. Reiter noted that the SPC priorities mentioned earlier suggest the problems to look into, but they do not go to the question of how to formulate and bound problems. This would be accomplished by considering who, how, etc., within the context of concerns and needs. The illustration below of an IMD Framework shows a conceptualization of this approach.



Dr. Reiter noted that an ORD Transformation Task Force was established to recommend transformation processes for:

- Selecting a research portfolio that is balanced across the continuum and a process for identification, selection and formulation of :
 - Problems of broad national significance and
 - Targeted research
- Ensuring integrated multidisciplinary approaches as appropriate:
 - Process for implementation plan development
 - Process to move IMD into ORD culture
- Communicating Transformation noting what Transformation is and our progress on transformation.

After talking about the Transformation Task Force's most recent ideas of how this might proceed, Dr. Reiter summed up by noting that Transformation is necessary to: 1) build on ORD's unique strengths; 2) directly support the Administrator's priorities and external expert advice; and 3) harness resources to meet the most complex environmental challenges.

SAB Questions and Comments:

- The need for cross-disciplinary work on many significant environmental issues is great. However, this might have implications for ORD structurally. Response: EPA often considers this and the developing an Integrated Multidisciplinary Research program is just the latest opportunity to do so. Large organizations need some structure and many different approaches can be appropriate. ORD prefers to focus on function and to bring various functions together in cross-organizational efforts. Focusing on structure would more likely be a diversion from the work we want to accomplish.
- NIH, FDA, and many academic organizations have begun to move to more integrated approaches. Do they hold lessons for ORD? Response: They do indeed and we are including in our planning some benchmarking of other organizations to see what we might learn. We are also looking to some of our own experience to learn more. We will also be valuing how individual scientists efforts are contributing to larger, cross-organizational activities as we consider them for promotions.
- ORD's "unique capacity" that is cited as the basis for IMDR seems to be lacking research in social sciences. Response: In the past, social sciences would have been ignored by ORD. We now recognize in our strategic workforce planning the need for introducing social sciences into our work. We have some experiences where inclusion of social sciences up front in our planning could have prevented some slow starts, and later needed redirections, in our research. We recognize this in our ecosystems services research program now, and we are looking for ways to see how we can do this more broadly.
- What is the likelihood that refocusing research as suggested in your slide 6 will leave some ORD scientists with disciplinary sets that fall outside the newly identified needs? Response: This is a challenge we recognize both in terms of staffing as well as shifting research itself to new things. One can always do another experiment in a current research program. We continue to increase the discussions of our research with others as a way of increasing the link of the research to the context that it fits within for EPA. By doing this in a transparent way, we make it possible for our own scientists to identify promising areas for redirecting their research (and likely expanding their expertise).
- It is good to see that the Board's call for greater integration is being taken. We recognize that this will still leave a need for targeted research but we are delighted with the initiative. There will be a great need for focused intellectual leadership as you move forward to add substantive direction to your now developing plan to do IMDR. As always, resources will be a problem and working with NSF and others to help them sponsor research that will be of use to EPA in an integrated program will be important. Some of those larger entities have gotten significant budget increases in recent years, in contrast to ORD's recent budget history. Response: That will be important. But, a balance will be needed for now in order to not hamper initial progress with too much discussion. For now we will also be looking for ways to begin some of these broader issues in our 2011 budget planning.

- An interesting approach might be to engage in some “portfolio management” i.e., a mental exercise in which you might ask:
 - What is focused near term research – what do you get from it?
 - What high risk research might be conducted that could give large benefit if done?
 - How do you disinvest; when is something done – what are your criteria?
- There are many techniques in “portfolio management” that might be of use to you in articulating your strategy and not just waiting for Congress, OMB or others to identify cuts to your program. Response: Portfolio Management offers an interesting way to discuss our base program in regard to how we move it into new directions, directions that could more clearly be related to policy needs for problems of broad national significance.

6. Strategic Research Directions: Dr. Kevin Teichman:

Dr. Teichman provided an overview of EPA’s strategic research directions for Board members. He first noted the changes between the President’s 2009 Budget and that enacted by the Congress. The changes include:

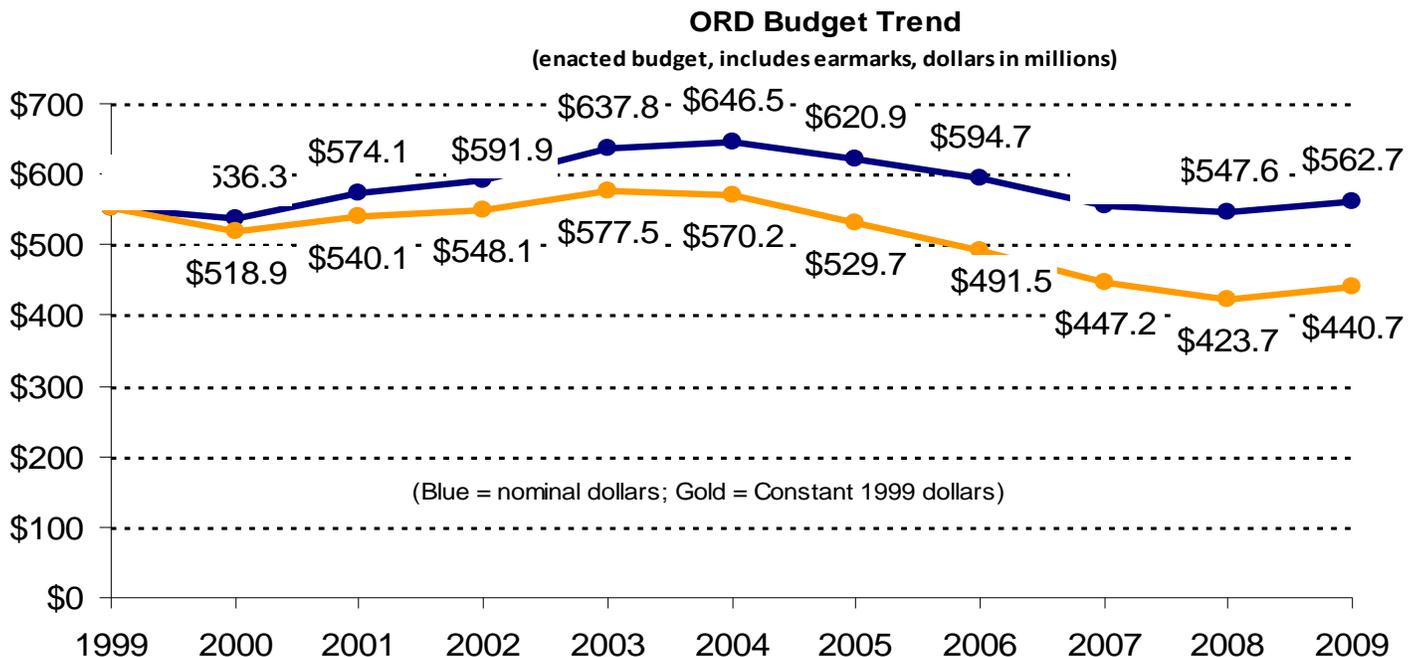
- Drinking Water (Carbon Sequestration) + \$ 2.0M
- Water Quality (Urban Storm Water Runoff) + \$ 2.0M
- Endocrine Disrupting Compounds + \$ 1.5M
- Global Change (GHG Mitigation and Adaptation Strategies) + \$ 2.0M
- Human Health and Ecosystems + \$ 8.6M
 - TIME/LTM + \$ 0.7M
 - Nanotechnology Research Roadmap + \$ 1.6M
 - Ecosystems + \$ 3.2M
 - Human Health + \$ 3.1M
- Fellowships + \$ 1.0M
- Earmarks + \$ 4.5M
 - Consortium for Plant Biotechnology + \$ 0.8M
 - AWWRF + \$ 1.7M
 - WERF + \$ 2.0M
 - Homeland Security - \$12.6M
 - Includes FY 2009 Biodefense Amendment (\$10.6M)

Greater details can be found in Attachment D.

Comparison of FY 2009 Enacted Budget to FY 2009 President's Budget

ORD Program/Project	FY 2008 Enacted ¹		FY 2009 President's Budget ¹		FY 2009 Enacted ^{1,3}		Change from FY 09 Pres. Bud. to	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
Clean Air	\$78.9	236.2	\$80.6	236.4	\$80.5	269.5	\$0.0	+33.1
Drinking Water	\$47.6	207.2	\$45.3	190.2	\$46.9	190.2	+\$1.6	0.0
Water Quality	\$56.0	239.4	\$56.2	236.8	\$59.3	236.8	+\$3.1	0.0
Land Preservation and	\$32.0	141.3	\$35.5	154.7	\$35.7	154.7	+\$0.2	0.0
Homeland Security	\$33.4	50.9	\$50.2 ²	57.5	\$37.0	57.5	-\$13.2	0.0
Human Health Risk	\$42.7	182.1	\$42.6	178.6	\$42.7	178.6	+\$0.1	0.0
Computational Toxicology	411.5	34.3	\$14.9	32.7	\$15.2	32.7	+\$0.3	0.0
Endocrine Disruptors	\$10.2	54.4	\$9.5	50.1	\$11.5	50.1	+\$2.0	0.0
Global Change	\$18.1	32.6	\$16.4	32.2	\$17.9	35.5	+\$1.5	+3.3
Human Health &	\$154.2	497.0	\$144.7	478.3	\$153.8	484.9	+\$9.0	+6.6
Pesticides and Toxics	\$25.5	126.3	\$26.6	137.4	\$26.9	137.4	+\$0.4	0.0
Fellowships	\$9.7	2.7	\$8.9	2.6	\$9.7	2.6	+\$0.8	0.0
Sustainability	23.5	76.2	\$20.0	70.8	\$21.2	70.8	+\$1.3	0.0
Congressional Earmarks	\$4.2	0.0	N.A.	N.A.	\$4.5	0.0	+\$4.5	0.0
Total	\$547.6	1,880.6	\$551.3	1,858.3	\$562.7	1,901.3	+\$11.5	+43.0

¹ Totals may not add due to rounding. ² This includes \$10.6M related to the FY 2009 Homeland Security Amendment. ³ FY 2009 Enacted includes adjustments such as payroll and funding of the Small Business Innovation Research Program.



The American recovery and Reinvestment Act (ARRA) of 2009 provided the following resources to EPA. These resources are intended to fund “shovel ready” projects and thus they do not affect the ORD budget.

• State and Tribal Assistance Grants (STAG)	+\$6.30B
– Clean Water SRF	+\$4.00B
– Drinking Water SRF	+\$2.00B
– Diesel Emission Reductions Act	+\$0.30B
– Other Appropriations	+\$0.92B
– Brownfields	+\$0.10B
– Superfund Remedial Clean-up Program	+\$0.60B
– Leaking Underground Storage Tank	+\$0.20B
– Inspector General	+\$0.02B

Dr. Teichman identified a series of exemplary accomplishments for each of the ORD research program areas and highlighted the strategic research directions and research products in each area. These are discussed in detail in the later sections of the ORD presentations in these minutes (see ORD National Program Directors (NPDs)).

Dr. Teichman then discussed highlights of EPA’s response to the SAB’s report on ORD’s strategic research directions report (see SAB, November 26, 2008 and see the Administrator’s April 21, 2009 letter to the Dr. Swackhamer, Attachment E). Responses to points made in the SAB cover letter to the report include:

- “At my confirmation hearing and in my communications with U.S. Environmental Protection Agency staff, I have emphasized that science must be the backbone of EPA programs.”
- “...I intend to rely heavily on the SAB to safeguard the integrity and quality of our science-based decisions.”
- “The SAB’s eight recommendations...are extremely helpful. We have reviewed these recommendations carefully and believe that in many areas we are already working toward the change in focus recommended by the SAB.”
- “At the same time, we recognize that more action will be needed to fully address the environmental challenges we face. Taking new action requires choices and trade-offs; we plan to engage the SAB as we navigate this more challenging part of the decision-making process.”
- “I share the Board’s interest in ensuring that ORD’s efforts are directed toward meeting our nation’s most important environmental challenges in an integrated, multidisciplinary way that draws on ORD’s unique expertise.”

Responses to other comments in the report include:

- *Broaden the interpretation of “land preservation”*
 - Addressing land-use issues concerning biofuels

- Using scenario analysis to examine the effects of biofuels policy on a suite of six ecosystem services
 - Continuing important research on asbestos, vapor intrusion, and contaminated sediments
- *Broaden consideration of the life-cycle of new products and their globalization*
 - Using life-cycle analysis to study the global consequences of new technologies such as nanotechnology and biofuels
- *Expand the analysis of water infrastructures*
 - Shifting to a sustainable water quality and quantity approach
 - Evaluating the ecosystem-service outcomes implicit in water-policy decisions
 - Supporting the Aging Water Infrastructure initiative
- *Reinvigorate and modernize research on sensitive human and ecological populations including research involving chemical mixtures*
 - A number of research programs (e.g., safe pesticides and products, computational toxicology, ecosystem services) include projects designed to address susceptible human and ecological populations
 - Exploring how to move to a more integrated, multidisciplinary approach that addresses chemical contaminants
- *Improve the science foundation needed to respond to unexpected and emerging problems and environmental disasters*
 - Co-funded, with the National Science Foundation, the Center for the Environmental Implications of Nanotechnology
 - Developing an interagency research strategy on pharmaceuticals in the environment
- *Expand policy-relevant research on developing, testing, and evaluating new and innovative alternatives to conventional command-and-control regulation*
 - This line of research is closely aligned with the changing emphasis of our risk-management research program
 - Economics plays an important role in framing alternative approaches, as EPA needs to analyze the costs and benefits of different risk-management options
- *Improve the science foundation needed to respond to unexpected and emerging problems and environmental disasters*
 - Co-funded, with the National Science Foundation, the Center for the Environmental Implications of Nanotechnology
 - Developing an interagency research strategy on pharmaceuticals in the environment
- *Improve dramatically the integration of economics and the decision and behavioral social sciences into research and policy development across the Agency*
 - ORD is partnering with EPA’s National Center for Environmental Economics

- Decision and behavioral sciences are currently under-represented as disciplines within EPA, so we will work with organizations such as the National Science Foundation to enhance our use of these skills
- *Continue to work on improving the effective communication of research results*
 - National Program Directors play critical communication roles; they facilitate end-to-end partnerships with both internal and external stakeholders
 - Internal efforts include leading routine seminars with EPA Programs and Regions, and participating in workgroups to develop regulations and guidance
 - External efforts include publications in the peer-reviewed literature and presentations at scientific and technical society meetings

Dr. Teichman stated that: 1) ORD’s research program continues to significantly inform the environmental decision-making of EPA and others; 2) to go from being a “good” organization to a “great” one, ORD is working with our partners to focus on what research it should be conducting and how it should be performing that research; and 3) as always, ORD looks forward to open and frank discussions with the SAB on the strategic directions for ORD’s research program. He also noted that the 2010 budget would soon be released and that the baseline information from today’s discussions would be a starting point for discussion of the next steps in the program that the 2010 budget will target. He also noted that he would provide updated information for our continued discussions on ORD’s strategic research directions at the SAB meeting scheduled for September 2009.

SAB Questions and Comments:

- Members commented that the earmarks appear to be decreasing. Response: The earmarks have indeed decreased over the last several years, going from about \$40 M to around \$4.5 M.
- Does ORD make use of the popular press, and the Web, to get research results information out to the public? Response: ORD is improving its use of the Web to get its information out. ORD is also devoting more staff time to engaging with the popular press to tell the research story.
- The accomplishments lists seem to still be individual things and they are not yet tied together to a bigger cross-cutting picture. Response: That is correct and it reflects that reality that current accomplishments come from projects started in programs that were less connected. Future accomplishments should show more in the way of an integrated picture.
- Where does outreach to other agencies occur in regard to the computational toxicology program? Response: The CT program is partnering with other groups like FDA, NIEHS and in some cases with OECD and departments in Canada. We get more from this than if we were doing the work alone. Outreach is thus an ongoing thing in that program.
- Does the current budget allow for flexibility to work on the “transformation” items you mention? Response: It does. But dealing with the issues from a functional approach allows us to work on issues in a more connected way than might be implied by the structured way that the SAB sees the program in its interactions with ORD.

7. Detailed Discussions of Each Research Program Area

SAB Members and EPA ORD National Program Directors (NPDs) then discussed each of the specific research program areas. NPDs briefed the Board on each specific program and then responded to questions from Members. ORD Research Program Areas were clustered for these discussions into groups of Programs that seemed related. An SAB Team was assigned for each cluster to lead the discussions within each cluster and to provide primary drafting for the SAB's written response to the Administrator after this meeting. Attachment F shows the SAB Team Assignments.

- a) **Ecosystems, Water and Security Cluster:** Research Program Areas included within this cluster include Homeland Security, Drinking Water, Water Quality, and Ecosystem Services.

The SAB Team for this Cluster:

Dr. LD McMullen*	Dr. John Giesy
Dr. Christine Moe	Dr. Judith Meyer
Dr. Joan Rose	Dr. Duncan Patten
Dr. Gary Saylor	Dr. James Sanders**

*Lead Writer for Drinking Water

**Lead Writer for Ecosystems and Water Quality

- i) **Homeland Security Research: Dr. Gregory Sayles:**

Dr. Gregory Sayles discussed the Homeland Security Research Program. The HS research program mission is to conduct research and develop scientific products that improve the capability of the Agency to carry out its Homeland Security responsibilities.

Drivers for this research area are:

- Bioterrorism Act (2002)
- Homeland Security Presidential Directives (2003-2008)
- National Response Framework (revised 2008), and
- Elements of:
 - Comprehensive Environmental Response, Compensation and Liability Act
 - Emergency Planning and Community Right-to-Know Act
 - Clean Water Act
 - Safe Drinking Water Act
 - Oil Pollution Act
 - Clean Air Act

Responsibilities for Homeland Security include:

- Protect water systems from attacks and for detecting and recovering from successful attacks affecting water systems by leading efforts to provide States and water utilities guidance, tools and strategies. *EPA is the federal government Sector Specific Agency (SSA) lead for water infrastructure.*

- Decontaminate buildings and outdoor areas impacted by a terrorist attack by leading efforts to establish clearance goals and clean up.
- Develop a nationwide laboratory network with the capability and capacity to analyze for chemical, biological and radiological agents for routine monitoring and in response to a terrorist attacks.

The primary clients for this research are EPA’s Office of Water (responsible for carrying out water sector-specific lead agency duties) and the **EPA Office of Solid Waste and Emergency Response** (broad responsibilities in response to indoor and outdoor areas incidents of national significance). **Other important stakeholders include:** EPA Office of Homeland Security, EPA Regions, EPA Office of Prevention, Pesticides and Toxic Substances, EPA Office of Air and Radiation, States and local authorities and water utilities.

The Homeland Security Research Program has two Long-Term Goals:

- Long Term Goal 1: The Office of Water, water utilities and other clients use homeland security research program products and expertise to improve protection from, and the capability to respond to, terrorist attacks on the nation’s water and wastewater infrastructure.
- Long Term Goal 2: The Office of Solid Waste and Emergency Response and other clients use homeland security research program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environment.

Strategic Directions for Homeland Security research come from:

- Strategic plans
 - National Homeland Security Strategy
 - EPA Strategic Plan
 - EPA Homeland Security Strategy
- Administration priorities
- DHS threat analyses
- Client needs
- External expert advice
 - SAB
 - BOSC (May 2008): *“The general quality of the research being conducted is quite high and directed by a well organized MYP. “*
 - National Research Council

Research themes compared to security event chronology:

Event Chronology	Water Infrastructure To provide the EPA response community and water/wastewater utilities guidance, methods and tools so that they may effectively.	Outdoor and Indoor Areas To provide the EPA response community guidance, methods and tools so that they may effectively.
Protect against attacks	✓	
↓		
Monitor, detect, and confirm CBR attack	✓	✓
↓		
Minimize exposure of the public to the contamination	✓	✓
↓		
Characterize the nature and extent of contamination	✓	✓
↓		
Assess the risk to human health and establish cleanup goals	✓	✓
↓		
Clean up the site	✓	✓

Recent Homeland Security research program accomplishments included:

- Development of Provisional Advisory Levels (PALs) for exposure to over 30 high priority hazardous chemicals and chemical warfare agents in air and drinking water.
- Instrument Testing: Sixteen instruments have been tested to determine their capability to screen samples submitted to all hazards receipt facilities prior to a full analysis, helping protect responders, workers, and others from potential injury. AHRFs were developed to prescreen for chemical, radiochemical, and explosive hazards in samples collected during suspected terrorist attacks.
- Chosen as one of six international finalists vying for the 2008 prestigious **Franz Edelman Award** for work on modeling and distribution systems, “Reducing Security Risks in American Drinking Water Systems.”
- Developed and licensed a ultrafiltration-based concentrator for microbial water samples to support rapid microbial analysis and licensed the technology to a private company for marketing.
- Determined the efficacy of decontaminating toxic industrial chemicals and chemical warfare agents on building materials using chlorine dioxide fumigant and liquid oxidants

Strategic Directions for Homeland Security research are based on needs and guidance from the White House Homeland Security Council, our primary clients, SAB and NAS. The major strategic direction identified, include:

- Responding to a wide-area anthrax attack – dose-response, clean up goals, sampling and analytical methods, risk assessment and communication, clean up strategies

- Responding to the detonation of a radiological dispersion device (RDD) – sampling and analytical methods, clean up strategies
- Responding to an attack on a water distribution system – modeling tools to contain the spread of contamination and locate the source, risk assessment and communication decontamination of infrastructure, treatment of contaminated water
- Developing sampling and analytical methods for chemical, biological and radiological materials that may be used as weapons of mass destruction.

Anticipated research products from the Homeland Security Research Program include:

- Strategies to decontaminate water infrastructure when intentionally contaminated with chemical, biological or radiological materials
- A non-zero, risk-based cleanup goal for anthrax
- Development and testing of decontamination methods to address wide-area anthrax and radiological contamination
- Verified and validated analytical methods for chemical warfare and biological agents (esp. anthrax) in water, air and on surfaces (in collaboration with OSWER and OW).
- Increased understanding of how to communicate risk and risk management decision to the public.
- Publication of the HS Research Multi-Year Plan
- Strategies to decontaminate water infrastructure when intentionally contaminated with chemical, biological or radiological materials
- A non-zero, risk-based cleanup goal for anthrax
- Development and testing of decontamination methods to address wide-area anthrax and radiological contamination
- Verified and validated analytical methods for chemical warfare and biological agents (esp. anthrax) in water, air and on surfaces (in collaboration with OSWER and OW).
- Increased understanding of how to communicate risk and risk management decision to the public.
- Publication of the HS Research Multi-Year Plan

Homeland security research has a dual impact on other research areas. Other program areas that benefit from this research include -

- ORD's research closest relatives:
 - Drinking Water Research Program
 - Land Research Program
 - Human Health Risk Assessment Research Program
- Interagency research coordination
 - **DoD** and **DHS** science and technology programs via "Tri-Agency workgroup" and several MOUs
- **CDC** collaboration on microbial risk assessment
 - Others
 - Water Research Foundation
 - Water Environment Research Foundation
 - International collaborations (UK, Australia, Russia)

SAB Questions and Comments:

- What is the status of ORD's risk communications research? Response: It has just begun and we are working on how to best integrate it into our program. We will be holding a workshop to address how to do this.
- Are multi-attack scenarios on the table? Response: Yes, we are planning for multi-faceted events as well as multiple events occurring at the same time.
- Is Homeland Security research still being considered for use in other programs as well as for Homeland Security? Response: This portion of our program focuses on Homeland Security first, but we do recognize the broader applicability of some of the projects to other scenarios.
- How does EPA decide on what it does and what other agencies are to do in this research area? Response: We focus first on those things that EPA has primary responsibility for doing under the National Response Framework. We coordinate our efforts with those of other agencies but not we would not usually do research on an issue that is the primary responsibility of another agency.

ii) **Drinking Water Research Program: Dr. Audrey Levine:**

Dr. Audrey Levine presented information to the Board on the strategic directions and current program of research in support of the EPA Drinking Water Program.

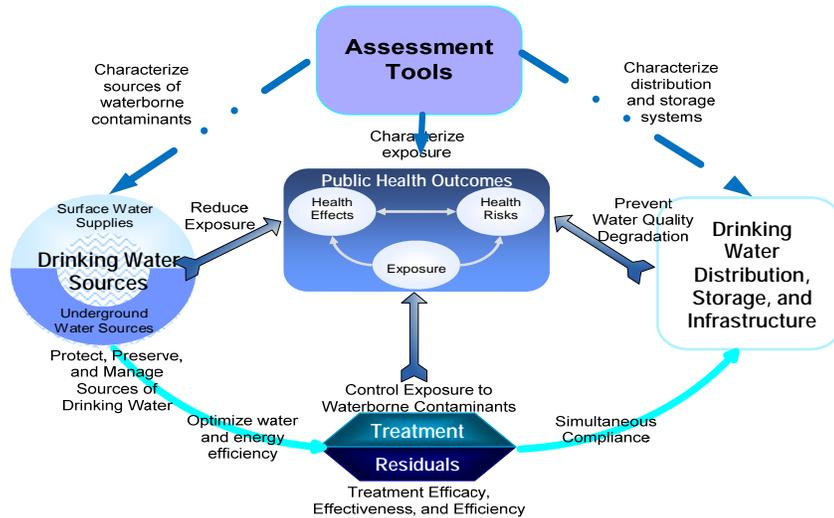
The Drinking Water Research program has two Long-term goals:

- One, is to characterize risks: chemical and microbial contaminants, infrastructure, water availability, and
- Two is to manage risks: Source water protection, treatment, distribution and storage

Thematic areas of the program relate to the hydrologic cycle, and include:

- Assessment tools
- Exposure/health effects
- Source water/Water Resources
- Treatment and residuals
- Distribution and storage

Schematically, this can be shown as:



Regulatory Research Drivers include:

Assessment tools

- Unregulated Contaminant Monitoring Rule (UCMR)
- CCL3 contaminants
- Distribution Systems
 - Lead and copper
 - Biofilms
 - Microbial indicators
 - Solids Accumulation
 - “Smart” monitoring

Exposure/ Health Effects

- CCL3 and emerging contaminants
- 6-year review: lead, DBPs

Source Water/Water Resources

- Surface water
- Source Water Protection
- Surface Water Treatment Rule (LT2)
- Underground sources of drinking water
- Underground Injection Control (UIC),
- Ground water Rule (GWR)

Treatment

- CCL3 contaminants
- Simultaneous Compliance
 - Corrosion control (LCR)
 - Disinfection byproducts (D/DBPs)
 - Nitrite/nitrate
 - Total Coliform Rule (TCR)

Distribution Systems

- Total Coliform Rule (TCR)
- Lead and Copper Rule (LCR)\
- Disinfection Byproduct Rule (DBP)
- Surface Water Treatment Rule (LT2)
- Simultaneous Compliance

Current and Emerging Research Drivers Include:

- **Public health protection**
 - Are current approaches adequate under changing water quality, water availability, and water use patterns?
 - Role of water infrastructure: Current inventory
Migration towards alternative water delivery/collection/reuse systems:
Green Infrastructure, Low Impact Development,
Integration of centralized and decentralized systems
 - Prioritization of waterborne contaminants
(health end-points, exposure pathways, mixtures, cumulative risks, sensitive populations)
- **Water scarcity/availability**
 - Impacts of drought/intense storms/snowpack variability on water quality and availability
 - Integrated water management and role of water reuse on regulatory construct for protecting public health
 - Increased rates of evaporation and variability in water sources (impacts on salinity, solubility, microbiology, pathogen diversity)
 - Nutrient and contaminant loadings:
Organic and inorganic disinfection byproduct precursors
- **Energy and economic impacts on treatment reliability**
 - Availability of chemicals (phosphates for corrosion control)
 - Energy needs to convey water (supply drinking water and collect wastewater)
 - Transportation costs—chemicals, residuals
 - Water-energy interdependencies--Carbon footprint of water and water footprint of energy production and delivery

- Impacts of energy decisions on water quality and availability (e.g. biofuels, thermo-electric power generation, geologic sequestration, etc.)
- Water economics—true costs of providing water, costs of waterborne disease outbreaks

• **Research directions for the drinking water research program include:**

Assessment tools

- Pathogen detection and viability/infectivity assessment
- Exposure metrics and links to occurrence
- CCL3 contaminants

Exposure/ Health Effects

- CCL3 and emerging contaminants
- Concurrent exposure to multiple contaminants
- Microbial Risk Characterization

Source Water/Water Resources

- Surface Water Protection
 - Emerging contaminants, Algal toxins, Pathogens (invasive species, antibiotic resistance, changing microbial ecology), Source tracking/attribution
 - Water reuse, Biofuels, water availability, quality/quantity, decentralized systems
- Ground water protection
 - Underground Injection Control (UIC): Geologic sequestration of carbon dioxide, groundwater recharge, aquifer storage and recovery,
 - Monitoring for public health indicators : microbes, emerging contaminant
 - Modeling: coupled hydrology and water quality

Treatment

- Treatment efficacy for CCL3 contaminants
- Small systems
- Corrosion control
- Residuals/Brine management

Distribution Systems

- Sustainable Infrastructure
- Research support for Total Coliform and Distribution System Research Partnership
 - Biofilms, Nitrification, Solids Accumulation
- Integrated corrosion control
 - Linkage with disinfection chemistry
 - Resilience to water quality variations (sources, precipitation impacts)
 - Secondary water quality impacts (biofilms, water discoloration, DBPs)
 - Impacts on wastewater treatment and water reuse (phosphate/nitrogen loading, metals release, sludge/biosolids)
- Sampling, Monitoring and Modeling

- Quantitative Microbial Risk Assessment Tools

Major Accomplishments for the Drinking Water Research program include:

- Where we've been: Major recent program accomplishments
 - Analytical methods for microbial pathogens and emerging chemical contaminants, arsenic bioavailability
 - Characterization of role of water quality (organic carbon, dissolved solids) in disinfection byproduct (DBP) formation and health effects (cancer and non-cancer) attributable to DBP mixtures (regulated and unregulated contaminants)
 - Treatment technologies for control of arsenic, particularly for small systems
 - Water distribution systems/infrastructure
- Where we're going: Major program accomplishments anticipated in the near-term
 - Biomarkers of exposure, Virulence Factor Activity Relationships (VFARs), analytical methods for sampling and analysis of multiple pathogens
 - Health effects: integration of screening tools, CCL3 high priority contaminants (strontium, molybdenum, nitrosamines, 1,1-dichloroethane)
 - Improved characterization of underground sources of drinking water—microbial risks, risk management, underground injection
 - Geologic sequestration of carbon dioxide: models, monitoring, geochemistry
 - Simultaneous compliance—lead and copper corrosion control; disinfectants and their byproducts, NPDWR
 - Water distribution systems—biofilms, solids accumulation, nitrification; integration/coordination with water infrastructure program
 - Water efficiency and water-energy nexus

Strategic Directions for the Drinking Water Research Program include:

Assessment Tools

- Integrated approaches for monitoring drinking water sources, treatment systems, and distribution systems

Exposure/Health effects

- Health effects attributable to mixtures relevant to drinking water including DBPs, PPCPs, environmental and treatment “degradates”, microbial metabolites, oxidation/reduction byproducts; emerging contaminants—tools for prioritizing health effects research

Source Water Protection

- Underground injection control with an emphasis on geologic sequestration; aquifer storage and recovery; water availability and quality; water reuse

Treatment and Distribution Systems

- Support for regulatory agenda including TCR, LCR, D/DBP, GWR, SWTR, 6-year review; support for Research and Information Collection Partnership (RICP), water infrastructure, Residuals management
- **Increased emphasis/visibility across thematic areas** — Water efficiency and water-energy nexus (includes source water protection, water reuse, water infrastructure, treatment and distribution systems); Environmental Justice

SAB Questions and Comments:

- Including research on carbon capture and sequestration is good. Does EPA work with DOE on this? Response: There is some “tag-team” interaction with DOE on this issue at some sites. OSTP is looking into more work in this area, but it is not necessarily going to be EPA work.
- In regard to climate changes impact on water resources, there is a need to look even more broadly at things such as storm water and its relation to waterways, as well as water reuse. Response: The research program is moving to incorporate some of these things. One of the issues discussed in the “transformation” initiative would fall into this area.

iii) **Water Quality: Dr. Ben Blaney**

Dr. Blaney discussed the ORD Water Quality Research Program. The program provides support for water quality criteria development, watershed management, and source control/management.

Recent accomplishments in each of these areas of the program include:

- Support for Criteria Development
 - Report on relative densities of genetic fecal indicator markers in wastewaters to evaluate their potential applicability for recreational water criteria, and updated Virtual Beach Model for use with environmental data and statistical techniques to predict beach concentrations of fecal indicators.
 - Reports on dosimetry methods for incorporating concentration and time variability into water quality criteria, and methods for assessing multiple risks for wildlife populations.
- Watershed Management
 - Developed benthic macroinvertebrate indicators of pesticides in stream water and sediment for linking pesticide exposures to causes of impairment in freshwater.
 - WASP7 (OW BASINS model) updated with eutrophication and mercury modules, extended application to headwater watersheds and improved application to estuaries.
 - ORD supported development of Watershed Central: an OW web-site for watershed information and management tools that became public in 2009.

- Source Control and Management
 - Reports on the state of the practice of aging infrastructure assessment and rehabilitation practices for use by utilities and others, including in effectively utilizing stimulus monies.
 - Manual on Design Concepts for Urban Watershed Wet-Weather Flow Management and Control for use in more effectively reduce CSO and other urban stormwater water quality problems.

Strategic directions for 2010 to 2014 include:

- Support for Criteria Development
 - Refining aquatic life/aquatic dependent wildlife methodologies, updating chemical occurrence and effects data, and evaluating biological condition gradients to better assess nutrient impacts.
 - Continue research to support recreational water criteria revisions.
- Watershed Management
 - Continuing efforts on assessing aquatic conditions and causes of impairment, and initiating work to better target where to focus efforts and how to measure the results of management strategies within the selected watersheds.
 - Continued development of tools for formulating and implementing effective watershed management strategies, with particular emphasis placed on how to restore the hydrology of urban watersheds, including the use of low impact development (green BMP) techniques.
- Source Control and Management
 - Major directions continue for improving the condition of water infrastructure and managing wet weather flows in both urban and agricultural settings.

A number of examples of research products that anticipated in each of the areas include:

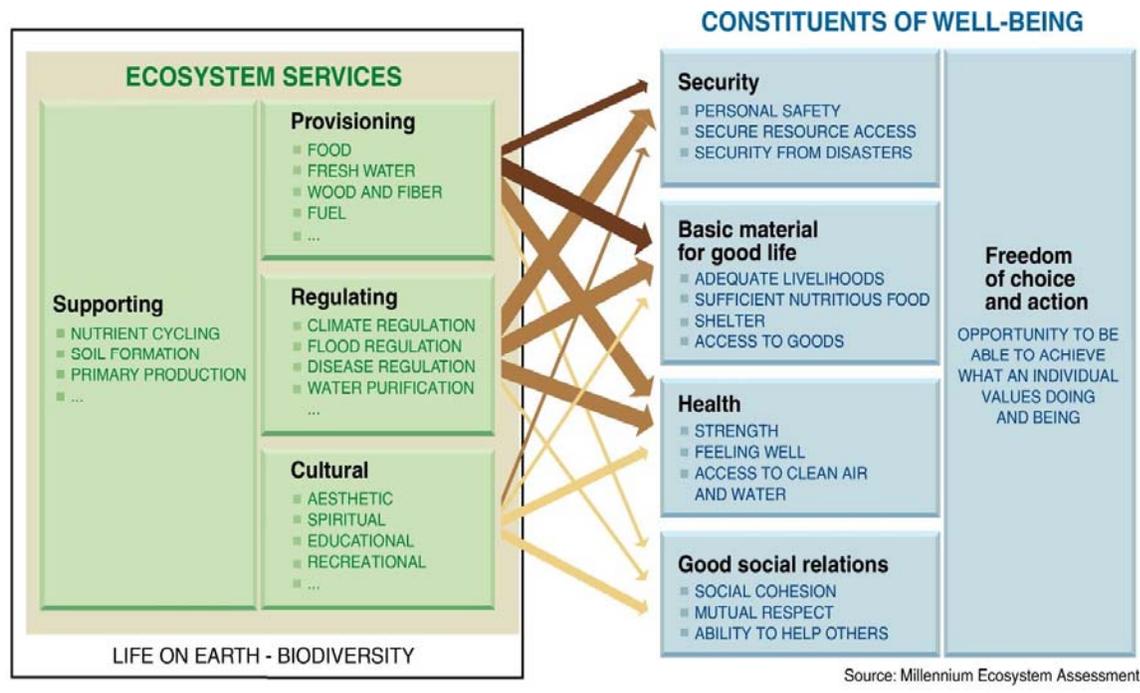
- Support for Criteria Development
 - Development, and ground-truthing, of analytical tools for measuring select emerging contaminants in various environmental compartments.
- Watershed Management
 - Reports on the use of metagenomics analyses and other indicators for determining the source of human and animal sources in watersheds.
 - Improved methodologies for projecting the effectiveness of BMPs in managing water quality on a watershed basis, including through the use of TMDLs.
 - Guidance on the effective design and implementation of riparian buffers.

- Source Control and Management
 - Results of full-scale condition assessment and rehabilitation demonstration projects, and demonstrations for the use of green infrastructure for urban storm water control.

SAB Questions and Comments:

- There seem to be many overlaps in the drinking water and water quality programs. How do they link up within the agency? Response: Both programs by nature deal with the same suite of general issues. Within this generality though the specific things we do in the R&D program for each are determined by each programs statutory focus.
 - Do the EPA and USDA research programs on non-point source run-off interact? Response: Yes they do. An example is our pathogens in surface water research that makes use of some information from USDA. Our work on nutrients in ground water is done at USDA through an interagency agreement. We have a strong interaction on consolidated animal feeding operation (CAFO). In watershed management we benefit from work we know that they are doing but in that area there is not much active collaboration.
 - Does EPA do research on pharmaceuticals in water? Response: Most of this is being done in the Drinking Water's Candidate Contaminant Listing program which is now into the third iteration of listing.
 - The biggest question (issue) in water quality is really in the areas of 1) agricultural non-point source pollution and 2) urban non-point source pollution. Much of this issue at the University of Minnesota comes from the Ag Extension and Ag Experimental Stations research. How do you access this information at EPA? Response: We tend to leave it to our individual researchers to keep up with the published research that is going on in areas relevant to their work. This is an area where looking for more information from USDA for these programs would be an excellent idea. The Chair noted that outreach to state extension would also be important and not just USDA.
 - Do you focus your BMP work on single or multiple pollutants? Our work in this area (long-term goal 3) is focused on understanding BMPs and how they function. We have produced some manuals on this. Our green BMPs work is focused on monitoring multiple pollutants and the results are intended to feed into our long-term goal 2.
 - From the Board's work on the Strategic Research Directions of ORD and from its Hypoxia report it is clear that, if ever there was an area ripe for it, there is a need for expanded policy relevant research here relative to alternatives to command and control methods. There is also a need to do work on determining how one can get people to use these alternatives to command and control.
- iv) **Ecosystems: Dr. Iris Goodman**
 Dr. Goodman discussed EPA's newly reconfigured ecosystems research program which focuses on research that will support decisions to conserve ecosystem services through

proactive action. Ecosystem services have consequences for people. Some linkages between services and constituents of human well-being were shown graphically.



The ecosystem research program will look at supporting, regulating, provisioning, and cultural services and work to quantify them in biophysical metrics (some will be monetized). The program follows a trans-disciplinary approach to conserving ecosystem services in which components such as ecology, economics, law, and decision sciences are connected.

Ecology can help by:

- Creating geo-spatial products that describe ecosystem services.
- Developing scenarios that envision alternative combinations of services and providing a means to assess trade-offs.
- Developing methods to restore and enhance ecosystem services through restoring or creating new ecological production functions.
- Identifying, quantifying, and anticipating ecological “tipping points” that threaten loss of services – and manage accordingly.

Dr. Goodman noted that ORD is finding this information to be of tremendous interest to policy makers, state governments, planning councils, economists, financial institutions, NGOs, and many others leading them to forge trans-disciplinary collaborations.

Looking linearly at the program, the goals are to transform the way we account for changes in ecosystem services that result from decisions by:

- Keeping the end in mind: integration, decision support and outreach;
- Monitoring, mapping, and modeling ecosystem services at multiple scales;
- Doing pollutant-specific studies: effects of nitrogen on ecosystem services;

- Doing ecosystem-specific studies: ecosystem services provided by wetlands and coral reefs; and
- Doing place-based studies: Willamette OR, Tampa Bay FL, Future Midwest Landscapes (including effects of biofuels on ES), Coastal Carolinas, Southwest U.S.

Recent accomplishments include:

- SAB EPEC review, April 2008: “commends the Agency for developing a research program that, if properly funded and executed, has the potential to be transformative for environmental decision-making as well as for ecological science.”
- ESRP matrix: we have integrated, multi-disciplinary teams drawn from across all Labs & Centers
- Program level research framework infused with “experimental design” concepts, i.e., foundational research x exploratory research x replicated demonstrations
 - methods standardized sufficient for comparative testing and evaluation,
 - flexible enough for innovation and refinement.
 - advances promoted at the intersections – the “x’s”
 - “replications” include decision analytic tools with clients, since framework designed by ultimate outcomes –i.e., decision-making
 *** these aspects critical at this juncture for ecosystem services science
- Now in implementation: 12 detailed IP for each row / column of matrix All are cross-Lab and Center products

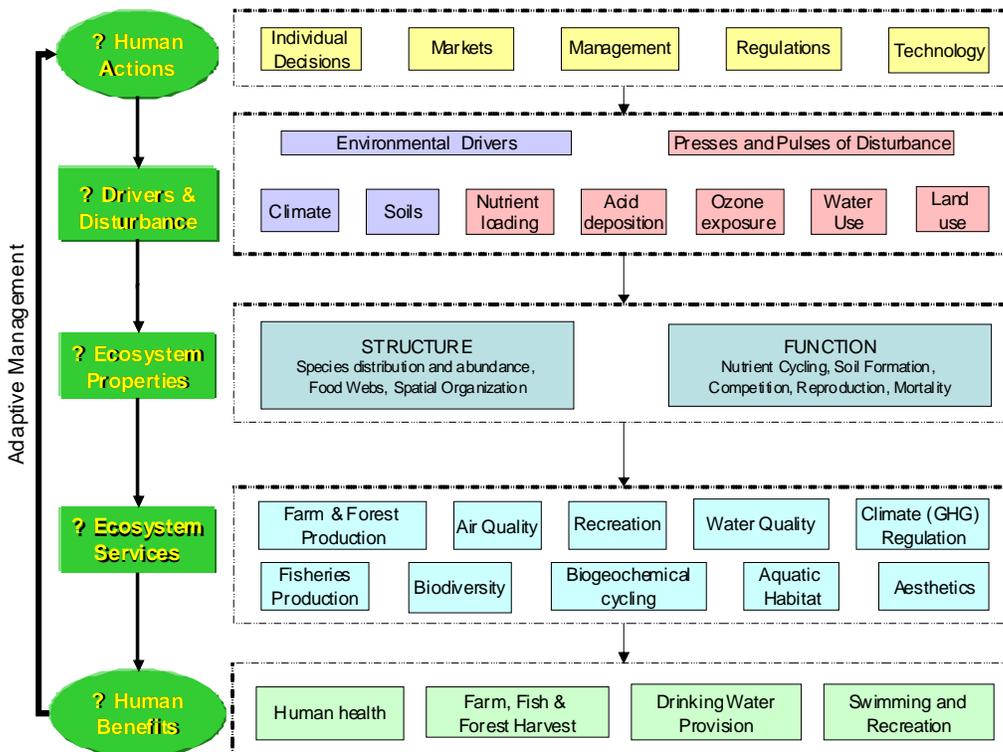
Dr. Goodman provided a program matrix to show how the ecosystem services projects are being organized to maximize ORD disciplinary strengths.

Projects and Long term Goals →		Eco-system Specific Studies: LTG 4--23%		Community Based Demonstration Projects: For National, Regional, State and Local Decisions (includes Nitrogen and Wetlands services) LTG 5—28%				Theme Leads
	Cross Program Themes and Research Objectives	Wetlands (19%)	Coral Reefs (4%)	Willamette (5%)	Tampa Bay (7%)	Mid-West (7%)	Coastal Carolinas (9%)	
Inventory, Map, and Forecast Ecosystem Services at multiple scales (National Atlas) LTG 2 38%	Landscape Characterization and Mapping (10%)	Ric Lopez	Anne Neale	Don Ebert	Taylor Jarnagin	Megan Mehaffey (New Hire in the future)	Deb Chaloud	Anne Neale
	Inventory and Monitoring of Services (21%)	Jack Kelley	Bill Fisher	Spence Peterson	John Macauley	Joe Flotemersch	Darryl Keith	Mike McDonald
	Modeling for Scenarios and Forecasting for different management options (7%)	Brenda Rashleigh	Susan Yee	Bob McKane	Sandy Rimondo	Russ Kreis	Steve Kraemerr	Tom Fontaine
Integration, Decision Support and Outreach LTG 1 8%	Ecosystem Services and Human Health (2%)	Kevin Summers	Kevin Summers	Steve Klein	Lisa Smith	Betsy Smith	Deb Mangis sending name	Laura Jackson
	Valuation of Ecosystem Services (2%)	Chuck Lane	Dan Campbell & Suzanne Ayvazian	Matt Weber	Sharon Hayes	Alex Macpherson	Alex Macpherson	Wayne Munns
	Decision Support Platform Created to Integrate Findings from Entire Program (3%)	Tim Canfield	Pat Bradley	Dave Burden	Marc Russell	Vasu Kilaru	Drew Pilant	Ann Vega
	Outreach & Education to (1%)	Janet Nestlerode	Pat Bradley	Bill Hogsett	Jim Harvey	Brenda Groskinsky	Walt Galloway	Suzanne Marcy
Eco-system Specific Studies LTG 4	Wetlands (23%)				Janet Nestlerode	Chuck Lane		Steve Jordan
Pollutant Specific Studies LTG 3	Nitrogen (5%)	Steve Jordan	Jim Latimer	Bill Hogsett	Richard Devereaux	Ken Fritz	Brent Johnson	Jana Compton
Project Area Leads	Rick Linthurst And Iris Goodman	Janet Keough	Bill Fisher	David Hammer	Marc Russell	Randy Bruins/ Betsy Smith	Dorsey Worthy	Rick Linthurst Iris Goodman
				Hal Walker Place Based Coordinator				

Another way of viewing the program that combines ORD's long-term goals with uses of the data and implementation partners is.

ESRP Research Activities	Applied Uses	Implementation Partners
LTG 1: Decision support	-- engaging stakeholders --- improved participatory, deliberative decision-making	-- <i>World Resources Institute</i> -- <i>Business for Social Responsibility</i>
LTG 1: Valuation, trade-offs	-- quantification of eco service changes, -- systems analysis of trade-offs -- improved benefit cost analyses	-- EPA NCEE -- new ES Research Partnership
LTG 2: framework to <i>inventory and monitor</i> selected ecosystem services nationwide	-- "green" national income accounts -- Potential use in <u>Report on the Environment</u>	EPA's National Center for Environmental Economics* NEON, ROE , Heinz Center, GAO
LTG 2: <i>Mapping</i> selected ecosystem services nationwide	-- see spatial distribution of services, baseline, projected, & retrospective -- can see ES sources and beneficiaries	<i>National Geographic</i> <i>USGS Geography Division</i>
LTG 2: Modeling key interactions among services, ecological production functions, scenarios, tipping points	-- optimizing service "bundles" -- creating "community of practice" (ICPP-like) -- "engine" for simulation portion of Decision Support framework	-- <i>Gund Institute for Ecological Economics</i> -- <i>Natural Capital Project</i> * -- <i>Smithsonian Institution</i>
Matrix theme leads: LTG 3, 4, 5 Cross-theme analyses to identify emergent properties for place-based, ecosystem-based, and pollutant-based studies.	-- comparative testing, evaluation -- cross-fertilization to "advance at intersections" -- identify cross-scale issues & dynamics -- identify attributes that confer ecosystem resilience	<i>Stakeholders (local, state)</i> <i>EPA Regions 2, 4, 5,7,8, 10</i> <i>Other federal agencies</i> <i>Many NGOs</i> <i>MA Sub "II" sub-global assessments</i>

Dr. Goodman also noted the ecological research program incorporates a logical to integrate across disciplines. Shown graphically,



Anticipated future accomplishments for this program include:

- Incorporating ecosystem services into wetlands permitting decisions: new methods to support 2008 EPA & ACE rules.
 - First federal rule specific to ecosystem service
- Developing “community of practice” for ecosystem service modeling (similar in concept to IPCC climate modeling, as discussed by SAB)
- Accelerated pilot on reactive Nitrogen – in support of OW, OAQPS, Gulf of Mexico hypoxia issues, SAB’s Integrated Nitrogen Committee
 - “fast failure” test of ESRP approach to IMD: low risk / high reward.
 - potentially ground-breaking, with respect to Agency benefit / cost analyses
- National Ecosystem Services Research Partnership: more than 160 respondents
 - state resource agencies, regional planning councils, interdisciplinary departments at universities, professional societies, business, federal agencies, legal practitioners
 - acts a catalyst to most swiftly create, test, and apply tools
- Participation in MA “II” – sub-global assessments: via research underway at five ESRP community-based study areas

SAB Questions and Comments:

- What types of social science are you incorporating into the ecosystems services program? Response: For now, we have broad-based economists, legal and policy scholars, and others with multiple degrees.
- Is the biofuels work considering impacts on third world land use? Response: Not explicitly addressing international issues yet.
- Climate change and CO2 efforts seem to focus on conserving/enhancing people’s well-being and not explicitly ecosystems themselves. This anthropogenic focus is troubling. Response: We see conserving these services as actually conserving ecosystem functions. We are also concerned with the perception that ours is mainly an anthropogenic view; but we do not just have a strictly utilitarian view.
- How is EPA to communicate the program’s results? Response: We are working with organizations such as the World Resources Institute, National Geographic Society, National Science Foundation, etc. in research partnerships and we hope to increase our ability to communicate our results using their assets as well as our own.
- Social sciences, decision sciences, and human behavioral sciences are all a bit different. From the information so far, it appears that there is a need to put more thought into how these differing perspectives can be integrated into the program.
- At a recent SAB/HSAC meeting we heard of EPA’s anthrax mitigation plans. We had a good feeling that the efforts tied to building clean up was in good shape. But for wide-area contamination events (e.g., ecosystems) there was little evidence that much could be done. How soon will research begin to address this? Response: This area is in need of additional work. We are working on that in our next 3-5 years of the program. It will take time.

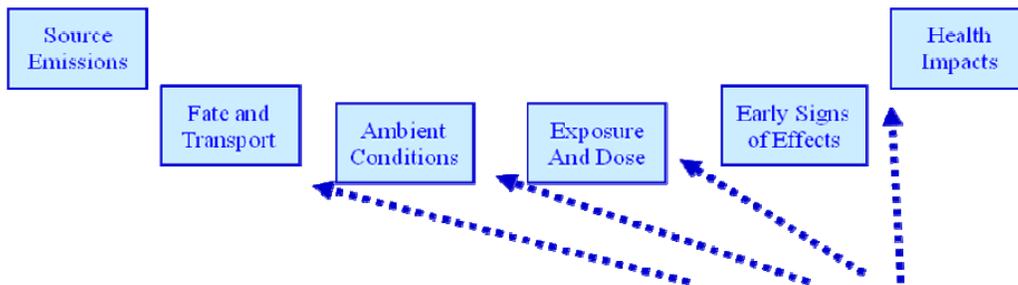
- b) **Human and Ecological Health Cluster:** Research Program Areas included within this cluster are: Human Health, Human Health Risk Assessment, Computational Toxicology, Endocrine Disruptors, and Safe Pesticides/Safe Products.

The SAB Team for this Cluster:

Thomas Burke	Meryl Karol
Tim Buckley	George Lambert
James Bus	Melanie Marty/Henry Anderson
Deborah Cory-Slechta	Steve Roberts
Steve Heeringa	Kristin Shrader-Frechette

- i) **Human Health: Dr. Sally Darney:**

The overarching goal of the Human Health research program is to help EPA protect human health. Human health research develops the methods, models, & data to characterize and reduce uncertainty in the ‘critical links’ across the exposure-to-effect paradigm and, explores fundamental determinants of exposure and dose, and the basic biological changes (effects) that result from exposure to environmental contaminants and lead to adverse health outcomes. The program focuses on the source to disease cascade shown in the following:



The program has four inter-related Long Term Goals:

- Understand and reduce uncertainty in risk assessment using mechanistic (mode of action) information
- Characterize aggregate & cumulative risk in order to manage risks to humans exposed to multiple environmental stressors
- Characterize and provide adequate protection for susceptible populations
- Evaluate the effectiveness of risk management decisions

Human Health research was in the past thought of as “Core Research” in past years; however. It has expanded to reflect the linkage of this program to other parts of the ORD research program (e.g., Endocrine Disruptors, Clean Air, Computational Toxicology, Drinking Water, Land, Human Health Risk Assessment, Global Change, Ecosystem Services, etc.

Human Health Research products are broadly applicable to many partners and stakeholders, e.g.,

- Research informs risk guidance and assessments by NCEA, and computational toxicology modeling in NCCT
- Relevance/utility of research is not program office specific (OAR, OPPTS, OW, OSWER)
- Projects solve problems in Regions (States) and Tribes
- Close ties with Office of Children's Health Protection and Environmental Education (OCHPEE)
- Stress Cooperation with Federal Agencies: NIH, CDC, NIEHS, HUD, and
- International: WHO, OECD, IPCS

Accomplishments by LTG, include the following:

Mode of Action Research

i) Current:

- Cancer vs. non-cancer mechanisms: Conazoles (2012), Arsenic, Neuro-endocrine
- Interpretation of Biomarkers using PBPK modeling (2008 RFA)

ii) Anticipated

- Strategic directions: Increasing emphasis on Key Events and Toxicity Pathways; Collaboration with NCCT
- Transition to Systems Biology Approaches
- Predictive Toxicology using "virtual organs"
- Responsive to NRC's "Toxicity Testing 21st Century" ...and EPA's "Strategic Plan for Evaluating the Toxicity of Chemicals" (2009)

Cumulative/Community Risk Assessment

i) Current

- Cumulative risk assessments (OPP SAP) OPs, Carbamates, Pyrethroids (2012)
- Exposure models: SHEDS, ERDEM, HEDS, CHAD [Characterize exposures in specific environments (homes, daycare, playgrounds)]

ii) Strategic Directions:

- Community based risk assessment: Regional-ORD workshop CBRA (July 2009)
- Interpretation & Use of Biomonitoring Data (collaborations with CDC)
- "Understanding the Role of Nonchemical Stressors and Developing Analytic Methods for Cumulative Risk Assessment" (2009 RFA)
- Next generation of exposure models (SHEDS multi-media); translate to Regions and States (user-friendly web tools)
- Collaboration with NCCT on exposure database

Children's Health Research (current and anticipated*)

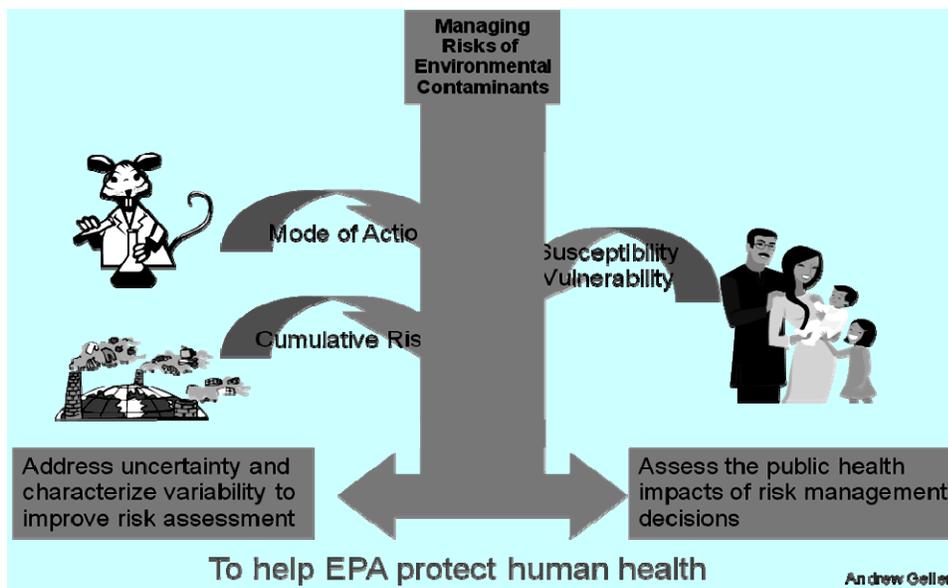
- EPA-NIEHS Children's Environmental Health & Disease Prevention Centers
- Asthma, Autism, Gene-Environment

- Socio-Economic Factors
- New Children's Center RFAs 2009*
- Vulnerability & Susceptibility based on life stage; Home/school environments*
- Child-specific exposure factor handbook (NCEA, 2008) all age groups
- Methods: Breast milk; Biomarkers
- Animal model: Developmental Basis for Health & Disease*
- Active partnership/collaboration with National Children's Study*

Evaluate Effectiveness of Risk Management Decisions ('Closing the Loop') (current and anticipated*)

- Framework & workshop 2008
- Public Health Indicators RFA, 2005
- Demonstration Projects ("Accountability") with R1(2012)
 - **MA Water Plant Upgrade & Water Borne Illness**
 - **Clean Air initiative in New Haven**
- Exploring Linkages between Health Outcomes and Environmental Hazards, Exposures, and Interventions for Public Health Tracking and Risk Management 2009*
- Tools & Public Health Indicators to understand disproportionate risk and impacts of climate change at community level (e.g. Tribal grants)*

Another way of looking at the linked program of Human Health Research is as follows:



SAB Questions and Comments:

- The linkage of this program to a “public health” concept is not clear. Response: Linking the toxicology side with public health remains a need. We hope that by partnering more with agencies that have a direct public health mission we will create greater linkages

between the toxicology programs and epidemiology, exposure, and other types of data from these agencies.

iii) **Human Health Risk Assessment: Dr. Peter Preuss:**

Human Health Risk Assessment has three Long-Term Goals:

- LTG 1: IRIS and other priority health hazard assessments
- LTG 2: State-of-the-science risk assessment guidance, models, and methods
- LTG 3: Integrated Science Assessments (ISAs)

Program accomplishments include:

- LTG 1: IRIS and other priority health hazard assessments
 - Initiated interagency or external peer review for 16 IRIS assessments and posted 5 final assessments in 2008.
 - Completed 20 new or renewed provisional peer reviewed toxicity values (PPRTV's) in 2008 to support OSWER, EPA regions and states' decision-making.
 - Upcoming release of several major assessments for interagency or external peer review (methanol, TCE) and an overall increase in the release of IRIS assessments
- LTG 2: State-of-the-science risk assessment guidance, models, and methods
 - Final Children's Exposure Factor Handbook for use by Agency and external risk assessors.
 - Final report on PBPK methods for assessing internal doses of mixtures of trihalomethanes in drinking water for use by OW.
 - Report on the 2007 workshop on "State of the Science on Low-Dose Extrapolation – Issues and Practice" which will support all EPA Programs.
 - Final report on methods to minimize exposure misclassification in epidemiological studies for use by several Program Offices.
 - Report on analysis of 2-stage clonal growth models for formaldehyde with relevance to other biologically-based dose response models.
- LTG 3: Integrated Science Assessments (ISAs)
 - Nitrogen Oxides and Sulfur Oxides – final ISAs for health effects will be used in review of the primary NAAQSs.
 - Nitrogen Oxides and Sulfur Oxides – final ISA for environmental effects will be used in review of the secondary NAAQSs.
 - Particulate Matter – external review draft ISA for health effects will be used in review of the primary NAAQS and secondary NAAQS.
 - Significant scientific support provided for NAAQS decision-making.

Strategic Directions for the Human Health Risk Assessment Program include:

- IRIS and risk assessment methodology
 - Accelerate IRIS and incorporate new data and methods for improved assessments.
 - Move towards *Next Generation Risk Assessment*.

- *Develop methods for the use of new data (e.g., comp tox) in risk assessment.*
- *Integrate methods into chemical assessment development to increase quantity of toxicity values available for decision-making.*
- *Collaborate across EPA (e.g., NHEERL, NCCT, OPPT).*
- *Implement NAS Report “Toxicity Testing in the 21st Century: A Vision and a Strategy” (2007) and EPA’s “Strategic Plan for Evaluating the Toxicity of Chemicals” (2009).*
- Increase collaboration with CalEPA and ATSDR to develop health assessments.
- Advance cumulative risk assessment (phthalates, PAH mixtures) – to implement NAS report “Phthalates and Cumulative Risk Assessment” (2008) – collaborate with OPPTS and OW.
- Evaluate and implement recommendations of NAS Report “Science and Decisions: Advancing Risk Assessment” (2008) – cross-Agency effort.
- Integrated Science Assessments
- ISA process underway simultaneously for all NAAQS pollutants; close coordination with OAR and acceleration possible pending L. Jackson decisions.
- Implement Health and Environmental Research Online (HERO) database.

Significant Anticipated Accomplishments include:

- LTG1: IRIS and other priority health hazard assessments
 - Deliver a substantially increased number of IRIS assessments for interagency or external peer review and final posting to support decision-making. Increase Program and Regional collaboration in nomination and prioritization processes.
 - Complete 50 new or renewed PPRTV’s to support OSWER, EPA regions and states’ decision-making each year. This will result in about 400 PPRTV’s being completed during FY09-15.
- LTG2: State-of-the-science risk assessment guidance, models, and methods
 - Develop guidance and methods for the use of new data in risk assessment.
 - Develop approaches for unifying cancer and noncancer dose-response assessment including moving away from the RfD to a probabilistic approach.
 - Develop methods for incorporating population background risk into dose-response assessment.
 - Improve cumulative risk methods by considering vulnerability, nonchemical stressors, and background risk factors.
 - Update Reference Concentration methods and provide Exposure-Response Arrays for evaluation of risks from varying exposure-time scenarios.
- LTG3: Integrated Science Assessments
 - Fully implement revised NAAQS process and develop new ISAs for the six criteria air pollutants on a 5-year review cycle meeting Clean Air Act mandates.
 - Sustain scientific support to OAR and Administrator for NAAQS decision-making.

SAB Questions and Comments:

- Soon , as a result of new ways of looking at toxicology, an avalanche of information will be available. Information will be coming from the U.S. as well as from other nations. Hopefully, EPA will be prepared for this and be able to move forward with the next generation of risk assessments.

iv) **Computational Toxicology: Dr. Robert Kavlock:**

Recent Program accomplishments in the Computational Toxicology research program include:

- Completion of Phase I of ToxCast
- Release of ToxRedDB with five major data sets in relational format
- Release of ACToR website
- Launch of v-Liver and v-Embryo
- Increased dialogue with ORD Labs/Centers on tools of computational toxicology
- Establishment of interagency Tox21 consortium
- Hosted v-Tissues 2009 with the European Union under joint Biotechnology Agreement
- Chair of OECD Working Group on Molecular Screening
- Award (pending) of 4th STAR Computational Toxicology Center
- Highly consistent with Administrator's (and SPC) priority to improve contaminant assessment

Major anticipated accomplishments include:

- Publication of large series of papers on ToxCast Phase 1 assays and predictions
- First ToxCast Data Summit, May 14-15 in RTP
- Awarding additional ToxCast HTS contracts
- Co-Lead on EPA's Strategic Plan for the Future of Toxicity Testing
- Launch of Phase II of ToxCast
- Recruitment of Communications specialist
- Construction of 10,000 chemical screening library at NCGC under Tox21
- Expansion of data modules contained in ToxRefDB
 - Developmental neurotoxicity, potentially the EDSP Tier 1 Battery
- Publication of molecular docking models for identification of protein based targets (first ER, then AR and then moving to ToxCast protein targets)
- Release of Knowledgebases supporting v-Tissues
- Fourth review of the program by the BOSC – September 29-30, 2009

Strategic Directions for the Computational Toxicology program include:

- Second Generation CTRP Implementation Plan
 - Collapsing three long term goals to single on (Providing Computational Tools for High Throughput Exposure, Hazard and Risk Assessments)
 - Disinvestment of NRMRL related CTRP activities
 - Stronger cross MYP and L/C interactions Development and verification of predictive bioactivity profiles
 - Concentrated effort to launch of ToxCast Phase II (+700 chemicals)

- Incorporation of failed pharmaceuticals and nanomaterials
- Initial efforts to develop exposure analogue of ToxCast (ExpoCast)
- Expansion of v-Tissue programs
- Continued support and growth of ToxRefDB and ACToR
- Discussion on future direction of the STAR Computational Toxicology Program as initial Centers expire
- Establishment of Contaminant IMD, based of Strategic Plan for Evaluating the Toxicity of Chemicals and spanning source to outcome to risk assessment
- The CTRP will continue to evolve as the research progress. The greatest chance will be an extension of the high throughput hazard prioritization model pioneered by ToxCast to exposure and risk assessment. There will have to the concordant advances in approaches to targeted testing in order to best interpret and understand results from HTS.

Significant anticipated accomplishments include:

- ToxCast will be reduced to practice and provided to EPA program offices for use in prioritizing chemicals for toxicity testing; ancillary benefits will include information about common modes of action, susceptible genotypes and effects of mixtures
- ToxRefDB will become a living, central repository of animal bioassay data across the Agency, with accompanying ability to probe the relational database by endpoint, chemical class or syndrome.
- Two virtual tissues will be developed that will allow computer simulations of the effects of perturbations in molecular pathways on cellular and tissue function. These will be used in conjunction with pharmacokinetic models to exposure the shape of dose response relationship below the experimentally observable range.

SAB Questions and Comments:

- Computational toxicology needs to contribute to addressing cumulative risk issues? There will be a need for predictive validation for the values you generate.
- There are exciting changes with the move to a new risk assessment paradigm, computational toxicology, and cumulative risk assessment for an endpoint. There are other types of cumulative risk, e.g., exposures to more than one type of a compound, not just one. Do you have an approach that focuses on sources and not just single pollutants? Response: Many have struggled with this issue, and for a long time. Some prefer to address a source using a technology approach and others using a risk-based approach. The NAAQS program is trying to address this issue and is finding that it is very difficult to do. The issue forms an undercurrent across all ORD research, but there are still no good answers. Another ORD representative suggested that if we conclude that our approach to high-throughput compounds works, then it is likely that it will also be useful for looking at multiple pollutants.
- With ORD's compression of three long-term goals into one you will find that some things won't fit neatly into the one. Is that a problem? Response: We now have a problem of fit with three long term goals in place. The situation is not so much that an issue does not fit any goal, rather it is that one project might well fit into more than one long-term goal. This should not be an issue with one goal written appropriately.

iv) **Endocrine Disruptors: Dr. Elaine Francis:**

Strategic Directions for the Endocrine Disruptors research program include:

- Provide a better understanding of the science underlying the effects, exposure, assessment, and management of endocrine disruptors
- Determine the extent of the impact of endocrine disruptors on humans, wildlife, and the environment
- Support Agency's screening and testing program
- Consistent with Administrator's priority areas:
 - Managing chemical risks. Protecting America's waters. Vulnerable subpopulations, specifically children
- Leveraging with other research partners
- Addressing SAB Recommendations:
 - Apply newer molecular tools to develop subsequent generations of screening assays, increase efforts on cumulative risk, incorporate newer "computational" approaches to CAFOs research
- Major Changes
 - Acceleration/augmentation of certain research areas as a result of FY09 Omnibus Bill increase of \$1.5 M more than FY08 enacted budget
 - Competitive internal RFPs with emphasis on integrated multi-disciplinary research
 - FY08 Appropriations requested a proposal and budget for extramural grants program – not known whether this will be considered in future
- **Major recent program accomplishments**
 - Completed research in developing assays for Tier 1 of the Agency's EDSP
 - Began integrated multi-disciplinary effort across all of ORD's Laboratories in collaboration with grantees, scientists from Programs/Regions and other Agencies to characterize the environmental impact of hormones (natural and synthetic) from CAFOs; held workshops in '07 and '08
 - Completed project with GWRC where assays, including one developed by EPA, were used to determine estrogenicity of WWTP effluents from around the world
 - Summary report on 10 years of accomplishments
 - Research on prenatal effects of phthalates (individual and mixtures of) considered in NAS report, PL 110-314, assessments in US, Canada, Europe
 - Report on whole lake study dosed with EE2 (one of *Discover's* top 100 papers of '07)
- **Major program accomplishments anticipated in the near-term**
 - Completion of last 2 assays for Tier 2 of EDSP using fish and amphibian models
 - Short term screen to predict developmental neurotoxicity of thyrotoxic agents
 - STAR grantee reports on characterization of low dose effects
 - Characterization of predictive value of *in vitro* aromatase assays
 - Improved biomarkers of exposure and development of other novel approaches for monitoring endocrine activity in complex environmental media

- Analytic methods to quantify EDCs and determine treatability of selected EDCs
- Approach for utilizing genomics data in EPA risk assessments
- Completion of 5 epidemiology studies on developmental/reproductive effects

Significant anticipated products and their intended use by partners include”

- Comprehensive battery of “next generation” assays using several classes of vertebrates
 - Used by OPPTS and others for chemical prioritization and screening
- Cross-Lab/Center/Program/Office/grantees/interagency/state/city efforts to develop/apply new analytical & *in vitro* methods & other tools to evaluate environmental samples for endocrine activity & determine potential impact on fish & human health using lab & field studies; determining efficacy of operations to reduce endocrine activity
 - Used by Program/Regional Offices, States, municipalities, and industry to assess and mitigate environmental impact of endocrine activity
- Frameworks for: cross-species models of TH and aromatase disruption; improved linkages between TH alternations in short term screens and adverse outcomes; cumulative risk assessments; characterization of impact of EDCs on toxicity pathways associated with neuroendocrine regulation of puberty and epigenetic mechanisms of transgenerationally induced reproductive effects
 - Used by EPA and others to improve risk assessments of EDCs
- Training of Programs/Regions, States, Tribes on molecular assays and exposure methods for environmental assessment; further application of methods, e.g., characterize impact of CAFOs, endocrine active pharmaceuticals in WWTPs on fish populations
 - Used by Programs/Regions, States, Tribes for environmental assessment

SAB Questions and Comments:

{ Questions for Dr. Francis are at the end of her second presentation that is in item “15” below. }

v) **Safe Pesticides/Safe Products: Dr. Elaine Francis:**

Strategic Directions for the Safe Pesticides/Safe Products research program.

OPPTS and/or other organizations use the results of ORD’s research on methods, models, and data as scientific foundation for:

- 1) prioritization of testing requirements, 2) enhanced interpretation of data to improve their human health and ecological risk assessments, and 3) decisionmaking regarding specific individual or classes of pesticides and toxic substances that are of high priority.
- probabilistic risk assessments to protect natural populations of birds, fish, other wildlife, and non-target plants.
- decisionmaking related to products of biotechnology.
- Consistent with Administrator’s priorities:
 - Managing chemical risks. Protecting American’s waters. Vulnerable subpopulations, specifically, children.
- Leveraging with other research partners
- Addresses SAB Recommendations: extension of program to develop ecological risk assessment tools

- Major changes
 - Additional FTEs brought in to develop integrated effects-exposure ecological risk assessment tools
 - Determine feasibility of having a viable biotechnology program with resources that are now 50% of the original initiative; Can expertise be applied to biofuels program? Can unmet priorities be addressed through/leveraged with biofuels program?

Major recent program accomplishments

- Issued joint RFA with NIAID on factors contributing to food allergenicity – funded 16 grantees; held session at SOT; workshop & publication
- Developed novel methods to detect pest resistance to GM crops: 1) Partnered w/NASA & developed remote sensing capability; 2) developed/applied methods for genetic characterization; 3) developed & evaluated exposure monitoring protocol
- Brought together 180 scientists and managers for international workshop on PFCs where ORD's multidisciplinary research was showcased
- Developed novel method to screen chemicals using HTPS and whole zebrafish approaches and contributed chemical analysis to ToxCast program
- Developed ecological models Web-ICE and ACE to support pesticide assessments
- Established ORD NMR-based Metabolomic Research Facility

Major program accomplishments anticipated in the near-term

- Additional data on effects, exposure and fate of PFCs
- Support to Agency assessment of potential risks in Decatur from PFCs
- Tools and data on the fate of pesticides and PFCs following drinking water treatment
- Compendium of AHS Pesticide Exposure Study results for use in exposure classification
- Population-level models for risk assessments for aquatic and avian populations
- Metabolite & degradate simulator model for rapid/efficient identification of chemicals
- Evaluation of the next generation of lead test kits

Significant anticipated products and their intended use by partners include:

- Assays to screen chemicals for their potential toxicity across a number of end points & multiple modeling approaches for prioritizing chemicals
 - Used by OPPTS and others to prioritize and screen chemicals
- Advanced methods/modeling approaches for extrapolating integrated toxicological and exposure data across wildlife, media, and individual- and population- level
 - Used by OPP and others to characterize individual- & spatial population- level exposures & effects in aquatic and other wildlife for use in addressing ESA
- Multiple models to assess potential allergenicity to GM crops & guidelines/tools to mitigate gene-transfer, non-target effects & development of resistance in targeted pest populations
 - Used by OPP to improve data requirements for registrants & aid management of potential human and ecological risks from GM crops
- Completion of multidisciplinary research on the toxicity, environmental pathways and fate of PFCs, including their characterization in environmental and biological species

- Used by OPPT and other organizations in their assessments on potential risks of PFCs Assays to screen chemicals for their potential toxicity across a number of end points & multiple modeling approaches for prioritizing chemicals
 - Used by OPPTS and others to prioritize and screen chemicals
- Advanced methods/modeling approaches for extrapolating integrated toxicological and exposure data across wildlife, media, and individual- and population- level
 - Used by OPP and others to characterize individual- & spatial population- level exposures & effects in aquatic and other wildlife for use in addressing ESA
- Multiple models to assess potential allergenicity to GM crops & guidelines/tools to mitigate gene-transfer, non-target effects & development of resistance in targeted pest populations
 - Used by OPP to improve data requirements for registrants & aid management of potential human and ecological risks from GM crops
- Completion of multidisciplinary research on the toxicity, environmental pathways and fate of PFCs, including their characterization in environmental and biological species
- Used by OPPT and other organizations in their assessments on potential risks of PFCs Assays to screen chemicals for their potential toxicity across a number of end points & multiple modeling approaches for prioritizing chemicals
 - Used by OPPTS and others to prioritize and screen chemicals
- Advanced methods/modeling approaches for extrapolating integrated toxicological and exposure data across wildlife, media, and individual- and population- level
 - Used by OPP and others to characterize individual- & spatial population- level exposures & effects in aquatic and other wildlife for use in addressing ESA
- Multiple models to assess potential allergenicity to GM crops & guidelines/tools to mitigate gene-transfer, non-target effects & development of resistance in targeted pest populations
 - Used by OPP to improve data requirements for registrants & aid management of potential human and ecological risks from GM crops
- Completion of multidisciplinary research on the toxicity, environmental pathways and fate of PFCs, including their characterization in environmental and biological species
 - Used by OPPT and other organizations in their assessments on potential risks of PFCs

SAB Questions and Comments:

- The apparent focus on developmental and reproductive effects seems strange. Early exposure can lead to other health endpoints. Also, why focus on phthalates? Other things act as endocrine disruptors. Response: The program is actually much broader. The issues presented are truncated to fit the time available for my presentation.
- Is this an area where EPA has pursued partnerships? Response: When the program started there was an attempt to get other agencies to partner with EPA. There was little interest shown by the other agencies then. It is better now.
- Members noted concern that the biotechnology and biofuels programs, that attempts to integrate new cellulosic materials as biofuels, might not be considering the high probability that these organisms might be highly invasive. Response: EPA has the lead

for developing reports on the potential impact of biofuels production every three years. The potential for invasiveness will be a big issue in those reports.

Friday, April 24, 2009

- c) **Economics and Sustainability Cluster:** Research Program Areas included within this cluster include: Economics and Decision Sciences and Sustainability.

The SAB Team for this Cluster:

Dr. Otto Doering	Dr. Thomas Theis
Dr. James Hammitt	Dr. Buzz Thompson
Dr. Cathy Cling	Dr. Gregory Biddinger
Dr. Kathy Segerson	Dr. Terry Daniel
Dr. Kerry Smith	Dr. Taylor Eighmy
Dr. Thomas Wallsten	Dr. Baruch Fischhoff
Mr. David Rejeski	

- i) **Economics and Decision Sciences: Dr. Al McGartland:**

Dr. McGartland focused on internal research conducted by the EPA National Center for Environmental Economics (NCEE) and some other upcoming activities (e.g., Workshops and Products and the PACE Survey).

Prior to 2008, ORD's National Center for Environmental Research (NCER) was responsible for administering and funding the EDS program. However, the program moved in FY2008 from NCER to OPEI (NCEE) under the Regulatory/Econ Management and Analysis program project. At that time, 38 active grants moved from NCER to NCEE. In addition, when the EDS program moved funding was cut by 50% (\$1million) and cut again due to 40 percent OPEI-wide cut. OPEI absorbed a substantial cut in the FY2009 continuing resolution. Recent funding levels: a) FY2008 Obligations - \$0 M, FY2009; likely 2009 enacted: \$0.2 M, and FY2010 President's Budget: \$1.1 M.

Current and future grant awards, include:

- Funding for seven grants (out of 22 applications) to support environmental economics workshops.
 - some single event, topic-focused (land use/meta analysis/experimental methods/micro-econometrics)
 - others multi-year to support regional events (Heartlands, Camp Resources, NBER Summer series)
- Currently processing several awards (out of 11 applications) for dissertation/early career research in environmental economics from one part of most recent RFP.
 - "...for gathering data for use in doctoral dissertations and other early career research in those areas of environmental economics involving pollution control."
- Preparing to make decisions on grants (23 applications) under the market mechanisms area from second part of most recent RFP.

- “...normative or positive research in the design of policies for pollution control using market mechanisms, particularly second-best and piecemeal approaches to regulation as well as multiple, hybrid, or adaptive policies to control one or more externalities or other problems.”

NCEE’s current research is focused on:

- NCEE economists and scientists engage in research to fill gaps in knowledge, often with support from other EPA offices.
- Ongoing research includes efforts:
 - to account for uncertainty in the economic analysis of climate change policies,
 - a national scale assessment of the environmental justice implications of air pollution regulations,
 - research linking EPA’s air quality data with the National Center for Health Statistics survey data,
 - to analyze how regulation-based induced technological change impacts emissions and marginal abatement costs over time,
 - and identification of organophosphate pesticides body burden
- NCEE published 13 papers in peer-reviewed journals in FY 2008 and had an additional 8 accepted for forthcoming publication.
- NCEE added 12 entries in its Working Paper series in FY 2008 (there are 67 papers total in the series).
- NCEE staff presented 28 papers at professional conferences, seminars, and government meetings.
- NCEE staff research continues to publish in peer reviewed journals, producing 20-30 papers per year in economics and risk science fields.

Other upcoming activities, workshops and products include:

- Hosting a workshop on market mechanisms next week.
 - Includes EDS grantees, NCEE staff, and other researchers
- Tentatively planning a 2010 workshop showcasing grantees from 2005 solicitation on Environmental Behavior and Decision-making.
 - Good opportunity to evaluate possibility of RFP on this topic
- Compiling list of all publications resulting from EDS program to help us evaluate future directions.
- Expect to package results of numerous benefit transfer grants as they are completed over next two years.
- Continuing to support the Environmental Valuation Reference Inventory (EVRI)
 - NCEE is currently participating in a review and evaluation of EVRI and its website

The PACE survey:

- Survey of roughly 20,000 U.S. manufacturing facilities.
- Census conducted and funded the PACE Survey from 1973-1994; Census collected PACE data in 1999 and 2005 with funding by EPA.
- PACE collects data on overall pollution abatement expenditures - not on specific regulations.

- EPA initiated a comprehensive review and evaluation of the PACE Survey in 2003 - first time that the PACE survey has undergone evaluation.
 - Extensive pretesting of the redeveloped survey by RTI International & U.S. Census Bureau
 - Final product of this multi-year project was the 2005 PACE Survey
- PACE is the only source of data available to:
 - analyze the costs of environmental regulations both at the industry and establishment level
 - compare the cost-effectiveness of alternative regulatory approaches.
- EPA has used the PACE data:
 - in periodic reports on Costs of Environmental Protection (Cost of Clean Environment (1990), Section 812 Clean Air Retrospective Cost Analysis, Administrator speeches)
 - to satisfy Congressionally mandated reporting requirements - Annual OMB Reports to Congress on Costs and Benefits of Federal Regulation (Thompson Report)
 - in Regulatory Impact Analyses and Social Cost Appendix of EPA's Strategic Plan.
- Government & academic researchers use PACE data to analyze the impact of EPA regulations on important economic and environmental outcomes including:
 - job growth; international competitiveness of U.S. manufacturing; environmental performance; investment demand; opening and closing of manufacturing facilities; productivity growth.
- Future of PACE
 - Collect PACE on an annual basis
 - SAB-EEAC has been very supportive of EPA's efforts to collect annual PACE data
 - Adapt PACE survey to collect information on GHG abatement costs
 - Proposal in FY 2010 Budget
 - No other survey collects this information
 - Could be important in international negotiations.

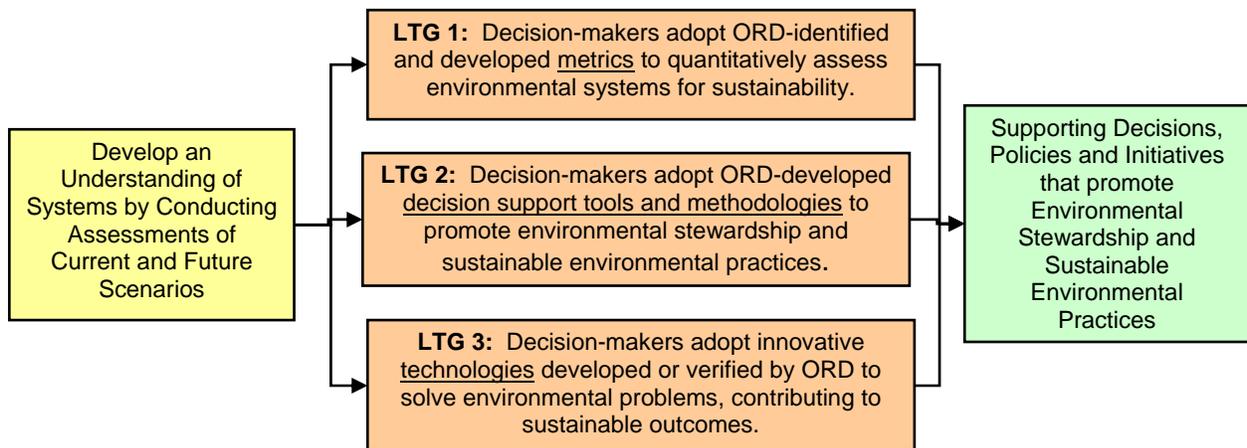
SAB Questions and Comments:

- It appears that decision-sciences is still not be a part of the EDS program. Response: We believe that decision sciences research will be important to our better understanding of business behavior. Our leadership is very interested in decision sciences.
- The past EPA Economics and Decision Sciences program collaborated with NSF in several requests for proposals. NSF was the recipient of a substantial budget increase in recent years while EPA's research budget was cut substantially. It would be wise of the agency to actively engage with NSF to get them to fund this program again. Response: We have a limited capacity to do this because research is not the main mission of NCEE; however, we are quite interested in such a partnership.

- What is the PACE survey? Response: In general, PACE measures end of pipe and pollution prevention expenditures by the regulated community. It is the only thing around to provide that information and it has done so over the years so researchers like the program because it provides data on such expenditures over a significant span of years.
- Your thoughts were influential in the recent NAS committee’s deliberations leading to the *Science and Decisions* report. It is a concern that your program has taken resource cuts the call in that report to broaden the approaches taken by EPA to prepare for and conduct assessments. Response: We have found over the years that current risk assessments are difficult to deal with when risks and benefits are considered together. The Administrator is interested in doing more.
- What is the status of decision sciences in regard to the mission of EPA? Response: The concept is not moribund. Some very smart people at EPA want to do more in this area, but there is not yet a “flurry” of activity. Much will depend on the desires of the new political leaders that are not yet in place.
- The SAB has lamented the loss of this program from the research office. What has been the actual impact of the transfer out of ORD? How much of your capacity is involved with research? Response: I am encouraged by the Administrator’s interest in this area as reflected by her questions on an issue we recently worked on. I want to see research in this area, and would not mind if the research mission was in ORD. As it is, NCEE might be spending as much as one-fourth of its personnel resources on research efforts.

ii) **Sustainability: Dr. Alan Hecht:**

Dr. Alan Hecht discussed the EPA Science and Technology for Sustainability Program. Sustainability science is difficult to define; however, a helpful way of thinking about sustainability science is to think of it as “problem solving.” The program’s long-term goals support agency activity as depicted in the following graphic:



In part because of SAB advice, we have applied our sustainability principles to a specific example, i.e., we focused STS LTGs on sustainable biofuel production as an integrating national issue, and:

- Analyzed strengths and weaknesses of LCA-based tools for assessing environmental impacts of biofuels production (interoffice review to follow)
- Completed literature review of sustainability metrics
- Completed, with Region 8, first phase of San Luis Basin metric study – a test case for sustainability metrics in regional ecological and urban planning. Second pilot project in Puerto Rico under development
- Responding to stakeholder interests, developed a number of decision support tools, e.g., Waste Reduction Algorithm (WAR), MARKAL, MSW-DST, and LCA models
- Using ETV model, began negotiations on international ETV protocol, completed over 400 verifications with ETV, which 31 States are using in drinking water regulations, guidance, and permitting decisions
- Awarded \$580,000 for 58 P3 grants for innovative technology projects

Biofuels related actions have included:

- Launched – by ORD’s ESRP (“Eco”) program – the Future Midwestern Landscapes Study
- Led interagency development of sustainable biofuels criteria and indicators
- Led organization of EHS work group of Biomass R&D Board
- Led development of EPA Biofuels Coordinating Framework (*aka* EPA Biofuels Strategy)
- Funded six SBIR Phase-I biofuels technology projects (FY2007–2009)
- Funded twenty-one P3 Phase-I and three P3 Phase-II biofuels technology projects (FY2007–2009)

The proposed strategic directions for our sustainability science program include:

- Partner with all Programs and Regions to advance research in support of sustainable biofuels production and use, focusing on current and next generations of feed stocks (See Hecht *CEP* article).
- Partner with OPEI, OSWER, OPPTS and States in supporting LCA and research on sustainable supply chain to advance management of materials – including industrial applications, infrastructure, green building, and sustainable urban development.
- Partner with OPEI, OEI and Regions to support development and application of sustainability metrics at national and regional levels.

Anticipated outcomes from these efforts:

- Following congressional mandates, assess environmental and health impacts resulting from current biofuels production and use and project anticipated impacts from next generation of biofuels
- Working with EPA Programs and other federal agencies, develop criteria and indicators and pilot studies for measuring sustainable biofuel production
- Working with OPPTS, OSWER, OPEI and States, develop pilot projects showcasing LCA of material management and reduction of environmental impacts
- Continue national and regional case studies for development and application of sustainability metrics

Dr. Hecht gave the members two publications on sustainability for their information:

- *Government Perspectives on Sustainability*, Alan Hecht, CEP January 2009.
- *Good policy follows good science: using criterion and indicators for assessing sustainable biofuels production*. Alan Hecht, *et al.*, Ecotoxicology dec 19, 2008.

SAB Questions and Comments:

- Again, the issue of potential invasiveness of organisms used in a biomass to ethanol programs is a concern. Response: We have had discussions on this issue at EPA. Environment/land use/invasive species are included in the report that was mentioned earlier as part of EPA’s mandate in the new “energy act.”
 - Health is explicitly mentioned in biofuels. How will it be considered? Response: This is one of the areas that will be the focus of a workgroup that will be preparing the assessment mentioned above.
 - Environmental Technology Validation is an important program that the SAB has supported over the years. NACEPT has also done considerable advisory work in ETV. How can the US program be strengthened? Response: This issue has long been controversial. Some think government should have no role in this and that it should be done only by industry. The issue needs to be revisited. The time is right for linking some issues together and deriving a technology strategy for EPA.
 - What is the investment level in this area? Response. Currently EPA has about 70 FTE and about \$20 M invested per year. None of the funds are for extramural efforts.
 - The term “sustainability” carries a significant amount of “baggage” with it. Is it an asset or a liability in your eyes? Response: It could be both an asset and a liability. The word also has meaning internationally. We’re looking at the issue.
 - Is the placement of the sustainability program and the program’s status such that is more or less secure? Response: The program is still developing. We are working to get it firmly established, but it is not yet secure.
- d) **Air and Global Climate Change Cluster:** Research Program Areas included are Global Change and Clean Air research.

The SAB Team for this Cluster:

Dr. David Allen	Dr. Jana Milford
Dr. John Balbus	Dr. Granger Morgan
Dr. Jim Galloway	Dr. Jonathan Samet
Dr. Rogene Henderson	Dr. Jerald Schnoor
Dr. Jill Lipoti	

i) Global Change: Dr. Joel Scheraga:

Dr. Joel Scheraga discussed EPA’s Global Change research Program. The program has well-defined mission to: Assess the potential consequences of *global change* – particularly

climate variability and change -- in the U.S., areas of focus include: air quality; water quality/aquatic ecosystems; human health. The program's intent is to provide timely and useful scientific information to support decision-making. The program now concentrates on the environmental and human health implications of alternative mitigation strategies. This new direction on mitigation is consistent with past SAB advice.

Additional Congressional Appropriations

- **FY'08: \$3 million (one-time increase):** *“to support future rule making on greenhouse gases”*
- **FY'09: \$2 million (increase in base program):** *“Within the amount provided, \$18,365,000 is for Global Change Research, of which \$2,000,000 is directed to study Greenhouse Gas mitigation and adaptation strategies”*

Projects initiated in FY'08:

- Environmental implications of alternative fuels (with a focus on biofuels)
- Co-Benefits: Evaluation of relationship between GHG mitigation strategies and strategies for adapting to a changing climate
- Evaluation of proposed forest offset accounting methods for effectiveness and applicability at the national scale
- Evaluation of emissions reduction potential of technological and non-technological options for reducing GHG emissions and improving air quality
- Development of comprehensive database of mitigation technologies for the power generation, transportation, industrial, and waste management sectors.

Global change program accomplishments include:

- **CCSP:** Completed 2 major CCSP Synthesis and Assessment Products
- **Climate Change & Air Quality:** Completed an assessment of the potential impacts of climate change on regional U.S. air quality, with a particular focus on ground-level ozone.
- **Climate Change & Air Quality:** Completed development of the 9-region MARKAL model of the U.S.
- **Climate Change & Water Quality:** Released online tool (WEPPCAT) for creating user-determined climate change scenarios for assessing the potential impacts of climate change on sediment loading to streams.

- **Climate Change & Water Quality:** Assessment of the potential impacts of climate change on combined sewer overflow mitigation in the Great Lakes and New England Regions.
- **Climate Change & Water Quality:** Assessment of the impacts of climate change on aquatic invasive species and state-level management opportunities.
- **Decision Support Tools:** Released BASINS Climate Assessment Tool that enables water resource managers to assess the influence of climate variability and change on water quantity and quality. Also released a draft User's Manual.

One effort, the *Global Change and Air Quality: Interim Assessment* addressed the question of whether climate change something we have to pay attention to going forward? The report's answer is "Yes." "*Climate change should be considered by air quality managers as they develop air pollution control strategies. Climate change has the potential to produce significant increases in ground-level ozone in many regions.*"

Strategic Directions for the Global Change Research Program:

Continued emphasis on outcomes consistent with EPA's mission, and the statutory requirements placed on the U.S. Climate Change Science Program (CCSP) -

- Assessment of the impacts of global change on air quality (focus on implications for statutory requirements under the Clean Air Act, and opportunities to adapt)
- Assessment of the impacts of global change on water quality/aquatic ecosystems (focus on implications for statutory requirements under the Clean Water Act and Safe Drinking Water Act, and opportunities to adapt)
- Supporting the statutory mandates on the CCSP to produce periodic assessments of the potential impacts of climate change
- **New Strategic Direction:** Research and assessment of the environmental implications of alternative strategies for mitigating greenhouse gas emissions (including co-benefits of mitigation strategies and the potential for unanticipated negative impacts).

Anticipated products from the continuing Global Change Research Program include:

Air Quality (FY2012): Completion of *Global Change/Air Quality Assessment*, "Effects of *Global Change* on Air Quality in the United States" - in partnership with OAR/OAQPS.

Water Quality (FY2010 – FY2013):

- Assessment of OW needs and priorities relating to water quality and global change;
- Broad based, national scale assessment of water quality endpoints vulnerable to global change;
- Detailed watershed-based, stakeholder-driven studies focused on local issues and specific management solutions for addressing global change;
- Detailed studies of the potential impacts and opportunities for adapting water infrastructure and the built environment, and
- Development of broadly applicable decision support tools to increase the capacity of OW clients to assess and manage the impacts of global change on water and watershed systems.

CCSP (FY2012: As mandated by 1990 Global Change Research Act):

- Completion of EPA contribution to third CCSP “National Assessment”

Dr. Scheraga concluded by noting the 2009 National Research Council’s conclusion on the EPA’s program, saying: “The Environmental Protection Agency (EPA) should expand its climate-related decision support programs to serve more regional and sectoral constituencies.” (NRC 2009, *Informing Decisions in a Changing Climate*)

SAB Questions and Comments:

- The Congress and EPA’s consideration of co-benefits of addressing climate change is laudable. How are you proceeding on this? Response: There are many possible impacts (co-benefits) to human health from addressing climate change.
- There are significant mental/emotional affects that occur when disasters potentially associated with climate change occur (e.g., hurricanes present an interesting case). We are aware of the issue, working on it, and it will be a part of our program – likely through the extramural grants route. Response: We have about \$3 M available in total for the implications of biofuels. This is only seed money. We are focusing now on climate change/land use changes relative to environmental and human health. For example, with ethanol production you get dramatic changes in land use. The effect of climate change on water quality is also a concern.

ii) Clean Air Research: Dr. Dan Costa:

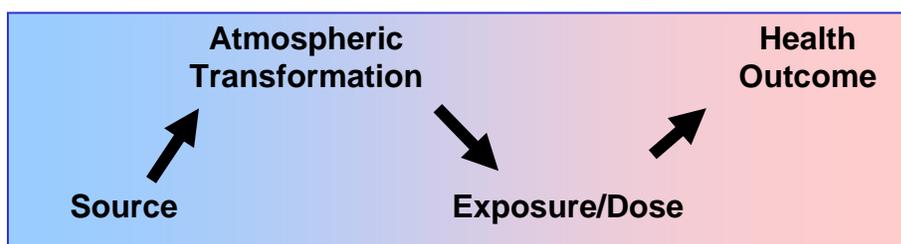
Dr. Dan Costa presented information to the SAB on the Clean Air Research Program.

Recent advances and accomplishments include:

- Lung growth retarded by air pollution
- Health risk impacts of Eastern > Western PM
- Roadway ‘emissions’ constitute a significant MP exposure burden with linked to multiple health outcomes (esp. re PM)
- CMAQ steadily evolves as a MP modeling tool with finer grid scales and enhanced SOA chemistry to improve client utility
- Coarse PM (like fine) alters cardiac function - esp. in susceptibles
- AQ-health researchers find common ground to advance PM conc-response risk estimates and dissect the role of components
- Reduction in ambient PM from 1980-2000 resulted in nearly half a year of increase in life-expectancy (accountability).

Basic themes of the program are unchanged from the past – to conduct & communicate air pollution science for stakeholder use by addressing “all NAAQS all the time” and “what about” Air Toxics. The program is increasingly moving more to a multipollutant program that will evolve from source to health paradigm.

- Execution of ‘IMD’ near-road campaigns across L/C and partners
- Promote the concept of ‘accountability’ in Air program areas

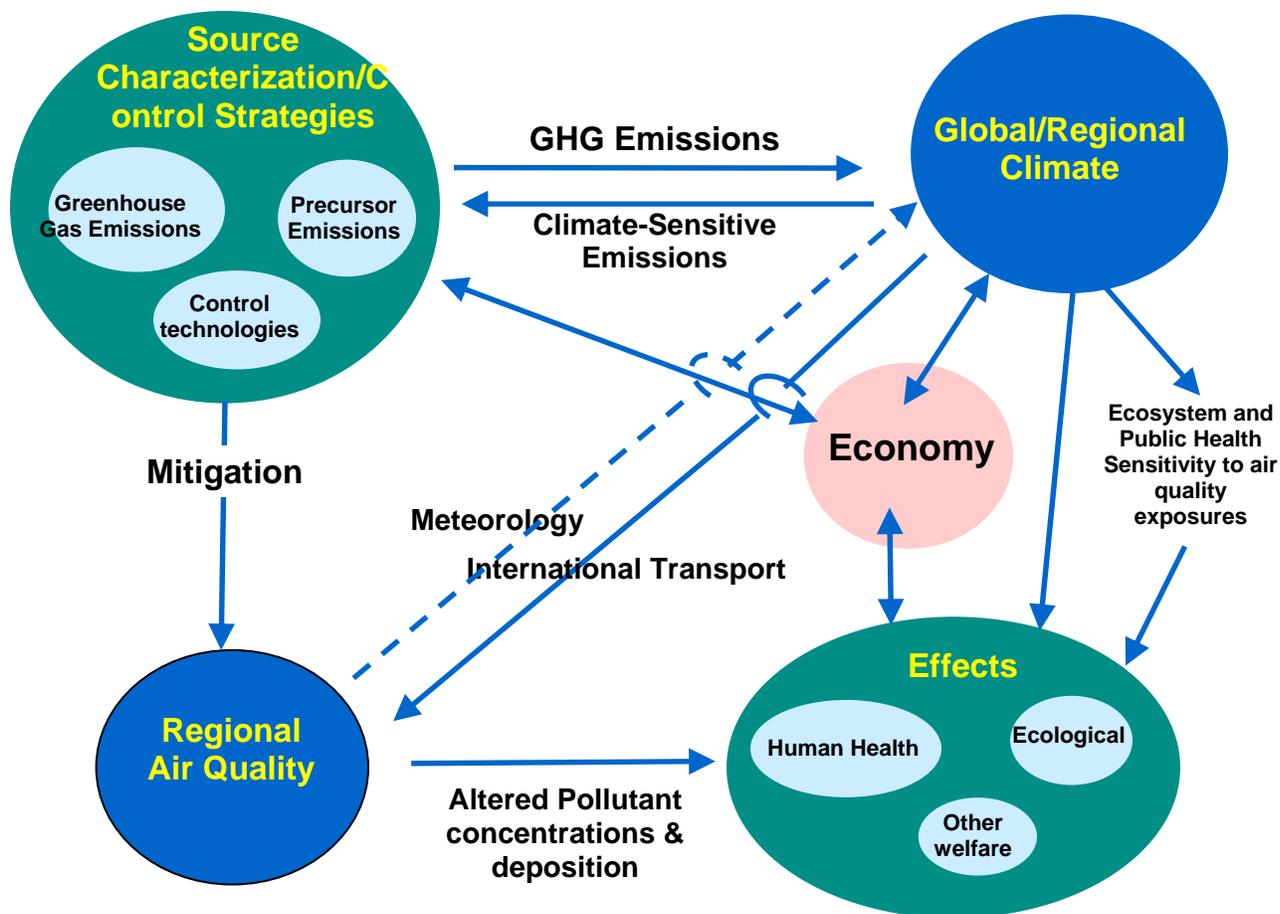


- Integration across L / C and science disciplines
- Opportunistic and proactive leveraging (public / private)

Anticipated 2010-2014 milestones and challenges, include:

- Maximize the integration of AQ monitoring -health assessments
- Shift Air program emphasis from 60:40 research effort in support of NAAQS/ATs relative to multipollutant research to 40:60 effort
- Complete LV near road campaign; fully establish ‘source to health outcome’ paradigm in Detroit (2009-11); Raleigh (?) – 2012
- Devise MP research strategies to disentangle the impact of single pollutants (in support of NAAQS) and their interactions
- Establish a strategy for integration of “accountability” into fundamental Air research project structure
- Implementation support through improved models, tools and methods (esp. continuous)

A graphic way of showing the interrelated air program, as envisioned for the future, was developed by OAR (Brian Bubble) and Dr. Costa.



SAB Questions and Comments:

- There is an increase in asthma in California that is associated with schools located near roadways. Is this an issue under study in your program? Response: Yes it is. We see this as part of our source to outcomes studies.
- ORD still seems to be in the mode of shifting limited funds from one NAAQS area to another to reflect the shifting regulatory considerations that also move from one NAAQS to another. Will this limit the work you can do on Air Toxics? Response: It is an issue. We need to collaborate with others. For example, HEI funds about \$3 m per year of research that is helpful.

e) **Technology Research Cluster:** Research Program Areas included within this cluster are Land Preservation, Nanotechnology, and Global Earth Observation System of Systems/Advanced Monitoring Initiative.

The SAB Team for This Cluster:

Dr. David Dzombak	Dr. Valerie Thomas
Dr. James Johnson	Dr. Robert Twiss
Dr. Bernd Kahn	Dr. Daniel Watts

i) **Land Preservation: Dr. Randy Wentsel:**

Dr. Randy Wentsel gave an overview of the Land research program. The program purpose is twofold:

- **Restoration:** to provide improved scientific knowledge and develop and apply more cost effective tools, models and methods to inform decisions on land restoration.
- **Preservation:** to provide improved scientific knowledge and develop and apply more cost effective tools, models and methods to manage material streams and, in collaboration with ecology and sustainability programs, to inform land use/reuse decisions.

Program accomplishments include:

- Contaminated sediment research has provided techniques for food chain modeling of PCBs and remediation efforts have evaluated alternative methods, and dredging effectiveness issue.
- A Smart Energy Resources Guide is a key document supporting Green Remediation
- Multimedia modeling produced a comparative risk reduction analysis for the OSWER waste minimization program
- Coal Combustion Residue reports on characterization and metal availability are informing regulatory actions
- Comparative toxicity studies of amphibole asbestos fibers supports Libby, MT remediation

For ground water, accomplishments include:

- Ground water research develops and applies various technologies to provide cost effective solutions for inorganic (including mining sites) and organic contaminants
- Vapor intrusion publications have addressed: the limitations of vapor intrusion models, sampling methods, and mitigation
- Underground Storage Tank research has developed treatment methods, models to support state guidance on MTBE and leveraged ethanol and gasoline plume models to support biofuels

Communications efforts have described the land research program. For example:

- Released a Land Research Program web site: epa.gov/ord/landscience
- Enhanced research planning with OSWER and the Regions
- Collaboration: with NIEHS Superfund Basic Research Program staff to increase relevance and through EPA membership on SERDP workgroups and panels

Strategic Directions, FY 2010 to 2014 include:

- Sediment remediation effectiveness and assessment of vapor intrusion into building are areas of increased emphasis for Superfund.
- An integrated cross-laboratory effort on bioavailability of metals is being initiated.
- Green remediation and land use/reuse (e.g. Brownfields) are areas where ORD is discussing a cross program role.
- Developing closer linkages to Sustainability Program via biofuels and Life Cycle Assessment

- A new Environmental Technology Verification Center on material management and remediation will support technology validation

Anticipated accomplishments for the period will:

- Develop processes to assess the effectiveness of sediment remediation
- Report on the State of the Science for long-term stewardship of Permeable Reactive Barriers at hazardous waste sites.
- Synthesis document on ground water dense non-aqueous phase liquids (DNAPL) remediation technologies will be provided to the regional forum.
- Publish reports on vapor intrusion modeling and engineering factors to determine approaches for screening and remediation.
- Demonstrate the long-term performance of passive treatment of mine waste contaminants of surface water
- Publish a comparative toxicity report on effects of asbestos fibers
- Complete studies on coal combustion residue (CCR) chemical/physical composition, leaching potential, and beneficial reuse for OSWER.
- Publish an improved in-vitro method to measure arsenic bioavailability and a new method for arsenic speciation for OSWER Bioavailability Workgroup

SAB Questions and Comments:

- Land seems to have more legacy issues than some other areas. This creates a perception that the program is always looking backwards. Sustainability, on the other hand, conveys the perception of a “forward-looking” program. Last year, we suggested merging the two. Has this seen any movement? Response: Nothing formal has occurred to merge the two, but we do continually work with the Sustainability program on some things.
- State and local organizations often seem trapped into the techniques of the past in dealing with environmental issues. Do you have mechanisms for helping the states/locals? Response: In some areas we do have connections (bioavailability, exposure, are two examples). We really need to connect with the site managers to be most helpful.
- What is EPA doing with coal combustion waste – is it collaborating with work at DOE? There is a need for work on ash control. Response: So far we are working on metals leaching, exposure pathways, and coal waste.
- We strongly support the new ETV Center. How does it compare to the former ETV efforts of EPA? Response: It is under the same umbrella as the past program.
- Are you making progress on broadening the focus of the “Land” research program? Is it included in the Report on the Environment? Response: ROE is a broad look at the environment and where the current land use fits is not clear. There are many very specific and narrow things that are needed by the Program and Regional offices relative to the currently focused Land program and that impedes making it broader.
- Most projects appear to be restoration not preservation. Response: The program is actually broader. We will have more to say to clarify this in our September meeting with the SAB.

ii) **Nanotechnology: Dr. Jeff Morris:**

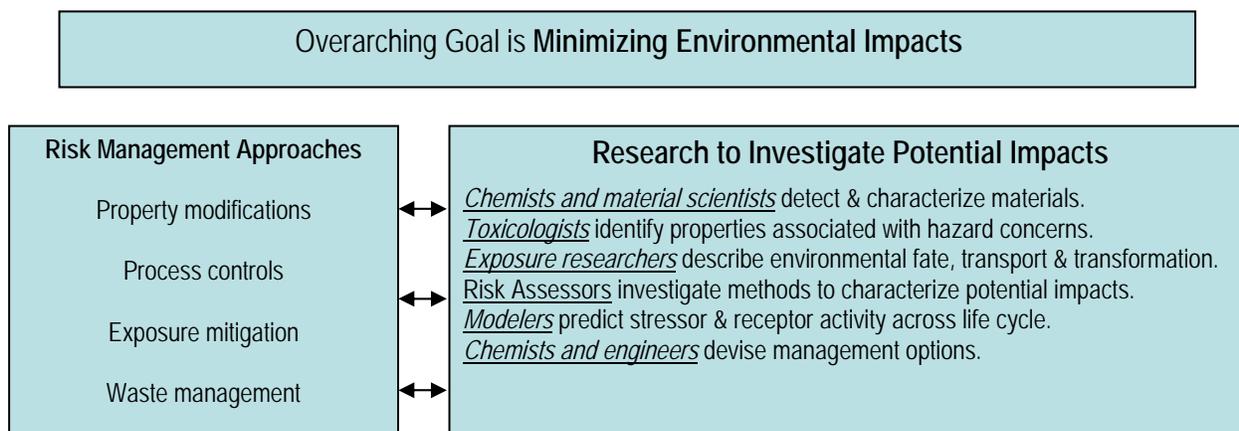
Dr. Jeff Morris discussed the EPA Nanomaterials research program.

Strategic directions for 2010 to 2014 include:

- Continued focus on 5 material types (Ag, C, CeO, Fe, TiO₂)
- Continued emphasis on exposure, fate & transport – “Source to dose”
- Continue research in soil, water, biota, and extend research to air medium
- Develop exposure models
- Increased emphasis on targeted effects, based on source-to-dose findings
- Integration of ToxCast into in-house program
- Increased emphasis on green nanotechnology from a life-cycle perspective
- Continued development of risk assessment methods, including comprehensive environmental assessment and decision analytic approaches.

“Multi-walled Carbon Nanotubes” (MWCNT) is an example of program integration. In this, ORD frames the question to focus on the goal: “Are humans or ecosystems likely to be exposed in the environment to MWCNT, and do MWCNT have unique properties that may result in harmful effects? If so, how can we avoid or mitigate potential risks from MWCNT?”

Graphically this form of integration can be shown as:



Key considerations:

- Information continuously moves between disciplines.
- All disciplines look at nanomaterials from a life-cycle perspective.

Anticipated products through 2014 include:

- Determine the major processes that govern environmental fate, transport, and transformation of the 5 nanomaterial types.
- Source-to-dose exposure models for the 5 nanomaterial types.
- Approaches to screen, rank, and predict *in vivo* toxicity.

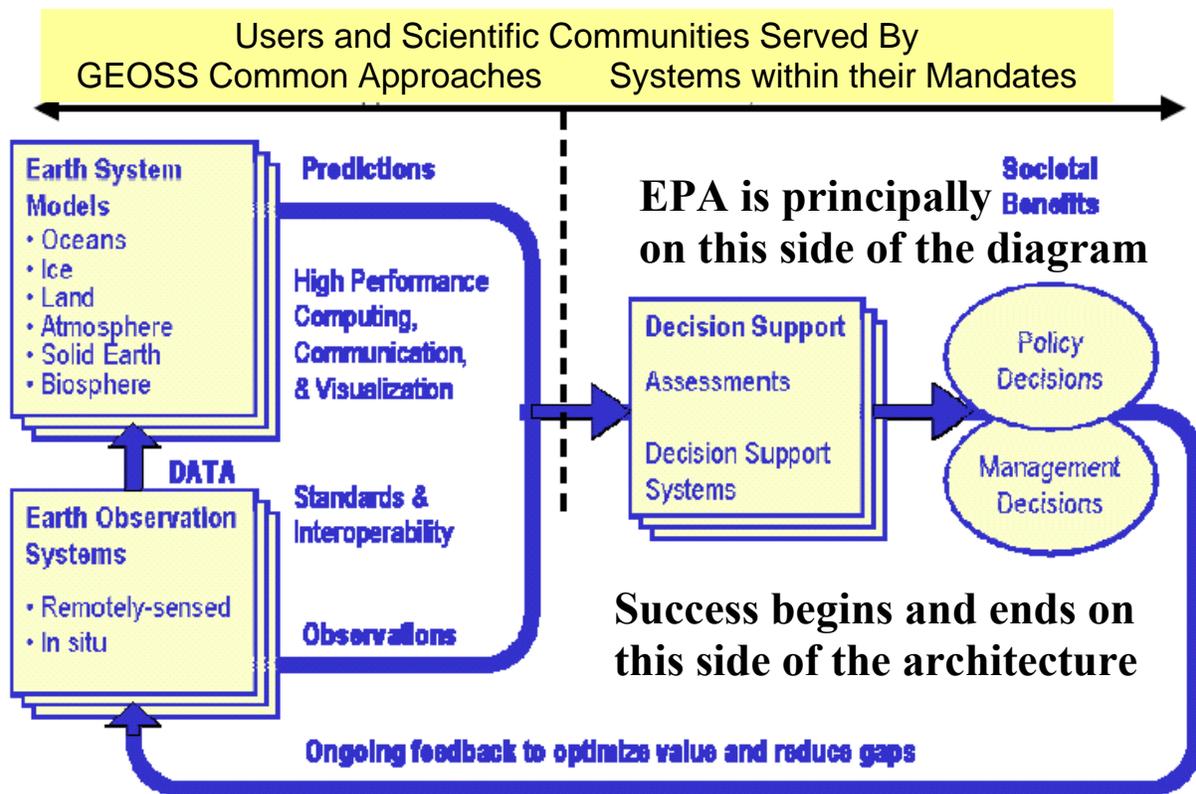
- Identification of key physical-chemical characteristics to inform development of predictive modeling.
- Comprehensive environmental assessments of selected nanomaterials, based on progress in prerequisite areas of research.
- Green nanotechnology and other risk management approaches for priority applications of the 5 nanomaterial types.

SAB Questions and Comments:

- The nanotechnology issue is bigger than just understanding fate, transport, and toxicology. Total energy requirements for nano-production is planned for a major increase. It is also not clear how many nanomaterials are under development.
- Regulation in Europe is “precautionary”. Doing much more might not be feasible.
- Initial focus for health was the lung. Now the brain is emerging as a possible site for effects from nanomaterials crossing the blood-brain barrier. Response: NIH is beginning to do work in this area. Our focus for this issue is on the exposure side.
- Broader distribution of these materials is apparent. Does EPA have the authority to ask for data as these things go through the PMN process? Response: Carbon nanomaterials are considered to be new chemicals and subject to the PMN program. Data could be asked for, but if you do so, there will need to be acceptable protocols available for generating the data.
- Is industry partnership a possibility? Response: Industry does have a role in the OECD. We will be talking with the ACC soon on the issue.
- The issue has now been around for some 15 years. EPA is finally asking for some data. Thus a significant (possibly 10-year) time lag already exists for identifying issues and developing regulations. Why not focus now on the next generation of nanomaterials that are under development? EPA might get ahead of the issue instead of creating another time lag relative to those new materials.

iii) **GEOSS/Advanced Monitoring Initiative: Dr. Gary Foley:**

Dr. Gary Foley discussed the Global Earth Observation System of Systems Advanced Monitoring Initiative (GEOSS/AMI).. Using efforts under the GEOSS architecture, EPA is conducting a pilot program to bring in new data, new analyses, and new approaches to improve the links among monitoring data, information, and decision-making itself. The GEOSS framework is shown graphically as:



Recent accomplishments include:

Global Air Quality

- The deployment of AIRNow-International and the emergence of a broader Air Quality (AQ) information system of systems supports the development of a global community of AQ management professionals. This enables improved AQ management and promotes awareness of AQ problems with the goal of leading to measures to reduce air pollution, domestically and globally, including long-range and hemispheric transport.

Lyme disease

- The most frequently reported vector-borne illness in the US. Due to fragmenting, forested habitat loses native biodiversity and Lyme disease transmission increases. Land Use tools are being used in Wisconsin, Maryland, Pennsylvania, and New York to map out projections of Lyme Disease risk under alternative scenarios of development patterns.

Water Quality (WQ) Aquatic Integrity Measurements

- Important to the Clean Water Act, the traditional methods are costly and lack quality. DNA Barcoding provides better resolution and has the potential to reduce costs. This effort is determining how to incorporate DNA Barcoding into the State's bioassessment programs in an effective manner.

Strategic Directions for 2010 to 2014 include:

The SPC's advice to the EPA GEO:

- Ensure a credible and transparent EPA GEO process and organization,
- Develop a set of EPA GEO strategic actions that supports the SPC science priorities,
- Enhance cross-Agency communication and coordination of the activities of the EPA GEO,
- Enhance the accessibility and application of EPA Global Earth Observation Systems of Systems (GEOSS) data and products,
- Leverage capabilities in the Agency for monitoring, modeling, technology innovation, and decision tools for integrated problem solving.

EPA GEO Proposed Principles (draft)

The EPA GEO was created to support and benefit from the GEOSS, and to bring the best monitoring data and information into the environmental decision making. Its architecture integrates environmental observation, monitoring, and measurements with modeling that directly support health, climate change, air quality, and other social benefit areas. The EPA GEO's primary responsibility, in addition to transferring currently funded research to products, and new undertakings should directly support the Agency's science priorities while leveraging capabilities across EPA programs, offices, and regions, as well as with states, federal partners, and the international community. These efforts should guide the Agency to integrate better monitoring and observational data, modeling results, technology, and decision tools.

Examples of anticipated products through the period include:

Global Earth Enhanced Visualization of Data and Modeling for Decision-Makers

The Google Earth "virtual globe" technology is being used to interoperably fuse together earth observation data, provide more powerful and user-friendly visualizations for advanced decision support analyses and real-time adaptive management applications, which include emergency response (spills, major fires/smoke, etc.), visualization of monitoring data and model outputs for watershed analysis and enforcement investigations.

Infectious Diseases and Integrated Pest Management

Characterization of environmental factors (i.e. land use, land condition, land cover change) affecting animals and pests, play a role in infectious disease transmission to humans and the design of environmentally-based (nonchemical) strategies to reduce infectious-disease incidence. For example, sound land use practices can be part of IPM strategies under the authority of *FIFRA section 20(a)* to minimize the use of pesticides as a control method of infectious diseases and result in less pollution to land, air and water.

Advanced Sensors and Measurement Techniques

Several brought to commercialization to enhance data collection for use in environmental decision-making.

Integrated Monitoring:

Products that address observation, modeling, technology needs in an manner to bring integrated science and technology to decision-makers.

SAB Questions and Comments:

- The need seems to be much greater than that covered in the materials. Response: That is true. Our efforts so far resulted from our first internal grant process in this area. We are now in the third year, and we are moving to more strategic themes and broader issues.
- What is the size of the program? Response: We are investing only about \$5 M each year for now. It is a small program. EPA GEO about 7 people working full time on the issues. Across EPA there are probably about 100 people involved in a variety of projects.
- Is there much interaction with the NSF water efforts? Response: There is a lot of interaction.
- Do you work with states in this program? There would seem to be great utility to states like California in the wildfire area. Response: Outreach to decision makers is built into most of the efforts. There is much need for such state interactions.

8. General Discussion:

Members discussed the ORD presentations. Comments made include:

- Pleasantly surprised at many responses that are visible because of our November advisory. In the area of “behavioral sciences” why not just do it. The need won’t go away.
- The level of information was good, but it might be delivered more efficiently if many of the presentations were not read.
- Nanomaterials is a troubling area. Warnings are already out there and we need to hear more.
- Seems still to be a big disconnect on resource allocation across program areas. The hope is that the connections occur at the lab level that are not readily apparent in the presentations which shows a somewhat artificial view of the actual program.
- There is a need for balance in the level of “response research” vs. “anticipatory research”.
- Transformation notion is a good thing. The health side of the equation is quickly getting to a point of having a “rapid explosion” information coming from a new toxicology. There is a need for a critical and comprehensive review to ensure we

are asking the right questions and that we have the right elements in our programs. It is important also to ensure the research is done right.

- There is a need for some level of SAB to BOSC interaction as we review strategic program directions and BOSC looks at the program's implementation over time.
- Institutional arrangements to ensure coordination will be important as programs expand their focus to a broader view. Many players have different pieces and all need to talk to ensure they are being effective in the broader sense of the issues.
- There is an amazing amount of science and the transformation notion is important. It is not yet clear if the programs are listening. Helping to translate the science of ORD to specific program areas will be important in transformation – **there is a need to be explicit about how these things will affect the programs.**
- Sustainability and LCA should be tied together strongly.
- ORD shows positive evidence of movement forward. Having a new Administrator presents a huge opportunity for more movement. Transformation is a good opportunity to also consider how you might get better at what you are doing. Portfolio management presents possibilities for this.
- Lack of attention to Social Sciences is a problem. Specific future SAB meetings on this topic alone might help to show how behavioral sciences are important and how they need to be incorporated into the research and operating programs.
- There is a glaring lack of apparent health research in the Land research program.
- What is EPA's action in response to the environmental emergencies report?
- There has been a large transformation in ORD's strategic directions for research over the last 5 years.

Dr. Teichman thanked the Board for its interaction with himself and the NPDs and looks forward to discussing the FY 2010 research budget with the Board once it is released as well as discussing the revised strategic research directions during the September 23-24 SAB meeting. At that time we would like the SAB to consider, among other things: 1) whether the ORD programs address the right priorities; 2) Do they achieve the desired outcomes; 3) Are resource allocations commensurate with the need; and 4) Within the research areas, are their program components that should be emphasized more or emphasized less?

9. Actions

- a) Teams should develop comments on the long-term strategic directions for each area (this should just be your impressions) and comments should be sent to each lead designated at the meeting.
- b) Members should also consider the program information for FY 2010 and offer overarching comments as they see the need. (Items a and b should be completed by May 15)
- c) When EPA provides the FY 2010 budget information, Teams should evaluate the information for each of the areas and develop comments for each of the areas. Comments should be targeted and brief. We will organize a teleconference meeting for no later than June 9 or 10 to agree on comments to make on the FY 2010 budget in a letter to the

Administrator. The intent is to comment on resource allocations vs. the goals set for each program in ORD's strategic planning.

- d) The June 9-10, 2009 face to face meeting of the full SAB is canceled. However the dates should be held in case we need one of them for the teleconference.

10. Science Integration Project Planning

Dr. Swackhamer briefed the Board on the planning activities for the Administrator's special project. Administrator Jackson has agreed to have the SAB move forward with the project noting that her interest is narrowed to contaminants, which are the undisputed domain of EPA, and with a time constraint on the project of not more than 15 months. The subgroup has reached consensus on the project but not complete agreement. With the Board's approval, we will move forward to establish a committee to conduct the study. The committee will provide periodic feedback to the Board on its progress, and when a report draft is completed, provide it to the Board for a quality review and approval. Dr. Thomas Burke has agreed to Chair the committee that we appoint. The recent NRC report, *Science and Decisions*, as well as the SAB report Toward Integrated Environmental Decision Making will be the backdrop for our study. Dr. Swackhamer asked for the Board's consent to move forward with the project as discussed and further described in Attachment G. The Board so agreed. **Action:** Staff will work with Dr. Swackhamer and Dr. Burke to carry out the project.

11. Adjourn the Meeting

The Designated Federal Officer adjourned the meeting.

Respectfully Submitted:

Certified as True:

/Signed /

Mr. Thomas Miller
SAB DFO

Dr. Deborah L. Swackhamer
SAB Chair

ATTACHMENTS

Attachment A:	Board Roster
Attachment B:	Agenda
Attachment C:	FR Notice
Attachment D:	Budget Tables
Attachment E:	Administrator's April 21, 2009 Letter
Attachment F:	Team Assignments
Attachment G:	Improving EPA Scientific Assessment Practices for Decision Making- Draft